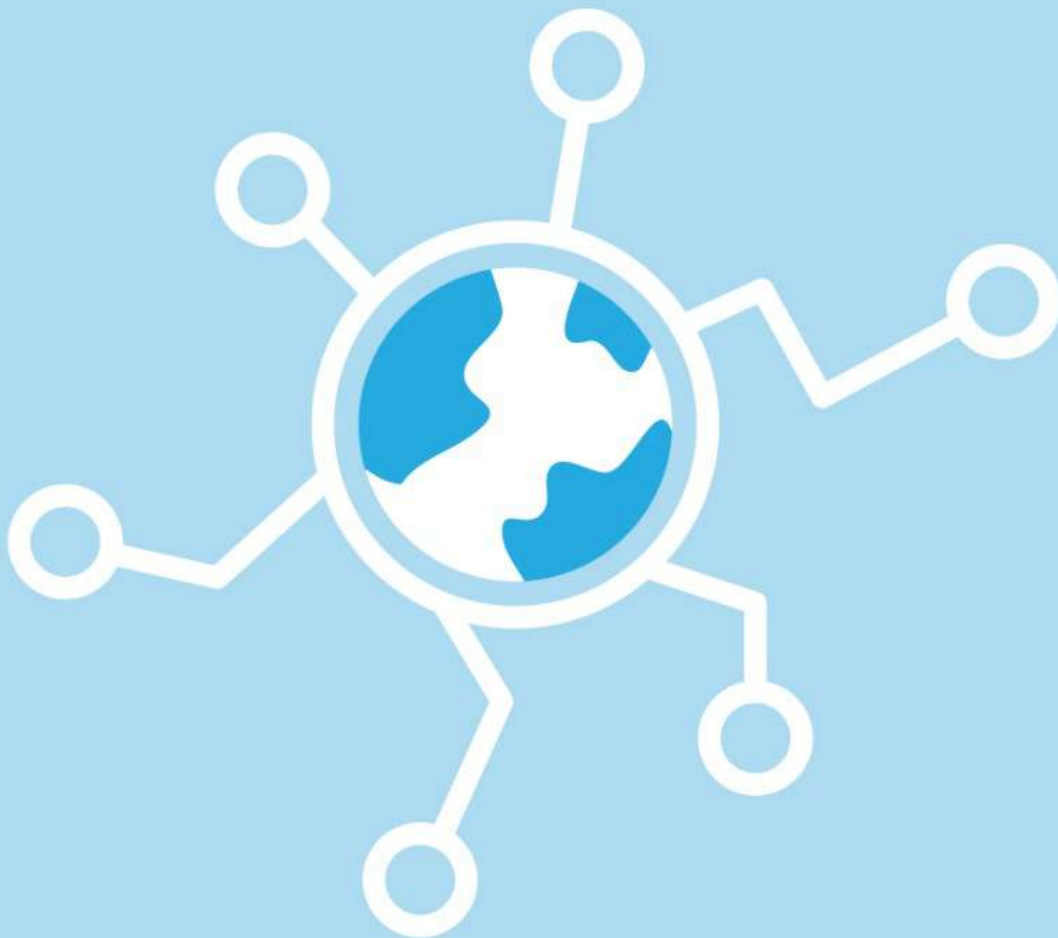


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BOOK SERIES**

Foundations of Computer Science and Information Technology



**EDITED BY :
DR. SUNITA CHAUDHARY
GAWAKSHI CHOUDHARY**

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EDITORIAL INTRODUCTION

The rapid advancement of computer science and information technology has significantly transformed the way individuals, organizations, and societies function in the modern world. In this context, a strong understanding of fundamental computing concepts has become essential for students and professionals across disciplines.

This volume, published under the **International Multidisciplinary Book Series (IMBS)**, presents a structured and comprehensive introduction to the core areas of computer science and information technology. The book covers a wide range of topics, including number systems, computer hardware and software, operating systems, networking concepts, and practical applications such as word processing using Microsoft Word.

The objective of this work is to provide learners with a clear conceptual foundation supported by practical insights. Each chapter has been carefully designed to maintain consistency in presentation, clarity in explanation, and relevance to academic curricula such as undergraduate and diploma programs. The content is suitable for students of computer science as well as learners from multidisciplinary backgrounds seeking to build essential digital competencies.

As part of an international academic series, this volume aims to contribute to the dissemination of knowledge in the field of computing and support teaching, learning, and research activities globally.

The editors sincerely hope that this book will serve as a valuable resource for students, educators, and researchers. Constructive feedback from readers is highly appreciated and will help in improving future editions.

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CHAPTER 1: DECODING NUMBERS: FROM HUMAN COUNTING TO MACHINE LOGIC

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Abstract

This chapter provides a comprehensive understanding of number systems used in computer science. It explains the binary, decimal, octal, and hexadecimal number systems, along with detailed methods for conversion between them. The chapter also covers binary arithmetic operations such as addition, subtraction (using One's and Two's complement), and multiplication with step-by-step solved examples. Diagrams, tables, and practice problems are included to enhance conceptual clarity.

Keywords

Binary, Decimal, Octal, Hexadecimal, Number System, Base, Radix, Conversion, One's Complement, Two's Complement, Binary Arithmetic

1. Introduction

A number system is a systematic way of representing numbers using a fixed set of symbols (digits) and rules. Each system is characterized by its base (or radix), which determines how many unique digits are available and how positional values are calculated.

In computer science, number systems are fundamental because all data—numbers, text, images, and instructions—are ultimately represented in binary (base-2) form. Digital hardware such as processors and memory devices operate using two stable electrical states (ON/OFF), naturally corresponding to binary digits 1 and 0.

1.1 Why Number Systems Matter in Computing

- Enable data representation (integers, real numbers, characters)
- Support arithmetic operations inside the CPU
- Provide compact forms like octal and hexadecimal for readability
- Bridge human-readable (decimal) and machine-level (binary) representations

1.2 Key Terminology

Term	Meaning
Base (Radix)	Number of unique digits in a system
Digit	A single symbol used in a number system
Positional Value	Value of a digit based on its position
Most Significant Digit (MSD)	Leftmost digit
Least Significant Digit (LSD)	Rightmost digit

1.3 Positional Number System Concept

- A positional number system assigns value to each digit based on its position and the base.
- General Representation Diagram (ASCII)
- Number = $(d_n d_{n-1} \dots d_1 d_0 . d_{-1} d_{-2})_b$
- Expanded form:

$$\text{Value} = d_n \cdot b^n + d_{n-1} \cdot b^{n-1} + \dots + d_1 \cdot b^1 + d_0 \cdot b^0 + d_{-1} \cdot b^{-1} + d_{-2} \cdot b^{-2}$$

Where:

d_i = digit at position i

b = base of the number system

1.4 Place Value Table (Example in Base 10)

Position	3	2	1	0	-1	-2
Power	10^3	10^2	10^1	10^0	10^{-1}	10^{-2}
Value	1000	100	10	1	0.1	0.01

Example: $(472.35)_{10} = 4 \times 10^2 + 7 \times 10^1 + 2 \times 10^0 + 3 \times 10^{-1} + 5 \times 10^{-2}$

1.5 Comparison of Positional Systems

System	Base	Example	Expansion
Decimal	10	25_{10}	$2 \times 10^1 + 5 \times 10^0$
Binary	2	1011_2	$1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 1 \times 2^0$
Octal	8	17_8	$1 \times 8^1 + 7 \times 8^0$
Hexadecimal	16	$A3_{16}$	$10 \times 16^1 + 3 \times 16^0$

1.6 Visual Interpretation (Binary Example)

Bit Position	3	2	1	0
Weight	8	4	2	1
Digit	1	0	1	1
Contribution	8	0	2	1

Total = $8 + 0 + 2 + 1 = 11_{10}$

1.7 Fractional Representation (Binary)

Position	-1	-2	-3
Weight	$1/2$	$1/4$	$1/8$

Example: $(0.101)_2 = 1 \times 1/2 + 0 \times 1/4 + 1 \times 1/8 = 0.625_{10}$

1.8 Summary of Concepts

- Every number system is defined by a base and digits
- Values are determined using powers of the base
- Binary is the foundation of digital systems
- Understanding positional notation is essential for conversion and arithmetic operations

2. Types of Number Systems

Number systems are categorized based on their base (radix), which determines how many unique symbols (digits) are available and how positional values are computed. In computing, four primary number systems are widely used—decimal, binary, octal, and hexadecimal. Each serves a specific purpose: decimal is human-friendly, binary is machine-native, while octal and hexadecimal act as compact representations of binary for easier readability and debugging.

Tabular Overview

Number System	Base	Digits Used
Decimal	10	0–9
Binary	2	0, 1
Octal	8	0–7
Hexadecimal	16	0–9, A–F

2.1 Decimal Number System (Base 10)

The decimal system uses ten digits (0–9) and is the standard system for everyday arithmetic. Each position represents a power of 10.

$$\text{Example: } (538)_{10} = 5 \times 10^2 + 3 \times 10^1 + 8 \times 10^0 = 500 + 30 + 8$$

2.2 Binary Number System (Base 2)

The binary system uses only two digits (0 and 1). It is fundamental to digital electronics because hardware circuits operate using two states (ON/OFF).

$$\text{Example: } (1011)_2 = 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 1 \times 2^0 = 8 + 0 + 2 + 1 = 11_{10}$$

2.3 Octal Number System (Base 8)

The octal system uses digits from 0 to 7. It provides a more compact representation of binary numbers, where each octal digit corresponds to three binary bits.

$$\text{Example: } (27)_8 = 2 \times 8^1 + 7 \times 8^0 = 16 + 7 = 23_{10}$$

2.4 Hexadecimal Number System (Base 16)

The hexadecimal system uses sixteen symbols: 0–9 and A–F (where A=10, B=11, ..., F=15). It is widely used in programming, memory addressing, and color codes.

$$\text{Example: } (AF)_{16} = 10 \times 16^1 + 15 \times 16^0 = 160 + 15 = 175_{10}$$

2.5 Comparative Insight

- Decimal is intuitive for humans but inefficient for machines.
- Binary is ideal for hardware but verbose for humans.
- Octal and hexadecimal provide compact and readable representations of binary data.

Number System	Base	Digits Used
Decimal	10	0–9
Binary	2	0, 1
Octal	8	0–7
Hexadecimal	16	0–9, A–F

3. Decimal Number System (Base 10)

The decimal number system is the most widely used number system in everyday life. It is a base-10 positional number system, meaning it uses ten digits ranging from 0 to 9. The value of each digit in a decimal number depends not only on the digit itself but also on its position, which is associated with powers of 10.

In a positional system, each digit is multiplied by a corresponding power of the base (10). The powers increase from right to left, starting from 10^0 at the rightmost position. This positional weighting allows numbers to be represented efficiently and unambiguously.

Structure Diagram

Digit	3	4	5
Power	10^2	10^1	10^0

In this representation, the digit 3 is in the hundreds place, 4 is in the tens place, and 5 is in the units place.

Example

The number $(345)_{10}$ can be expanded using positional values as follows:

$$\begin{aligned} (345)_{10} &= 3 \times 10^2 + 4 \times 10^1 + 5 \times 10^0 \\ &= 3 \times 100 + 4 \times 10 + 5 \times 1 \\ &= 300 + 40 + 5 \\ &= 345 \end{aligned}$$

Thus, the decimal system expresses numbers as a sum of digits multiplied by powers of 10, making it intuitive and suitable for human calculations.

4. Binary Number System (Base 2)

The binary number system is a base-2 positional number system that uses only two digits: 0 and 1. It is the most fundamental number system in computer science because all digital systems, including computers and electronic circuits, operate using two discrete states—commonly represented as OFF (0) and ON (1). Due to this simplicity and reliability, binary is used to represent all forms of data in computing systems.

In the binary system, each position in a number corresponds to a power of 2, increasing from right to left. The rightmost digit represents 2^0 , the next represents 2^1 , and so on. The value of a binary number is obtained by multiplying each digit by its corresponding power of 2 and summing the results.

Binary Place Value Chart

Position	4	3	2	1	0
Value	16	8	4	2	1

This chart shows how each position contributes to the total value of a binary number.

Example

Consider the binary number $(1011)_2$. Its value can be calculated as follows:

$$\begin{aligned} (1011)_2 &= 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 1 \times 2^0 \\ &= 8 + 0 + 2 + 1 \\ &= 11_{10} \end{aligned}$$

Thus, the binary number 1011 is equivalent to 11 in the decimal system.

In summary, the binary number system forms the backbone of modern computing, enabling efficient data processing and storage through simple two-state logic.

5. Octal Number System (Base 8)

Key Idea:

Each octal digit represents 3 binary digits.

6. Hexadecimal Number System (Base 16)

The hexadecimal number system is a base-16 positional number system that uses sixteen distinct symbols to represent values. These include the digits 0 to 9 and the alphabetic characters A to F, where A represents 10, B represents 11, C represents 12, D represents 13, E represents 14, and F represents 15. This system is widely used in computer science because it provides a compact and human-readable representation of binary numbers, with each hexadecimal digit corresponding exactly to four binary bits (a nibble).

In the hexadecimal system, the positional values are based on powers of 16. Similar to other positional number systems, each digit is multiplied by the corresponding power of 16 depending on its position, starting from 16^0 on the rightmost side. This allows large binary numbers to be represented in a much shorter and more manageable form, which is particularly useful in programming, memory addressing, and debugging.

Hexadecimal Digit Table

Decimal	Hex
10	A
11	B
12	C
13	D

Decimal	Hex
14	E
15	F

Example

Consider the hexadecimal number $(A3)_{16}$. Its decimal equivalent can be calculated as follows:

$$\begin{aligned}(A3)_{16} &= A \times 16^1 + 3 \times 16^0 \\ &= 10 \times 16 + 3 \times 1 \\ &= 160 + 3 \\ &= 163_{10}\end{aligned}$$

Thus, the hexadecimal number A3 represents the decimal value 163.

In summary, the hexadecimal number system serves as an efficient bridge between binary and decimal systems, making it an essential tool for programmers and computer engineers.

7. Conversion Techniques

Conversion between number systems is an essential skill in computer science, as it enables the transformation of data between human-readable formats (decimal) and machine-level representations (binary, octal, and hexadecimal). Each type of conversion follows a systematic procedure based on the base (radix) of the number system involved.

7.1 Decimal to Binary Conversion

The conversion from decimal (base 10) to binary (base 2) is performed using a repeated division method. In this method, the given decimal number is divided successively by 2, and the remainders are recorded at each step. The process continues until the quotient becomes zero. The binary equivalent is then obtained by reading the remainders from bottom to top.

Flow Process

- Step 1: Divide the decimal number by 2
- Step 2: Record the remainder (0 or 1)
- Step 3: Divide the quotient again by 2
- Step 4: Repeat until quotient = 0
- Step 5: Write remainders in reverse order

Example

Convert 13_{10} to binary:

$$\begin{aligned}13 \div 2 &= 6 \text{ remainder } 1 \\ 6 \div 2 &= 3 \text{ remainder } 0 \\ 3 \div 2 &= 1 \text{ remainder } 1 \\ 1 \div 2 &= 0 \text{ remainder } 1\end{aligned}$$

Reading from bottom to top:

$$13_{10} = 1101_2$$

7.2 Binary to Decimal Conversion

The conversion from binary to decimal is performed by multiplying each binary digit by its corresponding power of 2, based on its position, and then summing all the values.

Example

Convert $(1010)_2$ to decimal:

$$\begin{aligned}(1010)_2 &= 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 0 \times 2^0 \\ &= 8 + 0 + 2 + 0 \\ &= 10_{10}\end{aligned}$$

This method highlights the positional nature of the binary number system.

7.3 Octal to Binary Conversion

The conversion from octal (base 8) to binary (base 2) is straightforward because each octal digit corresponds exactly to three binary digits. Therefore, each octal digit is replaced by its equivalent 3-bit binary representation.

Octal	Binary
0	000
1	001
2	010
3	011
4	100
5	101
6	110
7	111

Example

Convert $(57)_8$ to binary:

$5 \rightarrow 101$

$7 \rightarrow 111$

Therefore,

$$(57)_8 = (101111)_2$$

7.4 Binary to Hexadecimal Conversion

The conversion from binary to hexadecimal (base 16) involves grouping binary digits into sets of four bits, starting from the right. Each group is then replaced by its corresponding hexadecimal digit.

Conversion Rule

- Group binary digits into 4-bit blocks
- Add leading zeros if necessary
- Convert each group into its hexadecimal equivalent

Example

Convert $(11010110)_2$ to hexadecimal:

Group into 4 bits:

1101 0110

Convert each group:

$1101 \rightarrow D$

$0110 \rightarrow 6$

Thus,

$$(11010110)_2 = (D6)_{16}$$

Summary of Conversion Methods

Decimal \leftrightarrow Binary: Division and positional expansion

Octal \leftrightarrow Binary: 3-bit grouping

Binary \leftrightarrow Hexadecimal: 4-bit grouping

These conversion techniques are widely used in programming, digital electronics, and data representation to ensure efficient communication between human users and computer systems.

8. Binary Arithmetic

Binary arithmetic refers to performing mathematical operations such as addition, subtraction, and multiplication using binary numbers (base 2). These operations follow rules similar to decimal arithmetic but are simplified due to the use of only two digits: 0 and 1. Binary arithmetic is fundamental to computer operations, as all calculations inside a computer system are carried out using binary logic.

8.1 Binary Addition

Binary addition is the simplest form of binary arithmetic and follows a set of basic rules based on combinations of binary digits and carry values. When adding binary numbers, a carry is generated whenever the sum exceeds 1.

A	B	Carry In	Sum	Carry Out
0	0	0	0	0
0	1	0	1	0
1	1	0	0	1

These rules can be extended when a carry-in is present during multi-bit addition.

Example

Consider the addition of two binary numbers:

$$\begin{array}{r} 1011 \\ + 1101 \\ \hline 11000 \end{array}$$

Step-by-step, the addition proceeds from right to left, carrying over whenever the sum of bits exceeds 1. The final result is $(11000)_2$.

8.2 Binary Subtraction

Binary subtraction can be performed using direct borrowing, but in computer systems, it is more efficiently handled using complement methods, namely One's complement and Two's complement.

One's Complement

The One's complement of a binary number is obtained by inverting all bits (changing 0 to 1 and 1 to 0).

Example:

Original number: 0101
 One's complement: 1010

Two's Complement Method

The Two's complement is widely used in computers for subtraction. It is obtained by:

- Step 1: Taking the One's complement
- Step 2: Adding 1 to the result

Example

Subtract 5 from 9 using Two's complement:
 $9 = 1001$
 $5 = 0101$

- Step 1:** One's complement of 5 $\rightarrow 1010$
- Step 2:** Add 1 $\rightarrow 1011$ (Two's complement)

Now add:

$$\begin{array}{r} 1001 \\ + 1011 \\ \hline 10100 \end{array}$$

Discard the overflow carry:
 Result = 0100 (which is 4 in decimal)
 Thus, $9 - 5 = 4$.

8.3 Binary Multiplication

Binary multiplication is similar to decimal multiplication but uses only binary digits (0 and 1). Each digit of the multiplier is multiplied with the multiplicand, and intermediate results are shifted and added accordingly.

Example

Multiply $(101)_2$ by $(11)_2$:

$$\begin{array}{r} 101 \\ \times 11 \\ \hline 101 \\ + 1010 \\ \hline 1111 \end{array}$$

Step-by-step:

Multiply 101 by 1 → 101
Multiply 101 by the next 1 (shift left) → 1010
Add the partial results
Final result = (1111)₂

Summary of Binary Arithmetic

- Binary addition follows simple carry rules
- Subtraction is efficiently performed using Two’s complement
- Multiplication involves shifting and adding partial products
- Binary arithmetic forms the core of all computations performed by digital systems and processors.

9. Applications of Number Systems

Number systems play a crucial role in various domains of computer science and digital technology. In digital circuits, binary numbers are used to represent electrical signals in the form of high (1) and low (0) states, forming the basis of logic gates and processors. In programming, number systems such as binary, octal, and hexadecimal are used for low-level coding, memory addressing, and debugging purposes.

Furthermore, number systems are essential in data storage, where all types of data—including text, images, audio, and video—are encoded in binary form for efficient storage and retrieval. In the field of networking, number systems are used in IP addressing, subnetting, and data transmission, enabling communication between devices over networks. Thus, number systems form the foundation of modern computing and communication systems.

10. Advantages of Binary System

The binary number system offers several advantages that make it ideal for use in digital systems. One of its primary benefits is its simple implementation, as it requires only two states (0 and 1), which can be easily represented using electronic components. Additionally, binary systems are highly reliable in electronic environments, as they are less susceptible to noise and signal distortion compared to multi-level systems.

Another key advantage is that binary arithmetic is efficient for computation, allowing computers to perform calculations quickly and accurately. These characteristics make binary the most suitable and universally adopted number system in computing.

11. Summary

In conclusion, number systems form the backbone of computer science and digital technology. This chapter has explored various number systems, including decimal, binary, octal, and hexadecimal, along with their structures, conversions, and arithmetic operations. A strong understanding of these concepts—especially binary arithmetic and conversion techniques—is essential for comprehending how computers represent, process, and manipulate data at the fundamental level.

References

1. Cormen, T. H., Leiserson, C. E., Rivest, R. L., & Stein, C. (2009). Introduction to algorithms (3rd ed.). MIT Press.
2. Graham, R. L., Knuth, D. E., & Patashnik, O. (1994). Concrete mathematics: A foundation for computer science (2nd ed.). Addison-Wesley.
3. Knuth, D. E. (1997). The art of computer programming (Vol. 1: Fundamental algorithms, 3rd ed.). Addison-Wesley.
4. Mano, M. M., & Ciletti, M. D. (2017). Digital design (6th ed.). Pearson.
5. Patterson, D. A., & Hennessy, J. L. (2017). Computer organization and design: The hardware/software interface (5th ed.). Morgan Kaufmann.
6. Latif, S., Ullah, R., & Jan, H. (2011). A step towards an easy interconversion of various number systems. arXiv

preprint arXiv:1107.1663.

7. Serbenyuk, S. (2019). Modeling numeral systems. arXiv preprint arXiv:1907.10534.
8. Rompis, L. (2021). Decimal-binary conversion methods. *International Journal of Computer Applications*, 174(5), 1–6.
9. Lande, D. R. (2014). Development of the binary number system. *The Mathematics Enthusiast*, 11(3), 1–12.
10. ScienceDirect. (n.d.). Binary number system. Retrieved from <https://www.sciencedirect.com>
11. ACM Digital Library. (n.d.). Number systems in computing. Retrieved from <https://dl.acm.org>
12. Binary systems form the basis of digital computation (Patterson & Hennessy, 2017).
13. Conversion between number systems is essential in computing (Latif et al., 2011).
14. Positional number systems depend on base powers (Knuth, 1997).

CHAPTER 2: CONCEPTS OF DATA, INFORMATION, AND COMPUTER SYSTEMS IN THE DIGITAL ERA

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Abstract

This chapter presents a comprehensive introduction to the fundamental concepts of data, information, and computer systems, along with their role in modern information processing. It begins by defining data as raw facts and information as processed, meaningful output, followed by an exploration of different types of data processing methods, including manual, mechanical, and electronic processing. The chapter further discusses the importance, uses, and levels of information in organizational decision-making, including operational, tactical, and strategic information. In addition, the chapter examines the characteristics and quality of information, highlighting key attributes such as accuracy, relevance, timeliness, and security. It also provides insights into electronic record keeping and compares electronic and manual systems. The evolution of computers through different generations is outlined, along with the fundamental components and characteristics of computer systems. Finally, the chapter explores real-world applications of computers across various domains such as education, business, healthcare, and home use, demonstrating their impact on modern society.

Keywords

Data, Information, Data Processing, Information Systems, Electronic Data Processing, Information Quality, Computer Systems, Computer Generations, Information Technology, Decision Making, Digital Systems

Data:

Data are the raw facts or figures which are processed to get the information.

Need of Data Processing

Data is processed to get the required results. Different operations may be performed on data. Therefore, data processing is defined as: "A sequence of operations on data to convert it into useful information is called data processing."

The important operations that can be performed on data are:

- Arithmetic and logical operations on data to get required results.
- To send and receive data from one location to another.
- Classification of data.
- Arranging data into a specific order etc.

The data processing is divided into three categories or levels.

1. Manual Data Processing: In manual data processing, data is processed manually without using any machine or tool to get required result. In manual data processing, all the calculations and logical operations are manually

performed on the data. Similarly, data is manually transferred from one place to another. This method of data processing is very slow and errors may occur in the output. In India, data is still processed manually in many small business firms as well as government offices & institutions.

2. **Mechanical Data Processing:** In mechanical data processing, data is processed by using different tools like calculators or other mechanical devices. This method of data processing is faster and more accurate than manual data processing.
3. **Electronic Data Processing:** It is the modern technique to process data. The data is processed through computer. Data and set of instructions are given to the computer as input and the computer automatically processes the data according to the given set of instructions. The computer is also known as electronic data processing machine. This method of processing data is very fast and accurate. Now-a-days, the data is processed and analyzed through computers. For example, the results of students are prepared through computer; in banks accounts of customers are processed through computers etc.

Information:

Information is the processed data. Data is entered into and stored in a computer. After processing (such as formatting and printing) output data become information. Means useful data is called Information.

Need of information:

- Information is needed to survive in the modern competitive world.
- Information is needed to create strong information systems and keep these systems up to date.
- Information is needed for organizational decision making.
- Most of the services sectors are depended on information including banking, financial organization, health care, entertainment, tourism and travel, education and numerous others.
- Strong growth of information services fuelled by increasing competition and reduced product life cycle.
- Need for sustainable development and quality life.
- Improvement in communication and transportation brought in by use of information processing.
- Use of information processing in reduction of energy consumption, reduction in pollution and a better ecological balance in future.
- Use of information processing in land record managements, legal delivery system, educational institutions, natural resource planning, customer relation management and so on.

The following list summarizes the five main uses and need of information by businesses and other organizations:

- **Planning** - At the planning stage, information is the most important ingredient in decision making. Information at planning stage includes that of business resources, assets, liabilities, plants and machineries, properties, suppliers, customers, competitors, market and market dynamics, fiscal policy changes of the Government, emerging technologies, etc.
- **Recording** - Business processing these days involves recording information about each transaction or event. This information collected, stored and updated regularly at the operational level.
- **Controlling** - A business need to set up an information filter, so that only filtered data is presented to the middle and top management. This ensures efficiency at the operational level and effectiveness at the tactical and strategic level.
- **Measuring** - A business measures its performance metrics by collecting and analyzing sales data, cost of manufacturing, and profit earned.
- **Decision-making** - MIS is primarily concerned with managerial decision-making, theory of organizational behavior, and underlying human behavior in organizational context. Decision-making information includes the socio-economic impact of competition, globalization, democratization, and the effects of all these factors on an organizational structure.

Level of Information:

Information, as required at different levels can be classified as operational, tactical and strategic.

1. Operational information:

Operational information relates to the day-to-day operations of the organization and thus, is useful in exercising control over the operations that are repetitive in nature. Since such activities are controlled at lower levels of management, operational information is needed by the lower management.

For example, the information regarding the cash position on day-to-day basis is monitored and controlled at the lower levels of management. Similarly, in marketing function, daily and weekly sales information is used by lower level manager to monitor the performance of the sales force.

It may be noted that operational information pertains to activities that are easily measurable by specific standards. The operational information mainly relates to current and historical performance, and is based primarily on internal sources of data. The predictive element in operational information is quite low and if at all it is there, it has a short term horizon.

2. Tactical information:

Tactical information helps middle level managers allocating resources and establishing controls to implement the top level plans of the organization. For example, information regarding the alternative sources of funds and their uses in the short run, opportunities for deployment of surplus funds in short- term securities, etc. may be required at the middle levels of management.

The tactical information is generally predictive, focusing on short-term trends. It may be partly current and partly historical, and may come from internal as well as external sources.

3. Strategic information:

While the operational information is needed to find out how the given activity can be performed better, strategic information is needed for making choices among the business options.

The strategic information helps in identifying and evaluating these options so that a manager makes informed choices which are different from the competitors and the limitations of what the rivals are doing or planning to do. Such choices are made by leaders only.

Strategic information is used by managers to define goals and priorities, initiate new programs and develop policies for acquisition and use of corporate resources. For example, information regarding the long-term needs of funds for on-going and future projects of the company may be used by top level managers in taking decision regarding going public or approaching financial institutions for term loan.

Strategic information is predictive in nature, relies heavily on external sources of data, has a long-term perspective, and is mostly in summary form. It may sometimes include ‘what if’ scenarios. However, the strategic information is not only external information.

For long, it was believed that strategic information is basically information regarding the external environment. However, it is now well recognized that the internal factors are equally responsible for success or failures of strategies and thus, internal information is also required for strategic decision making.

Figure 1.2 represents the types of information required at different levels of managerial hierarchy.

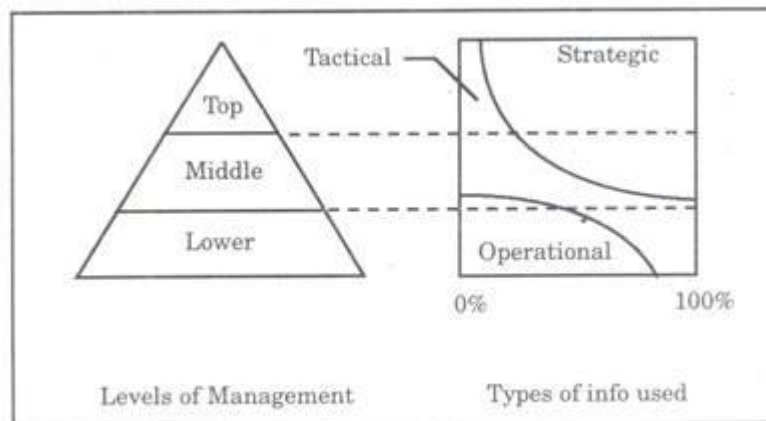


Fig. 1.2 Types of information and levels of management

It may be remembered that each type of information has its role to play in managerial effectiveness. Each type of information is needed with varying degree by the managers at all levels. Thus, a part of operational information may be used even by the chief executive officer of a company.

The difference lies in the proportion of each type of information in the total information needs of managers at different levels of managerial hierarchy.

Quality of information:

The meaning of information quality lies in how the information is perceived and used by its customer. Though

absolute attributes are important, it is how those attributes are perceived, now and in the future, that defines information quality. Identifying quality information involves two stages: first, highlighting which attributes are important and second, determining how these attributes affect the customers in question. Quality information meets certain recognized criteria such as "accuracy", "timeliness", "relevance", and "understandability". Following are the majors of information quality:

1.Relevance:

The key component for information quality is whether the information addresses its customer's needs. The *relevance* of information reflects the degree to which it meets the real needs of clients. It is concerned with whether the available information sheds light on the issues that are important to users. Assessing relevance is subjective and depends upon the varying needs of users.

2.Accuracy:

The *accuracy* of statistical information is the degree to which the information correctly describes the phenomena it was designed to measure. It is usually characterized in terms of error in statistical estimates and is traditionally decomposed into bias (systematic error) and variance (random error) components. It may also be described in terms of the major sources of error that potentially cause inaccuracy (e.g., coverage, sampling, non response, response).

3.Timeliness:

Timely information is still current. Implicit in this definition is a dynamic process where new information arises to replace the old. Information has a cycle time which depends on how quickly new information can be processed and communicated to its customer.

4.Completeness

Incomplete information can lead its customer astray. An example of this is the old story of blind travelers encountering an elephant in the road with each, after examining a small section, coming to a different conclusion regarding the object's identity. However, complete information for one person may be incomplete for another. For example, the marketing vice president and the director of research and development for a pharmaceutical company may be both be interested in the clinical trials tests for a new drug, but each may require different levels of detail.

5.Coherence

Coherence is how well the information "hangs together" and it consistent with itself. Information can become incoherent through irrelevant details, confusing measures or ambiguous format which can confuse information customers and cause them to not receive or even reject the information's message. Although information can be genuinely incoherent, incoherent information usually indicates an error in accuracy or timeliness.

6.Format

Information format refers to how the information is presented to the customer. Two components of information format are its underlying form and its context for interpretation, which is sometimes referred to as its frame.

The appropriate format for information depends on the information's customer and the information's use. For example, an accountant may prefer twenty pages of numbers to a graphical summary, but may insist of using only multi-color pie charts for his presentation to the senior vice president of sales.

The context with which we view information also is important. For example, when a company benchmarks its performance against industry or functional world class leader, it seeks to give that information context. For years financial analysts have viewed information in context, witness the focus on stock price performance over time, a portfolio manager's performance relative to the S&P 500, or corporate performance versus that of the corporation's industry.

7.Accessibility

Accessible information is information that can be obtained when needed. Accessibility depends on the customer and even the specific circumstances for that customer. For information quality to occur, timeliness and accessibility should complement each other. Timely information that is inaccessible or accessible information that is obsolete, cannot satisfy an information customer's needs.

Applications of information technology to customer services offer excellent examples of how firms can use quality in information accessibility to obtain competitive advantage witness 800 numbers for computer software and hardware firms, credit card providers and mutual funds.

8. Compatibility

To paraphrase a famous line, "no information is an island." Information quality lies not only in the quality of the information itself, but also in how it can be combined with other information and delivered to a customer. This often involves systems working together.

The proper information architecture enhances information quality by making the information suitable for enhanced uses. A quality architecture implies a dynamic structure that can grow with changing customer requirements. This is necessary when companies must leverage their information base to develop new products and services as well as optimize their production and management processes.

9. Security

Historically, information security has been a stepchild of the information technology revolution. Security often was either added on after information systems development was completed or ignored altogether. Two aspects of information security are protecting information from people (logical security) and protecting information from natural disasters (disaster recovery planning). Logical security relies on logical barriers such as passwords, data encryption and transaction authentication, along with human vigilance. Disaster recovery planning involves protecting information and ensuring appropriate back-up and alternate processing procedures are in place.

The topic of information security has become increasingly visible in recent years. Indeed breaches of information security are a potential Achilles heel for the entire information technology revolution because information that is not secure cannot be trusted, and will not be used to its fullest potential.

10. Validity

Information has validity when it can be verified as being true and satisfying appropriate standards related to other dimensions such as accuracy, timeliness, completeness and security. The most common form of verification is auditing information, either as an ongoing practice or as part of a special project. Auditing can uncover mistakes and is a accepted measure of information quality. An obvious example is the corporate financial statement, which to be credible must be audited by an independent party. However, just as quality cannot be inspected into manufactured products, quality cannot be audited into information products.

Validity is a resultant rather than a causal dimension of information quality. Though validity may be high, other crucial dimensions may be low and overall, the information may be of poor quality. Ultimately, optimizing the design and ongoing operation of the human and technological information system is the road to information quality.

Electronic record keeping

Advantages

- Helps you record business transactions, including income and expenses, payments to workers, and stock and asset details.
- Efficient way to keep financial records and requires less storage space.
- Provides the option of recording a sale when you raise an invoice, not when you receive a cash payment from a client.
- Easy to generate orders, invoices, debtor reports, financial statements, employee pay records, inventory reports.
- Automatically tallies amounts and provides reporting functions.
- Keeps up with the latest tax rates, tax laws and rulings.
- Many accounting programs have facilities to email invoices to clients, orders to suppliers, or BAS returns to the Australian Taxation Office.
- Allows you to back up records and keep them in a safe place in case of fire or theft.

Manual record keeping

Advantages

- Less expensive to set up.
- Correcting entries may be easier with manual systems, as opposed to computerized ones that can leave complicated audit trails.
- The risk of corrupted data is much less.
- Data loss is less of a risk, particularly if records are stored in a fire-proof environment.
- Problems with duplicate copies of the same records are generally avoided.
- The process is simplified as you don't need to be familiar with how accounting software calculates and treats your information.

The Difference/ comparison between Electronic and Paper Documents

1. The magnitude of electronic data is way larger than paper documents

This point is obvious to the majority of observers. Today's typical disks are at several dozen gigabytes and these sizes grow constantly. A typical medium-size company will have PC's on the desks of most white-collar workers, company-related data, accounting and order information, personnel information, a potential for several databases and company servers, an email server, backup tapes, etc. Such a company will easily have several terabytes of information. Accordingly, such a company has over 2 million documents. Just one personal hard drive can contain 1.5 million pages of data, and one corporate backup tape can contain 4 million pages of data. Thus the magnitude of electronic data that needs to be handled in discovery is staggering. In most corporate civil lawsuits, several backup tapes, hard drives, and removable media are involved.

2. Variety of electronic documents is larger than paper documents

Paper documents are ledgers, personnel files, notes, memos, letters, articles, papers, pictures, etc. This variety exists also in electronic form. But then spreadsheets are way more complex than ledger, for example. They contain formulas, may contain charts, they can serve as databases, etc. In addition to all added information, e.g. charts, ability to view the actual computations involved, e.g. formulae, the electronic spreadsheet supports experimentation with what-if version the discoverer may want to investigate. Personal digital assistants, pocket PCs, palm devices or BlackBerry devices, are subject to electronic discovery. Many of these devices can be used to send and retrieve e-mails. Since an e-mail deleted from a network may still exist on an individual employee's PDA, parties may demand discovery of the contents of PDAs.

3. Electronic documents contains attributes lacking in paper documents

Computers maintain information about your documents, referred to as "metadata," such as: author's name, document creation date, date of it last access, etc. A hard copy of the document does not reveal metadata, although certain metadata items may be printed. Depending on what you do with the document after opening it on your computer screen, the actions taken may change the metadata collected about that document. Paper documents were never this complex.

4 Electronic documents are more efficient than paper documents

Paper documents are delivered by mail and stored locally in filing cabinet. For multiple users to access documents simultaneously one needs a set of documents per each accessing person. File cabinets are bulky and use up valuable office space. Paper documents are difficult to search, carry, copy, and modify. Paper documents are easily damaged, misfiled or misplaced. Electronic documents are delivered by networks, disks, flash memory and CD/DVD and are stored on a file system. Multiple users can read and review electronic document simultaneously. Computer file systems are getting smaller and contain more data every year. Personal file systems are physically smaller than a small cell phone; only very large companies need massive file systems that occupy a lot of real estate. It is almost too easy to search, carry, copy, and modify electronic documents. Electronic documents, in a well run operation, have copies and damage to a single copy causes extra work but no loss.

5 The structure of electronic documents may reach complexity absent from paper documents

A description of the structure of an object (i.e. document) identifies its component parts and the nature of the relationships between those parts. Describing documents (i.e. objects) this way points to the complexity of electronic documents.

The following list shows some aspects of the complexity of electronic documents.

- An electronic document may consist of subdocuments that do not even have to reside on the same computer.
- An electronic document may be written in HTML and displayed by a Web browser. Such paper documents don't even exist.
- An electronic document may have hyperlinks to other documents.
- An electronic document may have dynamic parts. This holds in an obvious way to Web pages that can include (and invisible to the reader) programs in languages such as JavaScript and ASP, which run in the browser and the reader views only the results of these runs. It may also hold to text document or spreadsheets as a result of embedded executable fields, functions and macros.
- Electronic documents have much wider spectra than paper ones as they can include not only the classic, word-processed text but table databases or a part thereof as well as image, voice and video.

6 Electronic documents are more persistent and more difficult to destroy than paper documents

Paper documents are easy to destroy. Throwing away or shredding makes paper documents disappear. Deleting an electronic document eliminates only the ubiquitous accessible copy. The document, i.e. its data, still exists and in systems such as Windows and Mac OS, an accessible reference to deleted documents may be in the trash bin. Restoring a document in the trash bin, i.e. a deleted document, revives the document to its original glory. Even removing the document from the trash bin does not erase the documents data off the disk. Once removed from the trash bin, documents data areas on the disk go into a “free list” that makes those areas available for future data creation needs. The free list contains all areas not currently allocated to active documents as well as to deleted documents still in the trash bin. How long will an area stay on the free list (thereby still containing the deleted documents data)? That is difficult to predict due the huge variability of factors such as: future demand for disk space, size of current and future files, the current availability of disk space, etc.

Even the complete deletion of a document, its trash bin instance and the allocation of the document’s data area on the disk does not typically extinguishes the document altogether. Several practices create copies of documents and are only marginally affected by document deletion:

- Backups – most organizations and individuals create backup copies of documents as regular practice as precautionary actions. The backups are maintained independently of the document itself.
- Documents may be exchanged by email, access through web pages and manually handed electronic copies. Thus created copies continue to exist after the deletion of the original document.
- Even work on a simple text document is quite frequently preceded by creating a copy of the document being edited. Once again, such copies persist beyond the deleted document unless specifically deleted.

7 Electronic documents change faster, more frequently and easier than paper documents

Changes to an electronic document are fast and easy. The reason is obvious; all you need to do is make the change and save it. Changes to paper documents, however, require retyping the whole document. There are many other reasons to the difference in speed and frequency. We already said that documents may be dynamic. Web pages are made dynamic in order to ease change. For discovery, faster and frequent changes imply a need for a more meticulous and length monitoring of document discovery.

8 Electronic documents last longer than paper documents

Paper deteriorates with time; paper documents can be destroyed by flood and fire. Although these factors have their parallels in electronic documents, e.g. a flooded computer loses its data; typical backups of the documents practices maintain copies away from the “office.” Paper documents may enjoy the same treatment, but the frequency, extent and usage of such backups is substantially smaller. Electronic document suffer from upgrades in technology. If one used a peculiar word processor, e.g. WordStar, to write a document ten years ago, today it will be difficult to find a tool to read that document. Same holds for spreadsheets, databases, etc. Again, most companies have practices that avoided such problem by evolving documents with time.

9 The redundancy in electronic documents is higher than in paper documents

- There are several levels of redundancy to electronic documents.
- Due to the type of recording used for electronic data, minor errors in a document can be corrected by computer tools. The tools rely on the redundancy of checksums and other devices
- Due to frequent changes in documents, individuals learn to save previous versions of the documents. Doing that generates redundancy of document versions.
- Emails, flash memories, CDs all proliferate documents and result in high redundancy
- Most companies and many individuals make backup of documents
- Tool that control versioning of files create built-in redundancy

10 An electronic data is more likely to be created by several individuals than a paper document

MS Word supports “Document Collaboration.” Where this term implies: “new objects, properties, and methods of the Word 10.0 Object Library shown in this article allow you to change the display of revisions and comments, accept and reject revisions, and start and end a collaborative review cycle.” Another tool, Workshare , is an add-on to Microsoft Word that manages collaboration on Word documents and integrates this activity with email and the organization’s document repository tool. Collaborations on databases (e.g. people using a bank’s ATMs update the bank’s database), spreadsheets (e.g. BadBlue), and Web sites are commonly practiced. This dwarfs collaborations on paper documents possible. For discovery it implies that the author of a Word document may not be the only person

involved in writing the document. One has to determine all the parties that collaborated on the document.

11 Electronic documents may be created by electronic means while paper documents are created by humans

Paper documents are always written by human beings. That is not necessarily the case with documents. We start with a simple, and rather common, example. The Quicken financial program will generate financial reports from a database of financial transactions.

12 Electronic discovery requires support of an infrastructure that paper discovery has never needed

The large volumes of data, its complexity and its variety of electronic documents have brought about many types of computer tools to help overcome the obvious difficulties.

Brief History of Development of computers:

The history of computers starts out about 2000 years ago in Babylonia (Mesopotamia), at the birth of the abacus, a wooden rack holding two horizontal wires with beads strung on them. We can divide the history in 5 generations:

The Five Generations of Computers:

1.First Generation (1940-1956) Vacuum Tubes:

The first computers used vacuum tubes for circuitry and magnetic drums for memory, and were often enormous, taking up entire rooms. They were very expensive to operate and in addition to using a great deal of electricity, generated a lot of heat, which was often the cause of malfunctions.

First generation computers relied on machine language, the lowest-level programming language understood by computers, to perform operations, and they could only solve one problem at a time. Input was based on punched cards and paper tape, and output was displayed on printouts.

The UNIVAC and ENIAC computers are examples of first-generation computing devices. The UNIVAC was the first commercial computer delivered to a business client, the U.S. Census Bureau in 1951.

2.Second Generation (1956-1963) Transistors:

Transistors replaced vacuum tubes and ushered in the second generation of computers. The transistor was invented in 1947 but did not see widespread use in computers until the late 1950s. The transistor was far superior to the vacuum tube, allowing computers to become smaller, faster, cheaper, more energy-efficient and more reliable than their first-generation predecessors. Though the transistor still generated a great deal of heat that subjected the computer to damage, it was a vast improvement over the vacuum tube. Second-generation computers still relied on punched cards for input and printouts for output.

Second-generation computers moved from cryptic binary machine language to symbolic, or assembly, languages, which allowed programmers to specify instructions in words. High-level programming languages were also being developed at this time, such as early versions of COBOL and FORTRAN. These were also the first computers that stored their instructions in their memory, which moved from a magnetic drum to magnetic core technology.

The first computers of this generation were developed for the atomic energy industry.

3.Third Generation (1964-1971) Integrated Circuits:

The development of the integrated circuit was the hallmark of the third generation of computers. Transistors were miniaturized and placed on silicon chips, called semiconductors, which drastically increased the speed and efficiency of computers.

Instead of punched cards and printouts, users interacted with third generation computers through keyboards and monitors and interfaced with an operating system, which allowed the device to run many different applications at one time with a central program that monitored the memory. Computers for the first time became accessible to a mass audience because they were smaller and cheaper than their predecessors.

4.Fourth Generation (1971-Present) Microprocessors:

The microprocessor brought the fourth generation of computers, as thousands of integrated circuits were built onto a single silicon chip. What in the first generation filled an entire room could now fit in the palm of the hand. The Intel 4004 chip, developed in 1971, located all the components of the computer—from the central processing unit and memory to input/output controls—on a single chip.

In 1981 IBM introduced its first computer for the home user, and in 1984 Apple introduced the Macintosh. Microprocessors also moved out of the realm of desktop computers and into many areas of life as more and more

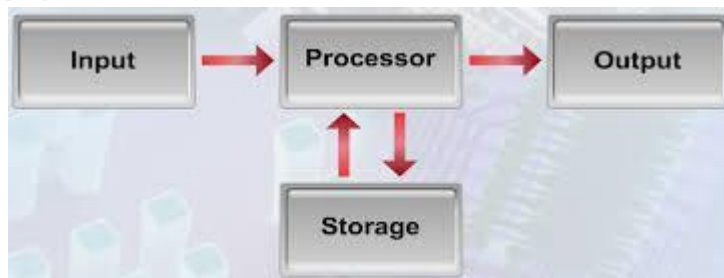
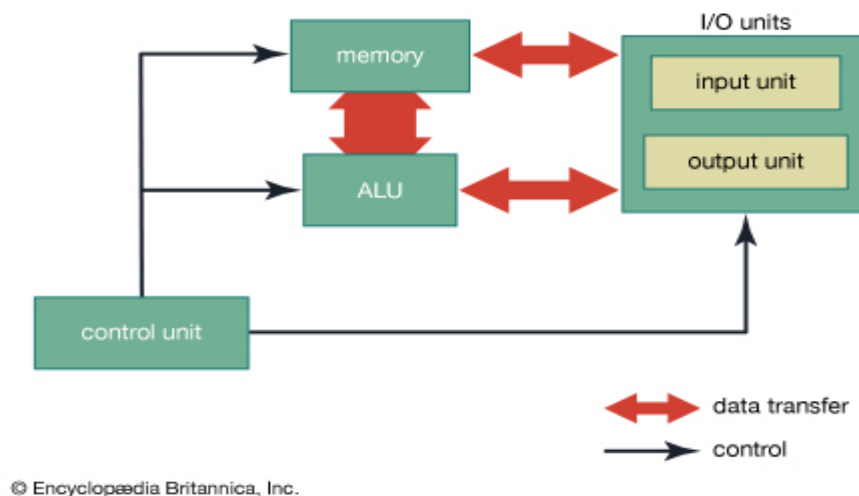
everyday products began to use microprocessors.

As these small computers became more powerful, they could be linked together to form networks, which eventually led to the development of the Internet. Fourth generation computers also saw the development of GUIs, the mouse and handheld devices.

5.Fifth Generation (Present and Beyond) Artificial Intelligence:

Fifth generation computing devices, based on artificial intelligence, are still in development, though there are some applications, such as voice recognition, that are being used today. The use of parallel processing and superconductors is helping to make artificial intelligence a reality. Quantum computation and molecular and nanotechnology will radically change the face of computers in years to come. The goal of fifth-generation computing is to develop devices that respond to natural language input and are capable of learning and self-organization.

Computer system concept:



The computer is a system of hardware devices organized according to the following system functions:

1.Input. The input devices of a computer system include keyboards, touch screens, pens, electronic, optical scanners, and so on. They convert data into electronic machine-readable form for direct entry or through telecommunications links into a computer system.

2.Processing. The central processing unit (CPU) is the main processing component of a computer system. (In microcomputers, it is the main microprocessor.) In particular, the arithmetic-logic unit, one of the CPU's major components, performs the arithmetic and logic functions required in computer processing.

3.Output. The output devices of a computer system include video display units, printers, audio response units, and so on. They convert electronic information produced by the computer system into human-intelligible form for presentation to end users.

4.Storage. The storage function of a computer system takes place in the computer's primary storage unit, or memory, and in secondary storage devices such as magnetic disk and tape units. These devices store data and program instructions needed for processing.

5.Control. The control unit of the CPU is the control component of a computer system. It interprets computer program instructions and transmits directions to the other components of the computer system.

Computer system characteristics:

The characteristics of computers that have made them so powerful and universally useful are speed, accuracy, diligence, versatility and storage capacity.

1.Speed: Computers work at an incredible speed. A powerful computer is capable of performing about 3-4 million simple instructions per second.

2. Accuracy: In addition to being fast, computers are also accurate. Errors that may occur can almost always be attributed to human error (inaccurate data, poorly designed system or faulty instructions/programs written by the programmer).

3. Diligence: Unlike human beings, computers are highly consistent. They do not suffer from human traits of boredom and tiredness resulting in lack of concentration. Computers, therefore, are better than human beings in performing voluminous and repetitive jobs.

4. Versatility: Computers are versatile machines and are capable of performing any task as long as it can be broken down into a series of logical steps. The presence of computers can be seen in almost every sphere – Railway/Air reservation, Banks, Hotels, Weather forecasting and many more.

5. Storage Capacity: Today's computers can store large volumes of data. A piece of information once recorded (or stored), in the computer, can never be forgotten and can be retrieved almost instantaneously.

Capabilities and Limitations of a Computer

Computers have become an essential part of modern life and are used in homes, schools, hospitals, banks, offices, and many other environments. They assist humans in performing a wide variety of tasks efficiently and accurately. Due to their versatility and power, people rely heavily on computers for work, communication, entertainment, and data storage. This widespread use is possible because computers possess several important capabilities.

Capabilities of a Computer

- One of the most significant features of a computer is its high processing speed. A computer can perform millions of calculations within a fraction of a second, making it extremely efficient for handling large volumes of data.
- Another important capability is accuracy. When provided with correct data and instructions, computers can produce highly precise results. This is why they are widely used in scientific research, engineering, and financial systems.
- Computers are also capable of storing vast amounts of data. Modern storage devices allow users to save and retrieve information easily whenever required. This makes computers highly useful for maintaining records and documents.
- In addition, computers allow users to retrieve and modify previously stored work. Users can edit documents, duplicate files, and restore earlier versions, making work management convenient and flexible.
- Computers are also known for their automation. Once a task is programmed, a computer can perform it automatically without requiring constant human intervention.
- Another advantage is their ability to perform multiple tasks simultaneously. Users can run different programs at the same time, increasing productivity and efficiency.
- Finally, computers can be upgraded and improved. Hardware components and software can be replaced or enhanced, allowing computers to adapt to new technologies and requirements.

Limitations of a Computer

- Despite their many advantages, computers have certain limitations. A computer can only perform tasks based on the instructions provided to it. It cannot think independently or make decisions beyond its programming.
- Computers also cannot generate information on their own. They depend entirely on input data and instructions given by users. Without proper input, they cannot produce meaningful output.
- Another limitation is that computers cannot distinguish between correct and incorrect data. If incorrect data is entered, the output will also be incorrect. This concept is often referred to as "Garbage In, Garbage Out" (GIGO).
- Additionally, computers cannot correct wrong instructions automatically. If an error exists in a program or command, the computer will not be able to fix it and may stop functioning until the issue is resolved by a user.

Applications of Computers in various fields(in general and pharmacy):

Computers are used in so many fields in our daily life. From Engineers to Doctors, Students, Teachers, and Government Organization they all use computers to perform specific tasks, for entertainment or just to finish office work. Computers have made our life easier. With greater precision and accuracy and less time taking computers can

do a lot in short time while that task can take a lot of time while doing manually. Computers have taken industries and businesses to a whole new level. They are used at Home for work and entertainment purposes, at Office, in hospitals, in government organizations. Following are some fields of the uses of computers.

A). Uses of Computer at Home:

Computer can be used at home in the following ways.

1.Home Budget:

Computer can be used to manage Home Budget. You can easily calculate your expenses and income. You can list all expenses in one column and income in another column. Then you can apply any calculation on these columns to plan your home budget. There are also specialize software that can manage your income and expenses and generate some cool reports.

2.Computer Games:

An important use of computers at home is playing games. Different types of games are available. These games are a source of entertainment and recreation. Many games are available that are specially developed to improve your mental capability and thinking power.

3.Working from Home:

People can manage the office work at home. The owner of a company can check the work of the employees from home. He can control his office while sitting at home.

4.Entertainment:

People can find entertainment on the internet. They can watch movies, listen to songs, and watch videos download different stuff. They can also watch live matches on the internet.

5.Information:

People can find any type of information on the internet. Educational and informative websites are available to download books, tutorials etc. to improve their knowledge and learn new things.

6.Chatting & Social Media:

People can chat with friends and family on the internet using different software like Skype etc. One can interact with friends over social media websites like Face book, Twitter & Google Plus. They can also share photos and videos with friends.

B).Uses of Computers in Education:

1.CBT(Computer based teaching): are different programs that are supplied on CD-ROM. These programs include text, graphics and sound. Audio and Video lectures are recorded on the CDs. CBT is a low cost solution for educating people. You can train a large number of people easily.

Benefits of CBT:

Some benefits of CBT are as follows:

1. The students can learn new skills at their own pace. They can easily acquire knowledge in any available time of their own choice.
2. Training time can be reduced.
3. Training materials are interactive and easy to learn. It encourages students to learn the topic.
4. Planning and timing problems are reduced or eliminated.
5. The skills can be taught at any time and at any place.
6. It is very cost effective way to train a large number of students.
7. Training videos and audios are available at affordable prices.

2.Computer Aided Learning (CAL):

Computer aided learning is the process of using information technology to help teaching and enhance the learning process. The use of computer can reduce the time that is spent on preparing teaching material. It can also reduce the administrative load of teaching and research. The use of multimedia projector and PowerPoint presentations has improved the quality of teaching. It has also helped the learning process.

3.Distance Learning:

Distance learning is a new learning methodology. Computer plays the key role in this kind of learning. Many institutes are providing distance learning programs. The student does not need to come to the institute. The institute provides the reading material and the student attends virtual classroom. In virtual classroom, the teacher delivers lecture at his own workplace. The student can attend the lecture at home by connecting to a network. The student can also ask questions to the teacher.

4. Online Examination:

The trend of online examination is becoming popular. Different examination like GRE, GMAT and SAT are conducted online all over the world. The questions are marked by computer. It minimizes the chance of mistakes. It also enables to announce the result in time.

C). Uses of Computers in Business:

The use of computer technology in business provides many facilities. Businessmen are using computers to interact with their customers anywhere in the world. Many business tasks are performed more quickly and efficiently. Computers also help them to reduce the overall cost of their business. Computer can be used in business in the following ways.

1. Marketing:

An organization can use computers for marketing their products. Marketing applications provide information about the products to customers. Computer is also used to manage distribution system, advertising and selling activities. It can also be used in deciding pricing strategies. Companies can know more about their customers and their needs and requirements etc.

2. Stock Exchange:

Stock Exchange is the most important place for businessmen. Many stock exchanges use computers to conduct bids. The stockbrokers perform all trading activities electronically. They connect with the computer where brokers match the buyers with sellers. It reduces cost as no paper or special building is required to conduct these activities.

D). Uses of computers in Pharmacy/Medical Field:

1. Hospital Management System:

Specialized hospital management software's are used to automate the day to day procedures and operations at hospitals. These tasks may be online appointments, payroll admittance and discharge records etc.

2. Patient History:

Hospital management systems can store data about patients. Computers are used to store data about patients, their diseases & symptoms, the medicines that are prescribed.

3. Patients Monitoring:

Monitoring systems are installed in medical wards and Intensive care units to monitoring patients continuously. These systems can monitor pulse, blood pressure and body temperature and can alert medical staff about any serious situations.

4. Life Support Systems:

Specialized devices are used to help impaired patients like hearing aids.

5. Diagnosis Purpose:

A variety of software's are used to investigate symptoms and prescribed medication accordingly. Sophisticated systems are used for tests like CT scan, ECG, and other medical tests.

References

1. Laudon, K. C., & Laudon, J. P. (2020). *Management information systems: Managing the digital firm* (16th ed.). Pearson.
2. Stair, R., & Reynolds, G. (2019). *Principles of information systems* (13th ed.). Cengage Learning.
3. O'Brien, J. A., & Marakas, G. M. (2011). *Management information systems* (10th ed.). McGraw-Hill.
4. Senn, J. A. (2004). *Information technology: Principles, practices, and opportunities* (3rd ed.). Pearson Education.
5. Ackoff, R. L. (1989). From data to wisdom. *Journal of Applied Systems Analysis*, 16, 3–9.
6. Davenport, T. H., & Prusak, L. (1998). *Working knowledge: How organizations manage what they know*. Harvard Business School Press.
7. Zins, C. (2007). Conceptual approaches for defining data, information, and knowledge. *Journal of the American Society for Information Science and Technology*, 58(4), 479–493.
8. Checkland, P., & Holwell, S. (1998). *Information, systems and information systems*. Wiley.

CHAPTER 3: COMPUTER SYSTEM ARCHITECTURE AND COMPONENTS: STRUCTURE, MEMORY, AND STORAGE TECHNOLOGIES

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Abstract

This chapter provides a detailed understanding of the architecture and components of a computer system, focusing on its fundamental units such as the input unit, central processing unit (CPU), and output unit. It explains how these components interact to perform data processing tasks efficiently. Special emphasis is given to the structure and functions of the CPU, including the Arithmetic Logic Unit (ALU), Control Unit (CU), and memory unit.

The chapter further explores different types of computer architectures, namely Von Neumann and Harvard architectures, highlighting their design principles and operational differences. In addition, it presents an in-depth discussion of computer memory systems, including primary memory, secondary memory, and cache memory, along with their characteristics and classifications.

The role of input and output devices is also examined, along with various storage technologies such as magnetic and optical storage devices. The chapter concludes with a comprehensive overview of storage media, including hard disks, magnetic tapes, and floppy disks, emphasizing their structure, working mechanisms, and performance considerations. Overall, this chapter builds a strong foundation for understanding how computer systems are organized and how they manage data and instructions.

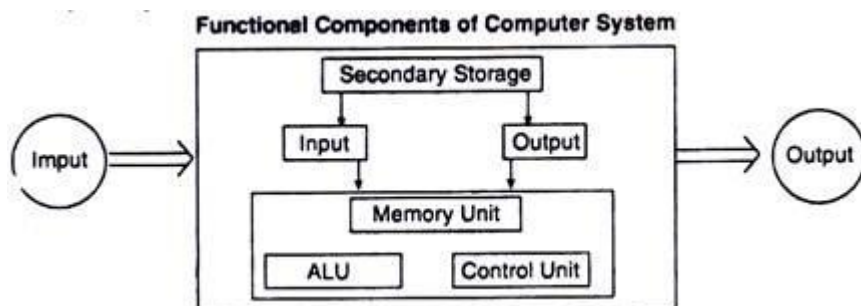
Keywords

Computer Architecture, CPU, ALU, Control Unit, Memory, Primary Memory, Secondary Memory, Cache Memory, Input Devices, Output Devices, Storage Devices, Von Neumann Architecture, Harvard Architecture, Magnetic Storage, Optical Storage

Elements/components of A Computer System(Architecture):

A computer system mainly has three components viz. Input Unit, Central Processing Unit and Output Unit. These components are the building blocks of a computer and define its architecture.

The relationship among these components is well established by the following diagram:



(i) Input Unit:

Input unit is responsible for controlling the various input devices that are used to enter data into the computer. The commonly used input devices are mouse, keyboard, light pen, optical scanner etc. While some input devices are designed for special purposes such as Optical Character Recognition (OCR), Magnetic Ink Character Recognition (MICR) and Bar Code Reader etc, there are other devices that accept input by responding to physical touch and voice such as ATMs.



(ii) Central Processing Unit (CPU):

The CPU ensures the flow of data into the system by directing the data to enter the system, storing it into the memory and retrieving it when needed to produce the output.

It has three parts:

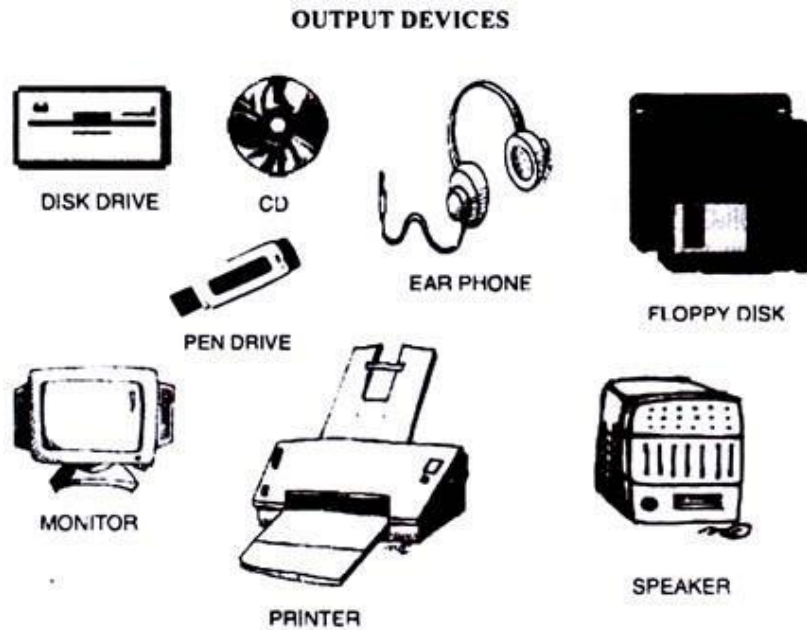
Arithmetic and Logic Unit (ALU): It performs all the arithmetical calculations and computations like addition, subtraction, multiplication and division. It is also responsible for logical calculations like comparisons among data items.

Memory Unit: The data has to be stored in the memory blocks of the computer before it is retrieved for actual processing.

Control Unit: As the name suggests, control unit controls and coordinates the activities of all the components of the computer system. It reads data from the memory, decodes the instructions, looks after its execution, and fetches the next instruction and so on.

(iii) Output Unit:

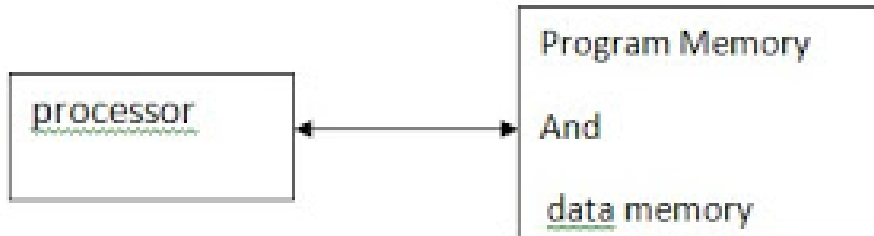
It controls various output devices like printer, graphic plotter, speech synthesizer, monitor (also known as Visual Display Unit or VDU) to produce the desired output and present it to the user. It ensures the convertibility of output into human readable form that is understandable by the user.



computer architectures:

There are basically two types of digital computer architectures. The first one is called Von Neumann architecture and later Harvard architecture was adopted for designing digital computers.

1.Von Neumann Architecture:



It is named after the mathematician and early computer scientist John Von Neumann. In this the computer has single storage system (memory) for storing data as well as program to be executed. Processor needs two clock cycles to complete an instruction. Pipelining the instructions is not possible with this architecture. In the first clock cycle the processor gets the instruction from memory and decodes it. In the next clock cycle the required data is taken from memory. For each instruction this cycle repeats and hence needs two cycles to complete an instruction. This is a relatively older architecture and was replaced by Harvard architecture.

2.Harvard Architecture:

The Harvard architecture is computer architecture with physically separate storage and signal pathways for instructions and data. The term originated from the Harvard Mark I relay-based computer, which stored instructions on punched tape (24 bits wide) and data in electro-mechanical counters. These early machines had data storage entirely contained within the central processing unit, and provided no access to the instruction storage as data. Programs needed to be loaded by an operator; the processor could not boot itself.



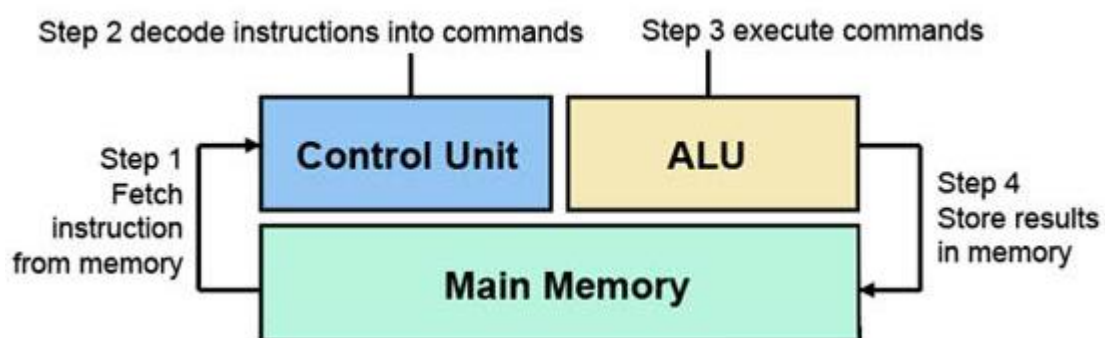
The name is originated from "Harvard Mark I" a relay based old computer. The computer has two separate memories for storing data and program. Processor can complete an instruction in one cycle if appropriate pipelining strategies are implemented. In the first stage of pipeline the instruction to be executed can be taken from program memory. In the second stage of pipeline data is taken from the data memory using the decoded instruction or address. Most of the modern computing architectures are based on Harvard architecture. But the number of stages in the pipeline varies from system to system.

CPU:

Alternately referred to as a processor, central processor, or microprocessor, the CPU is the Central Processing Unit of the computer. A computer's CPU handles all instructions it receives from hardware and software running on the computer.

Components of the CPU

In the CPU, the primary components are the ALU (Arithmetic Logic Unit) that performs mathematical, logical, and decision operations and the CU (Control Unit) that directs all of the processors operations. Following diagram gives working of CPU step by step.



ALU:

An arithmetic logic unit (ALU) is a digital circuit used to perform arithmetic and logic operations. It represents the fundamental building block of the central processing unit (CPU) of a computer. Modern CPUs contain very powerful and complex ALUs. In addition to ALUs, modern CPUs contain a control unit (CU).

Most of the operations of a CPU are performed by one or more ALUs, which load data from input registers. A register is a small amount of storage available as part of a CPU. The control unit tells the ALU what operation to perform on that data and the ALU stores the result in an output register. The control unit moves the data between these registers, the ALU, and memory.

How an ALU Works:

It performs both bitwise and mathematical operations on binary numbers and is the last component to perform calculations in the processor. The ALU uses, to operands and code that tells it which operations to perform for input data. After the information has been processed by the ALU, it is sent to the computer's memory.

Multiple Arithmetic Logic Units can be found in CPUs, GPUs and FPUs. In some computer processors, the ALU is divided into an AU and LU. The AU performs the arithmetic operations, and the LU performs the logical operations.

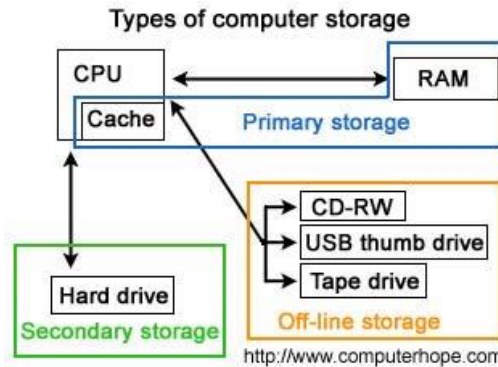
An ALU performs basic arithmetic and logic operations. Examples of arithmetic operations are addition, subtraction, multiplication, and division. Examples of logic operations are comparisons of values such as NOT, AND, and OR.

Control unit(CU):

A control unit is circuitry that directs operations within a computer's processor. It lets the computer's logic unit, memory, as well as both input and output devices know how to respond to instructions received from a program. Examples of devices that utilize control units include CPUs and GPUs.

A control unit works by receiving input information that it converts into control signals, which are then sent to the central processor. The computer's processor then tells the attached hardware what operations carry out. The functions a control unit performs depend on the type of CPU, due to the variance of architecture between different manufacturers. The following diagram illustrates how instructions from a program are processed.

Memory:

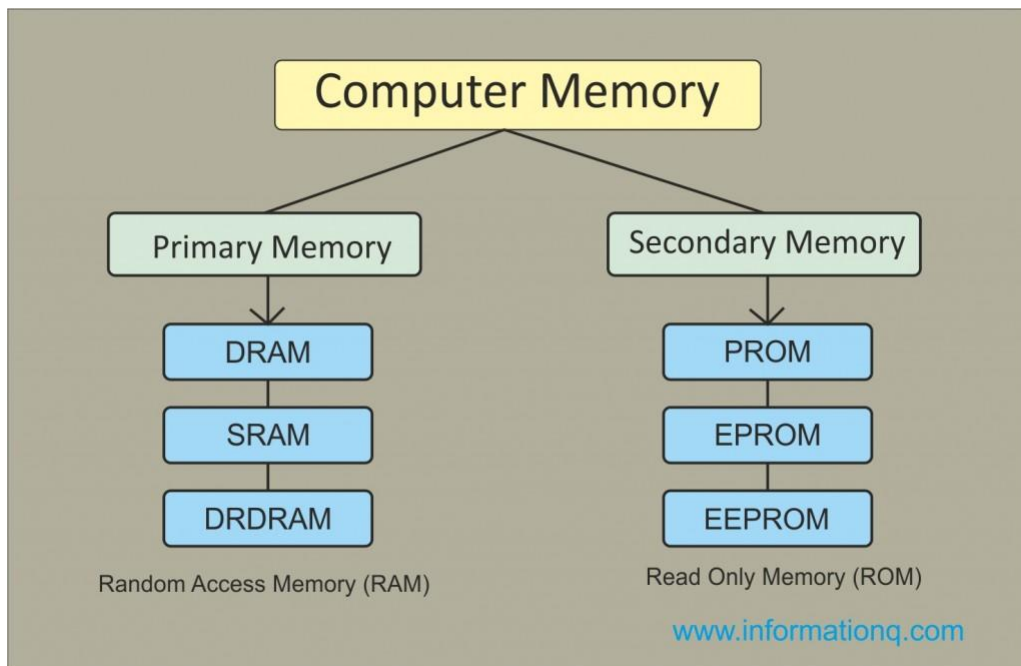


A memory is just like a human brain. It is used to store data and instructions. Computer memory is the storage space in computer where data is to be processed and instructions required for processing are stored. The memory is divided into large number of small parts called cells. Each location or cell has a unique address which varies from zero to memory size minus one. For example if computer has 64k words, then this memory unit has $64 * 1024 = 65536$ memory locations. The address of these locations varies from 0 to 65535.

Memory is major part of computers that categories into several types. The computer memory offers several kinds of storage media some of them can store data temporarily and some them can store permanently. Memory consists of instructions and the data saved into computer through Central Processing Unit (CPU).

Memory is primarily of three types

- Cache Memory
- Primary Memory/Main Memory
- Secondary Memory



Types of Computer Memory:-Memory is the best essential element of a computer because computer can't perform simple tasks. The performance of computer mainly based on memory and CPU. Memory is internal storage media of computer that has several names such as majorly categorized into two types, Main memory and Secondary memory.

1. Primary Memory / Volatile Memory.
2. Secondary Memory / Non Volatile Memory.
- 3.Cache Memory

1. Primary Memory / Volatile Memory/ Main memory:- Primary Memory also called as volatile memory because the memory can't store the data permanently. Primary memory select any part of memory when user want to save the data in memory but that may not be store permanently on that location. It also has another name i.e. RAM.

Random Access Memory (RAM):- The primary storage is referred to as random access memory (RAM) due to the random selection of memory locations. It performs both read and write operations on memory. If power failures happened in systems during memory access then you will lose your data permanently. So, RAM is volatile memory.

RAM categorized into following types.

- DRAM
- SRAM
- DRDRAM

Characteristics of Main Memory

- These are semiconductor memories
- It is known as main memory.
- Usually volatile memory.
- Data is lost in case power is switched off.
- It is working memory of the computer.
- Faster than secondary memories.
- A computer cannot run without primary memory.

2. Secondary Memory / Non Volatile Memory:- Secondary memory is external and permanent memory that is useful to store the external storage media such as floppy disk, magnetic disks, magnetic tapes and etc cache devices. Secondary memory deals with following types of components.

Read Only Memory (ROM) :- ROM is permanent memory location that offer huge types of standards to save data. But it work with read only operation. No data lose happen whenever power failure occurs during the ROM memory work in computers.

ROM memory has several models such names are following.

1. PROM: Programmable Read Only Memory (PROM) maintains large storage media but can't offer the erase features in ROM. This type of RO maintains PROM chips to write data once and read many. The programs or instructions designed in PROM can't be erased by other programs.

2. EPROM : Erasable Programmable Read Only Memory designed for recover the problems of PROM and ROM. Users can delete the data of EPROM thorough pass on ultraviolet light and it erases chip is reprogrammed.

3. EEPROM: Electrically Erasable Programmable Read Only Memory similar to the EPROM but it uses electrical beam for erase the data of ROM.

Characteristic of Secondary Memory

- These are magnetic and optical memories
- It is known as backup memory.
- It is non-volatile memory.
- Data is permanently stored even if power is switched off.
- It is used for storage of data in a computer.
- Computer may run without secondary memory.
- Slower than primary memories.

3.Cache Memory:- Cache memory is a very high speed semiconductor memory which can speed up CPU. It acts as a buffer between the CPU and main memory. It is used to hold those parts of data and program which are most

frequently used by CPU. The parts of data and programs are transferred from disk to cache memory by operating system, from where CPU can access them.

Advantages:- The advantages of cache memory are as follows:

- Cache memory is faster than main memory.
- It consumes less access time as compared to main memory.
- It stores the program that can be executed within a short period of time.
- It stores data for temporary use.

Disadvantages:- The disadvantages of cache memory are as follows:

- Cache memory has limited capacity.
- It is very expensive.

Input device

An input device is a piece of hardware that is used to enter data into a computer or a similar processing device such as a smart phone.

Input devices are usually categorized as either manual or automatic.

Examples of manual input devices are:

- Keyboard
- Mouse
- Touchpad
- Joystick
- Touchscreen
- Concept keyboard
- Scanner
- Graphics tablet
- Microphone
- Digital camera
- Examples of automatic input devices are:
- Barcode readers
- Optical mark reader (OMR)
- Magnetic Ink Character Recognition (MICR)
- Optical Character Recognition (OCR)
- Magnetic stripe readers
- Sensors
- Biometric devices

Output device

An output device is a piece of hardware that is used to output data that has been previously entered into a computer or similar processing device.

In computing terms, an output device is a piece of hardware that obeys a computer command to do something in the real world. For example a printer is an output device that will produce a page of information when the correct commands are sent to it from a computer

Here are some examples of output devices:

- Monitor
- Printer
- Plotter
- Projector
- Speaker
- Headphones
- Light / LED

Storage device:- Physical components or materials on which data is stored are called storage media. Hardware components that read/write to storage media are called storage devices. Two main categories of storage technology used today are magnetic storage and optical storage.

Primary magnetic storage:-

- Diskettes
- Hard disks (both fixed and removable)
- High capacity floppy disks
- Disk cartridges
- Magnetic tape

Primary optical storage

- Compact Disk Read Only Memory (CD ROM)
- Digital Video Disk Read Only Memory (DVD ROM)
- CD Recordable (CD R)
- CD Rewritable (CD RW)
- Photo CD

1) Magnetic Tapes: The Magnetic Tapes is the Type of Secondary Storage Device and this Device is used for taking back up of data and this Tape contains some magnetic fields and the Magnetic Tapes are used Accessing the data into the Sequential Form and the Tape Also Contains a Ribbon which is coated on the Single Side of the Tape and also contains a head which reads the data which is Recorded on to the Tape. And when we are reading the information from the disk then we can also read backward information means we can also back the Tape for Reading the Previous information. And For inserting the Tape into the System we also Requires Some Tape Drives Which Contains Tape and which is Responsible for Reading the contents from the Tapes.

They can Store huge Amount of data into the Tape Drive , But the Main Limitation of the Tape Drive is that we can't Access the Data from the Disks directly means if we want to 100th Record from the Tape then we must have to move all the Previous i.e. 99th Records first. And the Tapes are also easily damaged due to the Human Errors.

2.Magnetic Disks:- This is also called as the hard disk and this is made from the thin metal platter which is coated on the both sides of the magnetic Disks. And the there are Many Plates or Platters into a single Hard Disk and all the Plates are Made from the Magnetic Materials and all the Disks are Rotate from the 700 to 3600 rpm means Rotation per Minute and the Hard Disk also Contains a head which is used for both Reading and Writing the Data from the Hard Disks. The disk surface is divided into concentric tracks (circles within circles). The thinner the tracks, the more storage. The data bits are recorded as tiny magnetic spots on the tracks. The smaller the spot, the more bits per inch and the greater the storage.

The Plate of Disk is Divided into the Tracks and sectors and the collection of Tracks makes a Cylinder means all the Tracks of the Disk which a Consecutive Areas makes a Cylinder.

The Disk is first divided into the Number of Tracks and the Tracks are further divided into the sectors and the Number of Tracks Makes a Cylinder. All the data is Stored into the disk by using Some Sectors and each sectors belongs to a Tracks. The Data is accessed from the Disk by using the heads, all the heads have Some Arm those are used for Reading the Data from the Particular Tracks and sector. When the Disk Rotates very high Speed then the Head also Moves, For Reading the data from the Disk the ARM touches with the Particular Track and read the data from that Location.

For Locating a Particular data from the Disk the head Moves Around the Disk very Fastly and data which a user wants to Access must have an Address So that Arm of the head just use that Address Means the Number of Cylinder, Number of Track and Number of Sectors from which user wants to read the data. With the Help of these Read and Write heads we can also Read the Data from the Disk and we can also Stores some data onto the Disk. Some Time Considerations are also used when we are accessing or storing the data onto the hard disk.

1) Seek Time: - The Total Time which is Taken to Move on the Desired track is known as the seek Time. And time is always measured by using the Milliseconds.

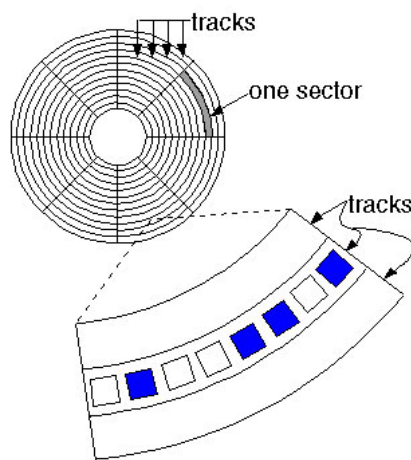
2) Latency Time. : The time required to Bring the Particular Track to the Desired Location Means the Total Time to bring the Correct the Sector for Reading or for the read and Write head. This is also called as the Average Time.

3) Data Transfer Time: The Total Time which is required for Reading and Writing the data into the Disk is known as the Data transfer Time.

When we are Taking About the Magnetic Tapes then we can say that the Storage Capacity of the disk is Measure in the Form of Mega Bytes and when are talking about the Hard Disk then the Measurement will be in the Form of Giga Bytes. Means the Capacity of t the Hard Disk will be Read by using the Giga Bytes. The Magnetic Tapes are Sequential Access Device and the Hard Disk is the Direct Access Device means the data of this Disk will be Read from Any Location and the Data can be Read from the Disk by using the Read Write Heads. But hard Disks are Costlier than the Simple Magnetic Tapes. But the capacity of the Hard Disk is very high in compare to the Tapes.

Tracks and Spots:-The disk surface is divided into concentric tracks (circles within circles). The thinner the tracks, the more storage. The data bits are recorded as tiny magnetic spots on the tracks. The smaller the spot, the more bits per inch and the greater the storage.

Sectors:-Tracks are further divided into sectors, which hold a block of data that is read or written at one time; for example, READ SECTOR 782, WRITE SECTOR 5448. In order to update the disk, one or more sectors are read into the computer, changed and written back to disk. The operating system figures out how to fit data into these fixed spaces. Modern disks have more sectors in the outer tracks than the inner ones because the outer radius of the platter is greater than the inner radius



Block diagram of Magnetic Disk

3. Floppy Diskette: Floppy disk is a kind of storage device that can be used to carried around? The Floppy Disk is also a Secondary Storage device which is used for storing the data in a Permanent Manner. The floppy is made up of Rigid Mylar Plastic and also contains a Magnetic black disk inside the Plastic Cover. The Floppy Disk also Stores all the Data into the Form of Tracks and Sectors and the floppy Disk provides both Reading and Writing the data into the Disk. The Floppy Disk is also called as Reusable Disk means the Floppy Disk Provides us the Facility to Read and Writes the Data into disk as and When Necessary and Also Many Times. We can Read and Write the data from the Disk.

The Main Advantage of the Floppy Disk is that the Data can be Stored many Times but the Main Limitation of the floppy Disk is that floppy Disk have a Small capacity and the Floppy Disk also doesn't have Reliability means the Data Stored into the Disk may not be used for Long Time because the floppy Disk is very Sensitive Thing when we Move the Head of the Disk Again and Again then the floppy disk gets Damaged. So that we can say that Floppy Disk is not a Reliable thing. And I the Other side the Cost of floppy Disk is also high means with the Comparison of the Other Storage Media's Floppy Disk have some more cost.

But the Main Advantage of the Floppy Disk is that floppy Disk is used for Moving the data from one Computer to Another With the Advent of the Floppy Disk we can Store the Data Into the Floppy Disk and after that we can Easily Remove that Disk from the System and Also Put the Disk into the Another System for Taking the Data.

But we cannot Start or Run the System without the Hard Disk So that floppy Disk is used to Transfer the Files from one System into the. There are Two Types of floppy Disk Available first is the 3.5 and second is the 5.2. But for inserting the Floppy Disk into the System we must have to use the Floppy Disk Drive in the System.

For Reading the data from the Disk there are also Some Read and Write heads those are too used. And the Head will touch the Surface of the floppy Disk So that this will lead to the Damage of the Disk So Quickly because when the Head Directly Touch the Surface of the Disk, then this will lead to the Scratches on the Disk and also cause Damage of the Disk. And the Drive can take only one Disk Means we can insert only one Floppy Disk at a Time into the Floppy Drive. The capacity of the floppy Disk is 1.44 MB. So that we can Floppy Disks as rare as Possible.

Floppy Disk Contains a Notch which Specify Whether the data will be Read or Write Means to Say if we wants to protect our data then we can set the Notch of the Floppy Disk as a Read Only.

4.Hard disk:- A hard disk drive also called hard drive, hard disk or disk drive is a device used for storing and retrieving digital data or information. A hard disk is a stack of disk known as the platter. A single hard disk usually consists of several platters and each platter requires two read/write heads, one for each side and is attached to a single access arm. Data are recorded electromagnetically in a concentric circle such as the track on a disk.

Hard disk is still the most common storage device for all computers. Like diskettes hard drives store data in tracks divided into sectors. Physically however they look quite different to diskettes. Includes one or more metal platters mounted on a central spindle, like a stack of rigid diskettes. Each platter is covered with a metal coating and the entire unit is contained in a sealed chamber. The hard disk and drive is a single unit which includes the hard disk, the motor that spins the platters and a set of read/write heads. Because you cannot remove the disk from the drive the terms hard disk and hard drive are used interchangeably. Hard drives have become the primary storage devices for PCs because they are convenient and cost effective. They outperform diskettes in both speed and capacity. Hard disks offer capacities from several hundred MB and more. Most entry level PCs now come with hard disks of at least 6.8MB.

Two important physical differences between hard disks and diskettes account for the differences in performance.

1. Hard disks are sealed in a chamber
2. Hard disk consists of a rigid metal platter (usually aluminum) rather than flexible Mylar.

Hard disk spin between 3600 rpm and 7200 rpm compared to a diskette 300 rpm. The speed at which the disk spins is a major factor in overall performance. The rigidity of the disk and the high-speed rotation allows more data to be recorded on the surface. Waving a magnet past an electric coil causes a current to flow. The faster you wave the magnet and the closer the magnet is to the coil, the larger the current generated in the coil. The disk that spins faster can use smaller magnetic charge to make current flow to the read/write head. The drives heads can also use a lower density current to record data on the disk. Not only does hard disks pack the data closer together they also hold more data because they usually include multiple platters stack one on top of each other. This configuration means that the disk has more than 2 sides, in addition to side 0 and 1 there are sides 2, 3, 4, and so on. Larger capacity disks may use 12 platters but both side of every platter are not always used. The number of sides that the disk uses is specified by the number of read/write heads. A particular disk may have 6 disks platters (12 sides) but only 11 heads à one side is not used to store data. Unused side is often the bottom one. The term cylinder is often used to refer to the same track across all the disks. Track 0 (outermost track) on every disk is cylinder 0.



Platter :-A hard disk platter or the disk is a circular disk in which the magnetic data is stored. A hard disk drive can have several platters that are mounted on the same spindle.

spindle / spindle motor :-The spindle motor is responsible for turning the hard disk platters and must provide stable, reliable and consistent turning, to allow the hard disk to function properly.

Head :-Responsible for read - write operation of data from and to the platter.

actuator :- Used to position the head arms to different tracks on the surface of the platter, actuator is used in changing from track to track the only operation on the hard disk that requires active movement. This mechanism of hard disk must works at extreme speed, with precise accuracy for the data to be read and write accurately on the platter.

References

1. Patterson, D. A., & Hennessy, J. L. (2017). *Computer organization and design: The hardware/software interface* (5th ed.). Morgan Kaufmann.
2. Stallings, W. (2019). *Computer organization and architecture: Designing for performance* (11th ed.). Pearson.
3. Tanenbaum, A. S., & Austin, T. (2013). *Structured computer organization* (6th ed.). Pearson.
4. Mano, M. M. (2017). *Computer system architecture* (3rd ed.). Pearson.
5. Backus, J. (1978). Can programming be liberated from the von Neumann style? *Communications of the ACM*, 21(8), 613–641.
6. Hennessy, J. L., & Patterson, D. A. (2011). Computer architecture: A quantitative approach. *ACM SIGARCH Computer Architecture News*, 39(4), 1–4.
7. Hill, M. D., & Smith, A. J. (1989). Evaluating associativity in CPU caches. *IEEE Transactions on Computers*, 38(12), 1612–1630.
8. IEEE Computer Society. (n.d.). *Computer architecture and organization*. Retrieved from <https://www.computer.org>
9. ACM Digital Library. (n.d.). *Computer systems and architecture research*. Retrieved from <https://dl.acm.org>

CHAPTER 4: PERIPHERAL DEVICES AND CLASSIFICATION OF COMPUTER SYSTEMS: INPUT, OUTPUT, STORAGE, AND COMPUTING TYPES

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Abstract

This chapter provides a comprehensive overview of peripheral devices and the classification of computer systems based on size, structure, and purpose. It begins with a detailed explanation of input devices, highlighting their role in converting human-readable data into machine-processable form. Various input devices such as keyboards, mouse, scanners, and recognition systems (OCR, MICR, OMR) are discussed along with their functionalities.

The chapter further explores output devices, including monitors, printers, and plotters, emphasizing their types, working principles, advantages, and limitations. Different display technologies such as CRT, LCD, LED, and OLED are also examined. In addition, the chapter provides an in-depth understanding of storage and printing technologies. Beyond peripheral devices, the chapter classifies computers based on size and processing power, including supercomputers, mainframe computers, minicomputers, and microcomputers. It also discusses computer types based on hardware structure, such as analog, digital, and hybrid computers, as well as classification based on purpose, including general-purpose and special-purpose computers. The chapter concludes with an explanation of personal computers, their characteristics, configurations, and types, offering a holistic understanding of modern computing systems.

Keywords: Peripheral Devices, Input Devices, Output Devices, Storage Devices, Keyboard, Mouse, Scanner, Monitor, Printer, Plotter, Computer Classification, Supercomputer, Mainframe, Minicomputer, Microcomputer, Analog Computer, Digital Computer, Hybrid Computer, Personal Computer

Peripheral Devices:-

What is Input and Input Devices:-

"Any data or instruction that is used by a computer is called input. This data or instruction can come directly from end user or from other devices." "An input device is a hardware device that is used to provide input (data / instructions) to a computer so that it can be processed". Input device translates words, sounds images, and actions that people understand into symbols that the system unit can process. Input devices include keyboards, Mouse, digital Camera and light pen. Besides the widely used input devices like keyboard & Mouse there are other different input devices that perform various input operations like a scanner scan images / documents. Webcams capture videos & images.

For example, while you prepare word documents or spread sheets, you use the keyboard to enter text & numbers and use command keys to save / print documents. You can also perform operations on computer using voice commands. These are all different methods of providing an input to a computer.

1.Keyboard:-

A keyboard is an essential input device that combines a typewriter keyboard with a numeric keypad. The special purpose keys and the function keys are used to perform a special tasks like pressing Control key (CTRL) key in combination with "P" prints a document, or pressing the "F2" function key opens a window with help content about

any issue or topic. Nowadays Multimedia keyboards are common as they have task specific keys & buttons. For example, volume control ext. Wireless keyboards are also popular these days that can be connected to a tablet or a computer via Bluetooth.

2. Mouse:-

The mouse is another essential input device that controls the pointer displayed on the monitor. A mouse can have 2 or more buttons. Mostly the Right-Mouse Button and the Left-Mouse button, and a wheel button for scrolling pages.

Mouse is of three types.

1. Mechanical Mouse

A mechanical mouse is considered as the traditional mouse and is now replaced by optical mouse. A mechanical mouse has a ball on the bottom, which is attached to the system unit through a cord. A mechanical mouse requires periodic cleaning.

2. Optical mouse

Optical Mouse is widely used these days. Like the mechanical mouse, it does not have any moving parts. It emits & senses light to detect mouse movements. Optical mouse can be used on any surface with great precision as compared to Mechanical mouse.

3. Wireless Mouse

A wireless mouse or cordless mouse uses infrared or radio waves to communicate with the system units. A wireless mouse is battery powered and can be connected to a laptop or tablet computer.

3. Character and mark recognition devices:-

Character and mark recognition devices are scanners that are able to recognize special characters and marks. Essentially used for certain applications.

Types of character and mark recognition devices are as follows:-

MICR (Magnetic Ink Character Recognition): Used by banks to read numbers written on cheque. Special purpose machine reads character made of ink containing magnetized particles.

OCR (Optical Character recognition): Special preprinted characters that can be read by light source and changed into machine readable form. Used in department stores to read retail price tags by reflecting light.

OMR (Optical Mark Recognition): An OMR device senses the presence or absence of a mark such as pencil mark. Used to calculate or store multiple choice tests.

4. Scanner:-

A scanner is an electronic device that scans printed or handwritten text documents, images, or a particular object to convert them into a digital file format. Most of the scanners use CCD, (charge-coupled device) or CIS, (Contact Image Sensor) as the image sensors. The common types of scanners we see today are flatbed scanners, handheld scanners, sheet-fed scanners, etc.

1. Flatbed Scanner:- A flatbed scanner is made up of a glass pane and a moving optical CIS or CCD array. The pane is illuminated with the help of bright light planted underneath it. The image which is to be scanned is then placed on the glass pane. The sensor and the source of light move across the glass pane to scan the document and produce its digital copy.

2. Sheet-fed Scanner:- In sheet-fed scanners, the document that is supposed to be scanned is fed into the horizontal or vertical slot provided in the scanner. The vital components of sheet-fed scanner are the sheet-feeder, scanning module and calibration sheet. Such scanners are most often used to scan single page documents. It can't be used to scan thicker objects, like books, which turn out to be its major drawback.

3. Handheld Scanner:- A handheld scanner is a small manual scanning device which is moved over the object that need to be scanned. For instance, if a document needs to be scanned, the handheld scanner has to be dragged over the document. Using a handheld scanner can prove to be a cumbersome task, as the hand needs to be steady all the time. Slight movement of the hand can lead to distortion of the image. One of the most utilized handheld scanner is the barcode scanner, typically used in shopping stores to value goods.

4. Photo Scanner:- Photo scanners are mostly used to scan photographs. High resolution and color depth are the most vital requirements for scanning photographs, and photo scanner provides the same. If the motive of buying a scanner is to digitize film negatives and slides, then the photo scanner is the best option. They are specially designed to work on slides and negatives. The in-built software in some photo scanners can also help in cleaning old photographs.

5. Film Scanner:- A film scanner is utilized to scan photographic films directly into a computer. The photographer

has direct control over certain aspects, such as cropping, ratio of original image on the film, etc. Some film scanner shave specialized software through which it is possible to minimize scratches and improve color quality. Low-end film scanners most often accept 35 mm film strips while the high-end scanners have interchangeable film loaders which can accept 35 mm strips or 120 mm ones, or individual slides.

6.Portable Scanners:- Being small in size, portable scanners can be easily carried with oneself anywhere. Some scanners are as small as your PDAs, hence, can be easily carried in the pockets. Such scanners are useful for text document scanning. The drawback of these scanners is their limitation as far as resolution is concerned. They cannot be used for scanning photographs or other such applications which require high resolution scanning.

5.Monitor:-

A computer monitor, technically termed as a visual display unit, can be plainly described as an electronic device that transmits information from the computer onto a screen, thereby acting as an interface and connecting the viewer with the computer. At present, computer monitors are available in a variety of shapes, designs, and colors. However, based on the technology used to make computer monitors, they can be broadly categorized into three types.

- CRT (Cathode Ray Tube)
- LCD (Liquid Crystal Display)
- LED (Light-Emitting Diodes)
- OLED(Organic light-emitting diodes)

CRT (Cathode Ray Tube) Monitors:- These monitors employ the CRT technology used most commonly in the manufacturing of television screens. In this, a stream of intense high energy electrons is used to form images on a fluorescent screen. A cathode ray tube is a basically a vacuum tube containing an electron gun at one end and a fluorescent screen at another end. From this electron gun, a process called thermionic emission generates a strong beam of electrons. These electrons travel through a narrow path within the tube with high speed using various electro-magnetic devices and finally strike the phosphor points present on the fluorescent screen, thus creating an image.



There are several Advantages of using CRT monitors:

- These monitors are highly reliable and efficient, and are capable of generating a resolution of up to 2048 x 1536 pixels, thereby providing a clear picture quality. Also, CRT monitors that are now available are capable of producing thousands of different colors.
- Secondly, CRT monitors are affordable and cost effective.
- Unlike conventional CRT monitors, modern technological advancements have resulted in the development of flat screen CRT monitors that reduce the glare and are good for the eyes.

Disadvantage of CRT Monitor:-

However, the only concern with buying CRT monitors is that they are heavy and can occupy a great deal of work space. Also, these devices get heated up very easily.

LCD (Liquid Crystal Display) Monitors:- Liquid crystal display, also known as liquid crystal diode, is one of the most advanced technologies available at present. Typically, an LCD monitor consists of a layer of color or monochrome pixels arranged schematically between a couple of transparent electrodes and two polarizing filters. Optical effect is achieved by polarizing the light in varied amounts and making it pass through the liquid crystal layer. At present, there are two types of LCD technology available. These include the active matrix or TFT and a passive matrix technology. Among these, TFT technology is more secure and reliable, and generates better picture quality. On the other hand, passive matrix has a slow response time and is slowly becoming outdated.



In recent times, LCD monitors have become increasing popular with consumers. Some major advantages of using an LCD monitor include:

- These monitors are compact, lightweight, and do not consume much desk space.
- Secondly, these monitors do not consume much electricity and can even be operated by using batteries.

- Also, the images transmitted by these monitors do not get geometrically distorted and have little flicker.
- However, LCD monitors do have certain disadvantages. Most importantly, these monitors are very expensive. Secondly, image quality is not constant when viewed from different angles. Also, an LCD monitor's resolution is always constant. Any alterations can result in a reduced performance.

LED (Light-Emitting Diodes) Monitors:- LED monitors are the latest types of monitors in the market today. Like LCD, it is again a flat panel display making use of light-emitting diodes for back-lighting instead of Cold Cathode Fluorescent (CCFL) back-lighting used in LCDs. Primarily, the display is of LCD only but the back-lighting is done by LEDs. LED monitors are said to use much lesser power than CRT and LCD. Thus, they are also considered environmental friendly. Other core advantages of LED monitors are:

- They produce images with higher contrast
- They have less negative environmental impact when disposed
- Lifespan and durability of LED monitors is more than CRT or LCD monitors
- Because of the technology, the monitor panels can be made very thin
- Do not produce much heat while running

The only Disadvantage is this LED monitors are little expensive than the former types.

There are multiple ways by which LED back-lighting is done.

- White-edge LEDs are fixed around the rim of the monitor. It used a special diffusion panel to spread light evenly behind the screen.
- An array of LEDs are placed behind the screen. Their brightness is not controlled individually.
- Again an array of LEDs are placed behind the screen, but the brightness of each individual LED is controlled separately.

OLED Monitors:- Organic light-emitting diodes that can light up individual picture elements is an improvement in LED technology. It works without a backlight so the monitors can be thinner and more energy efficient while producing vivid color saturation and displaying deep black levels. Currently there are few OLED monitors on the market due to the high costs in manufacturing. It is a technology that is beginning to show up in HDTVs, and in time, if successful, may translate into the computer monitor market.

Ultra-High Definition Monitors:- UHD takes LED technology and adds more pixels onto the screen, going from about 2 million pixels in full HD (1,920 by 1,080) to more than 8 million pixels in UHD (3,240 by 2,160). Also called 4K technology, the level of image detail and sharpness is excellent, especially when viewing videos, pictures, graphic designs and other content that is created in 4K. When sitting close to a UHD monitor, you can notice the clarity of the images on the screen.

The primary disadvantage to a UHD monitor is the high price when compared to other LED monitors that are in full HD, but not UHD. Plus, the small amount of 4k content is a detriment.

Touch screen Monitors:- Touch screens have been around for many years, and with advancements in technology, screens are sleeker, lighter and more accurate with your touch. You can type of the screen, but for some, keeping a keyboard and mouse for some tasks is still desired. A key advantage to a touch screen monitor is it allows you to use the touch option when you want to. Touch screen monitors are a little more expensive than non-touch monitors, but the pricing is pretty close. As the popularity of touch screens increases in all devices including Smartphone's, tablets and laptops, touch screen computer monitors will also gain in popularity and convenience.

Plasma Display Panel Monitor:- Plasma display panel monitors use small cells of charged gases to create an image. These cells are similar to household fluorescent light bulbs. Each plasma cell creates its own illumination, which eliminates the need for a separate back light and gives PDP monitors strong contrast. A plasma monitor is typically heavier than an LCD display. Plasma screens also draw more power than both LCD and LED monitors, and are susceptible to "burned in" images if they are left on for long periods of time.

6.Printer:- A printer is an external output device that takes data from a computer and generates output in the form of graphics / text on a paper". There are two types of printers.

1.Impact printers:- An impact printer makes contact with the paper. It usually forms the print image by pressing an inked ribbon against the paper using a hammer or pins. Following are some examples of impact printers.

- **Dot-Matrix Printers(DMP):-** The dot-matrix printer uses print heads containing from 9 to 24 pins. These pins produce patterns of dots on the paper to form the individual characters. The 24 pin dot-matrix printer produces more dots than a 9 pin dot-matrix printer, which results in much better quality and clearer characters. The general rule is: the more pins, the clearer the letters on the paper. The pins strike the ribbon individually as the print mechanism moves across the entire print line in both directions, i-e, from left to right, then right to left, and so on. The user can produce a color output with a dot-matrix printer (the user will change the black ribbon with a ribbon that has color stripes). Dot-matrix printers are inexpensive and typically print at speeds of 100-600 characters per second.
- **Daisy-wheel printers:-** In order to get the quality of type found on typewriters, a daisy-wheel impact printer can be used. It is called daisy-wheel printer because the print mechanism looks like a daisy; at the end of each "Petal" is a fully formed character which produces solid-line print. A hammer strikes a "petal" containing a character against the ribbon, and the character prints on the paper. Its speed is slow typically 25-55 characters per second.
- **Line printers:-** In business where enormous amount of material are printed, the character-at-a-time printers are too slow; therefore, these users need line-at-a-time printers. Line printers, or line-at-a-time printers, use special mechanism that can print a whole line at once; they can typically print the range of 1,200 to 6,000 lines per minute. Drum, chain, and band printers are line-at-a-time printers.
- **Drum printer:-** A drum printer consists of a solid, cylindrical drum that has raised characters in bands on its surface. The number of print positions across the drum equals the number available on the page. This number typically ranges from 80-132 print positions. The drum rotates at a rapid speed. For each possible print position there is a print hammer located behind the paper. These hammers strike the paper, along the ink ribbon, against the proper character on the drum as it passes. One revolution of the drum is required to print each line. This means that all characters on the line are not printed at exactly the same time, but the time required to print the entire line is fast enough to call them line printers. Typical speeds of drum printers are in the range of 300 to 2000 lines per minute.
- **Chain printers:-** A chain printer uses a chain of print characters wrapped around two pulleys. Like the drum printer, there is one hammer for each print position. Circuitry inside the printer detects when the correct character appears at the desired print location on the page. The hammer then strikes the page, pressing the paper against a ribbon and the character located at the desired print position. An impression of the character is left on the page. The chain keeps rotating until all the required print positions on the line have filled. Then the page moves up to print the next line. Speeds of chain printers range from 400 to 2500 characters per minute.
- **Band printers:-** A band printer operates similar to chain printer except it uses a band instead of a chain and has fewer hammers. Band printer has a steel band divided into five sections of 48 characters each. The hammers on a band printer are mounted on a cartridge that moves across the paper to the appropriate positions. Characters are rotated into place and struck by the hammers. Font styles can easily be changed by replacing a band or chain.

2.Non-impact printers:- Non-impact printers do not use a striking device to produce characters on the paper; and because these printers do not hammer against the paper they are much quieter. Following are some non-impacted printers.

- **Ink-jet printers:-** Ink-jet printers work in the same fashion as dot-matrix printers in the form images or characters with little dots. However, the dots are formed by tiny droplets of ink. Ink-jet printers form characters on paper by spraying ink from tiny nozzles through an electrical field that arranges the charged ink particles into characters at the rate of approximately 250 characters per second. The ink is absorbed into the paper and dries instantly. Various colors of ink can also be used. One or more nozzles in the print head emit a steady stream of ink drops. Droplets of ink are electrically charged after leaving the nozzle. The droplets are then guided to the paper by electrically charged deflecting plates [one plate has positive charge (upper plate) and the other has negative charge (lower plate)]. A nozzle for black ink may be all that's needed to print text, but full-color printing is also possible with the addition of needed to print text,

but full-color printing is also possible with the addition three extra nozzles for the cyan, magenta, and yellow primary colors. If a droplet isn't needed for the character or image being formed, it is recycled back to its input nozzle. Several manufacturers produce color ink-jet printer. Some of these printers come with all their color inks in a cartridge; if you want to replace on color, you must replace all the colors. Other color ink-jet printers allow you to replace ink individually. These printers are a better choice if user uses one color more than other colors. These printers produce less noise and print in better quality with greater speed.

- **Laser printers:-** A laser printer works like a photocopy machine. Laser printers produce images on paper by directing a laser beam at a mirror which bounces the beam onto a drum. The drum has a special coating on it to which toner (an ink powder) sticks. Using patterns of small dots, a laser beam conveys information from the computer to a positively charged drum to become neutralized. From all those areas of drum which become neutralized, the toner detaches. As the paper rolls by the drum, the toner is transferred to the paper printing the letters or other graphics on the paper. A hot roller bonds the toner to the paper. Laser printers use buffers that store an entire page at a time. When a whole page is loaded, it will be printed. The speed of laser printers is high and they print quietly without producing much noise. Many home-use laser printers can print eight pages per minute, but faster and print approximately 21,000 lines per minute, or 437 pages per minute if each page contains 48 lines. When high speed laser printers were introduced they were expensive. Developments in the last few years have provided relatively low-cost laser printers for use in small businesses.

Advantages of Laser Printer:-

- The main advantage of Laser printer is its speed & efficiency at which it prints high-quality quality graphics & text.
- Laser printers produce high-quality output as compared to other printers.
- Laser printers are quite and do not produce disturbing sounds.
- They are also capable to produce color prints.

Disadvantages of Laser Printer:-

- The main disadvantage of Laser printer is its cost; they are relatively costly as compared to other printers.
- The maintenance, repair & servicing charges are also high of these printers.
- Laser printers emit small amount of ozone and are hazardous to health and the atmosphere.

7. Plotters:- A plotter is a special output device used to produce hard copies of large graphs and designs on paper, such as construction maps, engineering drawings, architectural plans and business charts. The plotter is either a peripheral component that you add to your computer system or a standalone device with its own internal processor. Plotter has following types:-

- **1.Drum Plotter:-** A drum plotter is a pen plotter that wraps the paper around a drum with a pin feed attachment. The drum then rotates the paper as pens move across it and draw the image. It was the first output device used to print graphics and large engineering drawings. There are two types of drum plotters, external and internal. With an external drum plotter, the paper is wrapped around its external surface, while the internal drum plotter uses a sheet of paper wrapped around its internal surface.
- **2.Flat-Bed Plotter:-** A flat-bed plotter is a mechanical drafting device used with many CAD programs for designers. The paper remains stationary on a flat surface while a pen moves across it horizontally and vertically. This plotter may use several different pen colors to create the graphics. The size of the graphic is limited to the size of the flat-bed plotter's surface.
- **3.Inkjet Plotter:-** The inkjet plotter creates an image by spraying small droplets of ink on to paper. A popular choice for advertising agencies and graphic designers, inkjet plotters are used generally for large outputs, such as banners and billboards and large signs often seen along roadsides. They are available in thermal or piezoelectric models. Thermal inkjet plotters use heat to apply droplets of ink, while piezoelectric plotters use charged crystals to apply the ink. Inkjet plotters typically produce better quality graphics than other plotter types.
- **4.Cutting Plotter:-** The cutting plotter is a large scale cutting device that produces ready-cut mylar or vinyl lettering and graphics. Automated plotter knives cut into a sheet of the material lying on the plotter's flat surface area, carving out the design stored in the attached computer. Used for sign making, billboard

advertising and vehicle graphics, the devices offer far greater speed and precision than can be achieved with the traditional method of creating sign lettering and logos by hand.

Types of computer according to their size and power:- Computers can be generally classified by size and power as follows, though there is considerable overlap .The four basic types of computers are as under:

1. Supercomputer 2. Mainframe Computer 3. Minicomputer 4. Microcomputer

1. Supercomputer:- An extremely fast computer that can perform hundreds of millions of instructions per second. The most powerful computers in terms of performance and data processing are the Supercomputers. These are specialized and task specific computers used by large organizations. These computers are used for research and exploration purposes, like NASA uses supercomputers for launching space shuttles, controlling them and for space exploration purpose. The supercomputers are very expensive and very large in size. It can be accommodated in large air-conditioned rooms; some super computers can span an entire building.

Uses of Supercomputers

Space Exploration:- Supercomputers are used to study the origin of the universe, the dark-matters. For these studies scientist use IBM's powerful supercomputer "Roadrunner" at National Laboratory Los Alamos.

Earthquake studies:- Supercomputers are used to study the Earthquakes phenomenon. Besides that supercomputers are used for natural resources exploration, like natural gas, petroleum, coal, etc.

Weather Forecasting:- Supercomputers are used for weather forecasting, and to study the nature and extent of Hurricanes, Rainfalls, windstorms, etc.

Nuclear weapons testing:- Supercomputers are used to run weapon simulation that can test the Range, accuracy & impact of Nuclear weapons.

2. Mainframe computer:- A powerful multi-user computer capable of supporting many hundreds or thousands of users simultaneously. Although Mainframes are not as powerful as supercomputers, but certainly they are quite expensive nonetheless, and many large firms & government organizations uses Mainframes to run their business operations. The Mainframe computers can be accommodated in large air-conditioned rooms because of its size. Supercomputers are the fastest computers with large data storage capacity, Mainframes can also process & store large amount of data. Banks educational institutions & insurance companies use mainframe computers to store data about their customers, students & insurance policy holders.

Popular Mainframe computers:-

Fujitsu's ICL VME 2. Hitachi's Z800

3. Minicomputer:- A multi-user computer capable of supporting up to hundreds of users simultaneously. Minicomputers are used by small businesses & firms. Minicomputers are also called as "Midrange Computers". These are small machines and can be accommodated on a disk with not as processing and data storage capabilities as supercomputers & Mainframes. These computers are not designed for a single user. Individual departments of a large company or organizations use Mini-computers for specific purposes. For example, a production department can use Mini-computers for monitoring certain production process.

Popular Minicomputers:-

K-202 2. Texas Instrument TI-990 3. SDS-92 4. IBM Midrange computers

4. Microcomputer:- Desktop computers, laptops, personal digital assistant (PDA), tablets & Smartphone's are all types of microcomputers. The micro-computers are widely used & the fastest growing computers. These computers are the cheapest among the other three types of computers. The Micro-computers are specially designed for general usage like entertainment, education and work purposes. Well known manufacturers of Micro-computer are Dell, Apple, Samsung, Sony & Toshiba. Desktop computers, Gaming consoles, Sound & Navigation system of a car, Netbooks, Notebooks, PDA's, Tablet PC's, Smartphone's, Calculators are all type of Microcomputers.

Types of Computer according to their Hardware Structure:- Here are three basic kinds of computers. This is based on the hardware structure and the way physical quantities are represented in a computer. The following are the three types.

Analog Computers:- Analog computers are used to process analog data. Analog data is of continuous nature and which is not discrete or separate. Such type of data includes temperature, pressure, speed weight, voltage, depth etc. These quantities are continuous and having an infinite variety of values. It measures continuous changes in some physical quantity e.g. The Speedometer of a car measures speed, the change of temperature is measured by a Thermometer, the weight is measured by Weights machine. These computers are ideal in situations where data can be

accepted directly from measuring instrument without having to convert it into numbers or codes. Analog computers are the first computers being developed and provided the basis for the development of the modern digital computers. Analog computers are widely used for certain specialized engineering and scientific applications, for calculation and measurement of analog quantities. They are frequently used to control process such as those found in oil refinery where flow and temperature measurements are important. They are used for example in paper making and in chemical industry. Analog computers do not require any storage capability because they measure and compare quantities in a single operation. Output from an analog computer is generally in the form of readings on a series of dial (Speedometer of a car) or a graph on strip chart.

Digital Computers:- A Digital Computer, as its name implies, works with digits to represent numerals, letters or other special symbols. Digital Computers operate on inputs which are ON-OFF type and its output is also in the form of ON-OFF signal. Normally, an ON is represented by a 1 and an OFF is represented by a 0. So we can say that digital computers process information, which is based on the presence or the absence of an electrical charge or we prefer to say a binary 1 or 0. A digital computer can be used to process numeric as well as non-numeric data. It can perform arithmetic operations like addition, subtraction, multiplication and division and also logical operations. Most of the computers available today are digital computers. The most common examples of digital computers are accounting machines and calculators. The results of digital computers are more accurate than the results of analog computers. Analog computers are faster than digital. Analog computers lack memory whereas digital computers store information. We can say that digital computers count and analog computers measures.

Hybrid Computers:- A hybrid is a combination of digital and analog computers. It combines the best features of both types of computers, i.e. It has the speed of analog computer and the memory and accuracy of digital computer. Hybrid computers are used mainly in specialized applications where both kinds of data need to be processed. Therefore, they help the user, to process both continuous and discrete data. For example a petrol pump contains a processor that converts fuel flow measurements into quantity and price values. In hospital Intensive Care Unit (ICU), an analog device is used which measures patient's blood pressure and temperature etc, which are then converted and displayed in the form of digits. Hybrid computers for example are used for scientific calculations, in defense and radar systems.

Type of computer according to their Purpose:- There are two types of computers according to their purpose.

General-Purpose Computers:- Most computers in use today are General-Purpose computers — those built for a great variety of processing jobs. Simply by using a general purpose computer and different software, various tasks can be accomplished, including writing and editing (word processing), manipulating facts in a data base, tracking manufacturing inventory, making scientific calculations, or even controlling organization's security system, electricity consumption, and building temperature. General purpose computers are designed to perform a wide variety of functions and operations. You will probably use this type of computer reading this article and I am using a general purpose computer typing this article in some software (MS Word). A general purpose computer is able to perform a wide variety of operations because it can store and execute different programs in its internal storage. Unfortunately, having this ability is often achieved at the expense of speed and efficiency. In most situations, however, you will find that having this flexibility makes this compromise a most acceptable one

Special-Purpose Computers:- As the name states, a Special-Purpose Computer are designed to be task specific and most of the times their job is to solve one particular problem. They are also known as dedicated computers, because they are dedicated to perform a single task over and over again. Such a computer system would be useful in playing graphic intensive Video Games, traffic lights control system, navigational system in an aircraft, weather forecasting, satellite launch / tracking, oil exploration, and in automotive industries, keeping time in a digital watch, or Robot helicopter. While a special purpose computer may have many of the same features found in a general purpose computer, its applicability to a particular problem is a function of its design rather than to a stored program. The instructions that control it are built directly into the computer, which makes for a more efficient and effective operation. They perform only one function and therefore cut down on the amount of memory needed and also the amount of information which can be input into them. As these computers have to perform only one task, therefore, they are fast in processing. A drawback of this specialization, however, is the computer's lack of versatility. It cannot be used to perform other operations.

Difference between Supercomputer and Mainframe

Supercomputer is a broad term for one of the fastest computers currently available. Supercomputers are very expensive and are employed for specialized applications that require immense amounts of mathematical calculations

(number crunching). For example, weather forecasting requires a supercomputer. Other uses of supercomputers scientific simulations, (animated) graphics, fluid dynamic calculations, nuclear energy research, electronic design, and analysis of geological data (e.g. in petrochemical prospecting). Perhaps the best known supercomputer manufacturer is Cray Research.

Mainframe was a term originally referring to the cabinet containing the central processor unit or "main frame" of a room-filling Stone Age batch machine. After the emergence of smaller "minicomputer" designs in the early 1970s, the traditional big iron machines were described as "mainframe computers" and eventually just as mainframes. Nowadays a Mainframe is a very large and expensive computer capable of supporting hundreds, or even thousands, of users simultaneously. The chief difference between a supercomputer and a mainframe is that a supercomputer channels all its power into executing a few programs as fast as possible, whereas a mainframe uses its power to execute many programs concurrently. In some ways, mainframes are more powerful than supercomputers because they support more simultaneous programs. But supercomputers can execute a single program faster than a mainframe. The distinction between small mainframes and minicomputers is vague, depending really on how the manufacturer wants to market its machines.

Personal computer(PC's):-

It can be defined as a small, relatively inexpensive computer designed for an individual user. In price, personal computers range anywhere from a few hundred pounds to over five thousand pounds. All are based on the microprocessor technology that enables manufacturers to put an entire CPU on one chip. Businesses use personal computers for word processing, accounting, desktop publishing, and for running spreadsheet and database management applications. At home, the most popular use for personal computers is for playing games and recently for surfing the Internet.

Configuration and specifications of PC's:-Personal computers first appeared in the late 1970s. One of the first and most popular personal computers was the Apple II, introduced in 1977 by Apple Computer. During the late 1970s and early 1980s, new models and competing operating systems seemed to appear daily. Then, in 1981, IBM entered the fray with its first personal computer, known as the IBM PC. The IBM PC quickly became the personal computer of choice, and most other personal computer manufacturers fell by the wayside. P.C. is short for personal computer or IBM PC. One of the few companies to survive IBM's onslaught was Apple Computer, which remains a major player in the personal computer marketplace. Other companies adjusted to IBM's dominance by building IBM clones, computers that were internally almost the same as the IBM PC, but that cost less. Because IBM clones used the same microprocessors as IBM PCs, they were capable of running the same software. Over the years, IBM has lost much of its influence in directing the evolution of PCs. Therefore after the release of the first PC by IBM the term PC increasingly came to mean IBM or IBM-compatible personal computers, to the exclusion of other types of personal computers, such as Macintoshes. In recent years, the term PC has become more and more difficult to pin down. In general, though, it applies to any personal computer based on an Intel microprocessor, or on an Intel-compatible microprocessor. For nearly every other component, including the operating system, there are several options, all of which fall under the rubric of PC.

Main Characteristics of PC's:- Today, the world of personal computers is basically divided between Apple Macintoshes and PCs. The principal characteristics of personal computers are that they are single-user systems and are based on microprocessors. However, although personal computers are designed as single-user systems, it is common to link them together to form a network. In terms of power, there is great variety. At the high end, the distinction between personal computers and workstations has faded. High-end models of the Macintosh and PC offer the same computing power and graphics capability as low-end workstations by Sun Microsystems, Hewlett-Packard, and DEC.

Types of Personal Computer:-

Actual personal computers can be generally classified by size and chassis / case.

1. Type of computer according to chassis:- The chassis or case is the metal frame that serves as the structural support for electronic components. Every computer system requires at least one chassis to house the circuit boards and wiring. The chassis also contains slots for expansion boards. If you want to insert more boards than there are slots, you will need an expansion chassis, which provides additional slots. There are two basic flavors of chassis designs—desktop models and tower models—but there are many variations on these two basic types.

Tower model:- The term refers to a computer in which the power supply, motherboard, and mass storage devices are stacked on top of each other in a cabinet. This is in contrast to desktop models, in which these components are housed in a more compact box. The main advantage of tower models is that there are fewer space constraints, which makes installation of additional storage devices easier.

Desktop model:- A computer designed to fit comfortably on top of a desk, typically with the monitor sitting on top of the computer. Desktop model computers are broad and low, whereas tower model computers are narrow and tall. Because of their shape, desktop model computers are generally limited to three internal mass storage devices. Desktop models designed to be very small are sometimes referred to as slim line models.

2. Type of computer according to size:- Then come the portable computers that are computers small enough to carry. Portable computers include notebook and subnotebook computers, hand-held computers, palmtops, and PDAs.

Notebook computer:-An extremely lightweight personal computer. Notebook computers typically weigh less than 6 pounds and are small enough to fit easily in a briefcase. Aside from size, the principal difference between a notebook computer and a personal computer is the display screen. Notebook computers use a variety of techniques, known as flat-panel technologies, to produce a lightweight and non-bulky display screen. The quality of notebook display screens varies considerably. In terms of computing power, modern notebook computers are nearly equivalent to personal computers. They have the same CPUs, memory capacity, and disk drives. However, all this power in a small package is expensive. Notebook computers cost about twice as much as equivalent regular-sized computers. Notebook computers come with battery packs that enable you to run them without plugging them in. However, the batteries need to be recharged every few hours.

Laptop computer:- A small, portable computer -- small enough that it can sit on your lap. Nowadays, laptop computers are more frequently called notebook computers.

Subnotebook computer:- A portable computer that is slightly lighter and smaller than a full-sized notebook computer. Typically, subnotebook computers have a smaller keyboard and screen, but are otherwise equivalent to notebook computers.

Hand-held computer:- A portable computer that is small enough to be held in one's hand. Although extremely convenient to carry, handheld computers have not replaced notebook computers because of their small keyboards and screens. The most popular hand-held computers are those that are specifically designed to provide PIM (personal information manager) functions, such as a calendar and address book. Some manufacturers are trying to solve the small keyboard problem by replacing the keyboard with an electronic pen. However, these pen-based devices rely on handwriting recognition technologies, which are still in their infancy. Hand-held computers are also called PDAs, palmtops and pocket computers.

Palmtop:- A small computer that literally fits in your palm. Compared to full-size computers, palmtops are severely limited, but they are practical for certain functions such as phone books and calendars. Palmtops that use a pen rather than a keyboard for input are often called hand-held computers or PDAs. Because of their small size, most palmtop computers do not include disk drives. However, many contain PCMCIA slots in which you can insert disk drives, modems, memory, and other devices. Palmtops are also called PDAs, hand-held computers and pocket computers.

PDA:- Short for personal digital assistant, a handheld device that combines computing, telephone/fax, and networking features. A typical PDA can function as a cellular phone, fax sender, and personal organizer. Unlike portable computers, most PDAs are pen-based, using a stylus rather than a keyboard for input. This means that they also incorporate handwriting recognition features. Some PDAs can also react to voice input by using voice recognition technologies. The field of PDA was pioneered by Apple Computer, which introduced the Newton MessagePad in 1993. Shortly thereafter, several other manufacturers offered similar products. To date, PDAs have had only modest success in the marketplace, due to their high price tags and limited applications. However, many experts believe that PDAs will eventually become common gadgets. PDAs are also called palmtops, hand-held computers and pocket computers.

Workstation:- A powerful, single-user computer. A workstation is like a personal computer, but it has a more powerful microprocessor and, in general, a higher-quality monitor. It is a type of computer used for engineering applications (CAD/CAM), desktop publishing, software development, and other types of applications that require a moderate amount of computing power and relatively high quality graphics capabilities. Workstations generally come with a large, high-resolution graphics screen, at large amount of RAM, built-in network support, and a graphical user interface. Most workstations also have a mass storage device such as a disk drive, but a special type of workstation, called a diskless workstation, comes without a disk drive. The most common operating systems for workstations are UNIX and Windows NT. Like personal computers, most workstations are single-user computers. However, workstations are typically linked together to form a local-area network, although they can also be used as stand-alone systems. In networking, workstation refers to any computer connected to a local-area network. It could be a workstation or a personal computer.

References

1. Stallings, W. (2019). Computer organization and architecture: Designing for performance (11th ed.). Pearson.

2. Tanenbaum, A. S., & Austin, T. (2013). *Structured computer organization* (6th ed.). Pearson.
3. Sinha, P. K., & Sinha, P. (2007). *Computer fundamentals* (6th ed.). BPB Publications.
4. Norton, P. (2006). *Introduction to computers* (6th ed.). McGraw-Hill.
5. Backus, J. (1978). Can programming be liberated from the von Neumann style? *Communications of the ACM*, 21(8), 613–641.
6. Hennessy, J. L., & Patterson, D. A. (2011). *Computer architecture: A quantitative approach*. *ACM SIGARCH Computer Architecture News*, 39(4), 1–4.
7. Foley, J. D., van Dam, A., Feiner, S. K., & Hughes, J. F. (1996). *Computer graphics: Principles and practice*. ACM Press.
8. IEEE Computer Society. (n.d.). *Computer hardware and peripheral devices*. Retrieved from <https://www.computer.org>
9. ACM Digital Library. (n.d.). *Input/output devices and computer systems research*. Retrieved from <https://dl.acm.org>

CHAPTER 5: SOFTWARE SYSTEMS, OPERATING SYSTEMS, AND PROGRAMMING LANGUAGES: CONCEPTS AND APPLICATIONS

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Abstract

This chapter presents a comprehensive overview of computer software, operating systems, and programming language concepts, forming a critical foundation for understanding modern computing systems. It begins with the definition and classification of software into system software and application software, highlighting their roles in managing hardware and supporting user-oriented tasks. Various types of application software, such as word processing, database management, spreadsheet, presentation, and multimedia tools, are discussed with practical examples.

The chapter further explores the concept of open-source software, emphasizing its collaborative development model and contrast with proprietary software. A detailed explanation of operating systems is provided, including their functions, user interfaces, and examples such as MS-DOS, Windows, Linux, and UNIX. The evolution and features of these operating systems are also examined.

Additionally, the chapter introduces fundamental programming concepts, including algorithms, variables, data types, loops, functions, and object-oriented principles. It also explains the classification of programming languages into low-level and high-level languages, along with their advantages, limitations, and real-world applications. Furthermore, the chapter covers language translators such as assemblers, compilers, and interpreters, explaining their roles in converting source code into executable programs. Overall, this chapter provides a structured understanding of software systems and their significance in computer science.

Keywords: Software, System Software, Application Software, Open Source Software, Operating System, MS-DOS, Windows, Linux, Programming Concepts, Algorithms, Compiler, Interpreter, Assembler, Programming Languages, High-Level Languages, Low-Level Languages

Software:- Computer software is the set of programs that makes the hardware perform a set of tasks in particular order. Hardware and software are complimentary to each other. Both have to work together to produce meaningful results.

Types of software:- Computer software is classified into two broad categories; system software and application software.

1. System Software:- System software consists of a group of programs that control the operations of a computer equipment including functions like managing memory, managing peripherals, loading, storing, and is an interface between the application programs and the computer. MS DOS (Microsoft's Disk Operating System), UNIX are examples of system software.

2. Application software:- Software that can perform a specific task for the user, such as word processing, accounting, budgeting or payroll, fall under the category of application software. Word processors, spreadsheets, database management systems are all examples of general purpose application software.

Types of application software are:-

1. Word processing software: The main purpose of this software is to produce documents. MS-Word, Word Pad, Notepad and some other text editors are some of the examples of word processing software.

2.Database software: Database is a collection of related data. The purpose of this software is to organize and manage data. The advantage of this software is that you can change the way data is stored and displayed. MS access, dBase, FoxPro, Paradox, and Oracle are some of the examples of database software.

3. Spread sheet software: The spread sheet software is used to maintain budget, financial statements, grade sheets, and sales records. The purpose of this software is organizing numbers. It also allows the users to perform simple or complex calculations on the numbers entered in rows and columns. MS-Excel is one of the examples of spreadsheet software.

4.Presentation software: This software is used to display the information in the form of slide show. The three main functions of presentation software is editing that allows insertion and formatting of text, including graphics in the text and executing the slide shows. The best example

for this type of application software is Microsoft PowerPoint.

5.Multimedia software: Media players and real players are the examples of multimedia software. This software will allow the user to create audio and videos. The different forms of multimedia software are audio converters, players, burners, video encoders and decoders.

6. Open source software:- Open source refers to a program or software in which the source code (the form of the program when a programmer writes a program in a particular programming language) is available to the general public for use and/or modification from its original design free of charge. Open source code is typically created as a collaborative effort in which programmers improve upon the code and share the changes within the community. The rationale for this movement is that a larger group of programmers not concerned with proprietary ownership or financial gain will produce a more useful and bug-free product for everyone to use.

The basics behind the Open Source Initiative is that when programmers can read, redistribute and modify the source code for a piece of software, the software evolves. Open source sprouted in the technological community as a response to proprietary software owned by corporations. Proprietary software is privately owned and controlled. In the computer industry, proprietary is considered the opposite of open. A proprietary design or technique is one that is owned by a company. It also implies that the company has not divulged specifications that would allow other companies to duplicate the product

OPERATING SYSTEM :- An operating system is a software component of a computer system that is responsible for the management of various activities of the computer and the sharing of computer resources. It hosts several applications that run on a computer and handles the operations of computer hardware. Users and application programs access the services offered by the operating systems, by means of system calls and application programming interfaces. Users interact with a computer operating system through Command Line Interfaces (CLIs) or Graphical User Interfaces known as GUIs. In short, an operating system enables user interaction with computer systems by acting as an interface between users or application programs and the computer hardware. Some of the common operating systems are LINUX, Windows, DOS etc.

1.Introduction to MS-DOS:- An operating system is a set of interrelated programs that manage and control computer processing. The Microsoft Disk Operating System, MS-DOS, is a traditional microcomputer operating system that consists of four major components.:-

- MS-DOS Kernel,
- User Interface (shell),
- MS-DOS BIOS,
- Operating-system loader

Short for Microsoft Disk Operating System, MS-DOS is a non-graphical command line operating system derived from 86-DOS that was created for IBM compatible computers. MS-DOS originally written by Tim Paterson and introduced by Microsoft in August 1981 and was last updated in 1994 when MS-DOS 6.22 was released. MS-DOS allows the user to navigate, open, and otherwise manipulate files on their computer from a command line instead of a GUI like Windows.

Today, MS-DOS is no longer used; however, the command shell, more commonly known as the Windows command line is still used by many users. The picture to the right, is an example of what an MS-DOS window more appropriately referred to as the Windows command line looks like running under Microsoft Windows.

Most computer users are only familiar with how to navigate Microsoft Windows using the mouse. Unlike Windows, MS-DOS is a command-line and is navigated by using MS-DOS commands. For example, if you wanted to see all the files in a folder in Windows you would double-click the folder to open the folder in Windows Explorer. In MS-DOS, to view that same folder you would navigate to the folder using the cd command and then list the files in that folder

using the dir command.

2.Introduction to Windows :-Microsoft Windows is a series of operating systems and environments developed and marketed by Microsoft Corporation. The first version of Windows was released in 1985 as a graphical user interface to MS-DOS, providing multiple document support, mouse support, drop down menus, and color video drivers. Later versions gradually replaced many of MS-DOS's built-in hardware functions with their own enhanced functions, until Windows fully assimilated MS-DOS and became a full-fledged operating system. Microsoft Windows is now often referred to as an integrated operating system due to the high level of integration between the core kernel functions and other Microsoft software such as Outlook, Windows Explorer and Internet Explorer. Despite its poor security record caused by this integration, Microsoft Windows is today the most widely used OS on personal home computers, laptop computers, and small business machines.

As an integrated operating system, all Microsoft Windows versions come with preinstalled software that is ready to use upon installation. Basic text editors and calculators have been available since the first versions of Windows. Windows 98 added Media Player, Internet Explorer and Outlook Express. Windows Vista expands this with the Windows Mobility Center, Photo Gallery, DVD Maker, and the Linux-like Windows Sidebar. Vista is also the first version of Windows to have built-in security features. Although the second Windows XP service pack added a firewall and anti-virus monitoring service, Vista implements these features and more at the kernel level. Individual programs are 'sandboxed' and cannot access each other's memory. Critical drivers are executed in user mode, so crashes and malicious behavior cannot cause system-wide instability or security breaches. Even third-party anti-virus and anti-spware software runs outside the kernel, further protecting it from bugs and backdoors in those programs.

3.Introduction to Linux:- Two of the most popular variations of UNIX come in the form of Linux. A big advantage of both Linux is that they are both open-source, that is, any user can contribute to the development of the OS. Versions of both operating systems are completely free.

Linux can easily take the role of a server or client machine. However, they are considered to be more difficult to master as both utilize the command line rather than a user friendly GUI. There are several different distributions of Linux, but for each the underlying operating system remains the same. Apple Macintosh machines offer high performance sound and graphics editing and are therefore extremely popular in the design industry. Apple have developed their own operating system, the newest version of which is the Mac OS X, which is based on UNIX. Mac OS X is a very user friendly operating system and is increasingly popular for home PCs.

4.Other Operating Systems:-

UNIX:-A big advantage of UNIX is that it can be run on nearly every computer hardware platform including Apple Macintosh machines. The UNIX operating system is one of the oldest and most powerful operating systems. It was developed by Bell Laboratories. There are many variants of UNIX available.

Novell NetWare:-Novell NetWare is an advanced network operating system. It has an advanced directory service structure similar to Microsoft's Active Directory. Fortunately both directory services are interoperable as both directories use the x500 directory service standard.

Computer programming concepts:- Following concepts are present in the majority of computer programming languages and/or are a fundamental part of the programming process.

- **Algorithm:-** A set of steps for carrying out a specific task. Algorithms are used extensively in computer programming to arrive at a solution for a problem. The process of creating an algorithm involves documenting all the necessary steps needed to arrive at the solution and how to perform each step. A real world example of an algorithm would be a recipe. The instructions of a typical recipe (add ingredients, mix, stir, etc.) are an algorithm.
- **Source code:-** The actual text used to write the instructions for a computer program. This text is then translated into something meaningful the computer can understand.
- **Compiler :-** A software tool that translates source code into data that the computer can understand. Specifically, a compiler is used to turn source code into object code. The object code is then passed through a program called a linker which turns it into an executable program.
- **Data type :-** The classification of pieces of information in a program. The amount of different data types varies between languages. Typically, there are data types for integers (whole numbers), floating-point numbers (numbers with a decimal part), and single characters. To distinguish between different data types, a computer uses special internal codes.
- **Variable :-** A container which represents a value in a program. Variables can store different types of data including numeric values, single characters, and text strings. The value of a variable can change all

throughout a program.

- Constant:- The same thing as a variable with one major difference - the value of a constant does not change, while the value of a variable can change all throughout a program.
- Conditional :- A set of code that will execute only if a certain condition is true. Conditionals are used to test expressions and perform certain operations accordingly. For example, you could test a number input by the user and if it is too high print the message "The number entered is too high" and the program exits. Thanks to conditionals, a program can work differently every time it runs.
- Array :- A special type of variable used in many programming and web languages including PHP, JavaScript, and Java that contains a list of related values. For example, a colors array would contain a list of colors.
- Loop:- A segment of code that executes repeatedly based on a certain condition. Loops are used to perform tasks repeatedly a certain amount of times. For example, if you needed to print the numbers 1 to 10. You can use a loop for this task instead of manually printing all the numbers.
- Function :- A set of code used to carry out specific tasks. A function can take parameters which will affect its output as well as return values. Functions prevent unnecessary redundancy because you can use them as much as needed instead of retyping some code over and over. For example, if you need to multiply two numbers, instead of doing the calculation manually every time, you can supply the data to a function through some parameters which will do it for you.
- Class :- A template for a real world object to be used in a program. For example, a programmer can create a car class which represents a car. This class can contain the properties of a car (color, model, year, etc.) and functions that specify what the car does (drive, reverse, stop, etc.). Classes are used in object-oriented programming.

Two Basic Types of Computer Language:- Different kinds of languages have been developed to perform different types of work on the computer. Basically, languages can be divided into two categories according to how the computer understands them.

- Low-Level Languages: A language that corresponds directly to a specific machine
- High-Level Languages: Any language that is independent of the machine
- There are also other types of languages, which include
- System languages: These are designed for low-level tasks, like memory and process management
- Scripting languages: These tend to be high-level and very powerful
- Domain-specific languages: These are only used in very specific contexts
- Visual languages: Languages that are not text-based
- Esoteric languages: Languages that are jokes or are not intended for serious use

These languages are not mutually exclusive, and some languages can belong to multiple categories. The terms low-level and high-level are also open to interpretation, and some languages that were once considered high-level are now considered low-level as languages have continued to develop.

Computer language or programming language is a coded syntax used by computer programmers to communicate with a computer. Computer language establishes a flow of communication between software programs. The language enables a computer user to dictate what commands the computer must perform to process data. These languages can be classified into following categories.

- Machine language
- Assembly language
- High level language

Low-Level Languages:

Low-level computer languages are either machine codes or are very close them. A computer cannot understand instructions given to it in high-level languages or in English. It can only understand and execute instructions given in the form of machine language i.e. binary. There are two types of low-level languages:

Machine Language: a language that is directly interpreted into the hardware. Machine language or machine code is the native language directly understood by the computer's central processing unit or CPU. This type of computer language is not easy to understand, as it only uses a binary system, an element of notations containing only a series of numbers consisting of one and zero, to produce commands.

Machine language is the lowest and most elementary level of programming language and was the first type of programming language to be developed. Machine language is basically the only language that a computer can understand and it is usually written in hex.

In fact, a manufacturer designs a computer to obey just one language, its machine code, which is represented inside the computer by a string of binary digits (bits) 0 and 1. The symbol 0 stands for the absence of an electric pulse and the 1 stands for the presence of an electric pulse. Since a computer is capable of recognizing electric signals, it understands machine language.

Advantages	Disadvantages
Machine language makes fast and efficient use of the computer.	All operation codes have to be remembered
It requires no translator to translate the code. It is directly understood by the computer.	All memory addresses have to be remembered.
	It is hard to amend or find errors in a program written in the machine language.

Assembly Language: Its a slightly more user-friendly language that directly corresponds to machine language. Assembly Level Language is a set of codes that can run directly on the computer’s processor. This type of language is most appropriate in writing operating systems and maintaining desktop applications. With the assembly level language, it is easier for a programmer to define commands. It is easier to understand and use as compared to machine language.

Assembly language was developed to overcome some of the many inconveniences of machine language. This is another low-level but very important language in which operation codes and operands are given in the form of alphanumeric symbols instead of 0’s and 1’s.

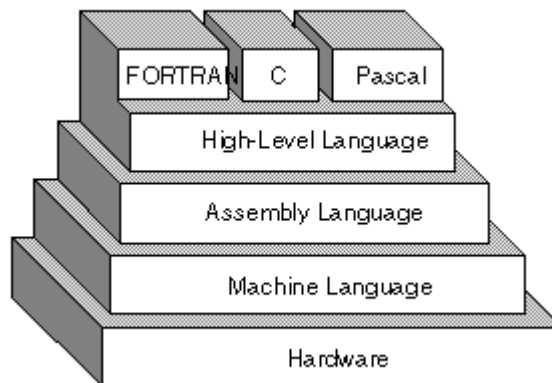
These alphanumeric symbols are known as mnemonic codes and can combine in a maximum of five-letter combinations e.g. ADD for addition, SUB for subtraction, START, LABEL etc. Because of this feature, assembly language is also known as ‘Symbolic Programming Language.’

This language is also very difficult and needs a lot of practice to master it because there is only a little English support in this language. Mostly assembly language is used to help in compiler orientations. The instructions of the assembly language are converted to machine codes by a language translator and then they are executed by the computer.

Advantages	Disadvantages
Assembly language is easier to understand and use as compared to machine language.	Like machine language, it is also machine dependent/specific.
It is easy to locate and correct errors.	Since it is machine dependent, the programmer also needs to understand the hardware.
It is easily modified.	

High-Level Languages:

High Level Languages are user-friendly languages which are similar to English with vocabulary of words and symbols. These are easier to learn and require less time to write. They are problem oriented rather than ‘machine’ based. Program written in a high-level language can be translated into many machine languages and therefore can run on any computer for which there exists an appropriate translator.



High-level computer languages use formats that are similar to English. The purpose of developing high-level languages was to enable people to write programs easily, in their own native language environment (English).

High-level languages are basically symbolic languages that use English words and/or mathematical symbols rather than mnemonic codes. Each instruction in the high-level language is translated into many machine language instructions that the computer can understand.

Advantages	Disadvantages
High-level languages are user-friendly	A high-level language has to be translated into the machine language by a translator, which takes up time
They are similar to English and use English vocabulary and well-known symbols	The object code generated by a translator might be inefficient compared to an equivalent assembly language program
They are easier to learn	
They are easier to maintain	
They are problem-oriented rather than 'machine'-based	
A program written in a high-level language can be translated into many machine languages and can run on any computer for which there exists an appropriate translator	
The language is independent of the machine on which it is used i.e. programs developed in a high-level language can be run on any computer text	

Types of High-Level Languages

Many languages have been developed for achieving a variety of different tasks. Some are fairly specialized, and others are quite general.

These languages, categorized according to their use, are:

1) Algebraic Formula-Type Processing

These languages are oriented towards the computational procedures for solving mathematical and statistical problems.

Examples include:

- BASIC (Beginners All Purpose Symbolic Instruction Code)
- FORTRAN (Formula Translation)
- PL/I (Programming Language, Version 1)
- ALGOL (Algorithmic Language)
- APL (A Programming Language)

2. Business Data Processing

These languages are best able to maintain data processing procedures and problems involved in handling files. Some examples include:

- COBOL (Common Business Oriented Language)
- RPG (Report Program Generator)

3. String and List Processing

These are used for string manipulation, including search patterns and inserting and deleting characters. Examples are:

- LISP (List Processing)
- Prolog (Program in Logic)
- Object-Oriented Programming Language
- In OOP, the computer program is divided into objects. Examples are:
- C++
- Java

5. Visual Programming Language

These programming languages are designed for building Windows-based applications. Examples are:

- Visual Basic
- Visual Java
- Visual C

Some of the High level languages are as follows:-

FORTRAN:- The first important algorithmic language was FORTRAN (formula translation), designed in 1957 by an IBM team led by John Backus. It was intended for scientific computations with real numbers and collections of them organized as one- or multidimensional arrays. Its control structures included conditional IF statements, repetitive loops (so-called DO loops), and a GOTO statement that allowed non sequential execution of program code. FORTRAN made it convenient to have subprograms for common mathematical operations, and built libraries of them. FORTRAN was also designed to translate into efficient machine language. It was immediately successful and continues to evolve.

ALGOL:- ALGOL (algorithmic language) was designed by a committee of American and European computer scientists during 1958–60 for publishing algorithms, as well as for doing computations. ALGOL had recursive subprograms—procedures that could invoke themselves to solve a problem by reducing it to a smaller problem of the same kind. ALGOL introduced block structure, in which a program is composed of blocks that might contain both data and instructions and have the same structure as an entire program. Block structure became a powerful tool for building large programs out of small components.

ALGOL contributed a notation for describing the structure of a programming language, Backus–Naur Form, which in some variation became the standard tool for stating the syntax (grammar) of programming languages. ALGOL was widely used in Europe, and for many years it remained the language in which computer algorithms were published. Many important languages, such as Pascal and Ada, are its descendants.

LISP:- LISP (list processing) was developed about 1960 by John McCarthy at the Massachusetts Institute of Technology (MIT) and was founded on the mathematical theory of recursive functions (in which a function appears in its own definition). A LISP program is a function applied to data, rather than being a sequence of procedural steps as in FORTRAN and ALGOL. LISP uses a very simple notation in which operations and their operands are given in a parenthesized list. For example, $(+ a (* b c))$ stands for $a + b*c$. Although this appears awkward, the notation works well for computers. LISP also uses the list structure to represent data, and, because programs and data use the same structure, it is easy for a LISP program to operate on other programs as data. LISP became a common language for artificial intelligence (AI) programming, partly owing to the confluence of LISP and AI work at MIT and partly because AI programs capable of “learning” could be written in LISP as self-modifying programs. LISP has evolved through numerous dialects, such as Scheme and Common LISP.

C Language:- The C programming language was developed in 1972 by Dennis Ritchie and Brian Kernighan at the AT&T Corporation for programming computer operating systems. Its capacity to structure data and programs through the composition of smaller units is comparable to that of ALGOL. It uses a compact notation and provides the programmer with the ability to operate with the addresses of data as well as with their values. This ability is important in systems programming, and C shares with assembly language the power to exploit all the features of a computer’s internal architecture. C, along with its descendant C++, remains one of the most common languages.

Business-oriented languages

COBOL:-COBOL (common business oriented language) has been heavily used by businesses since its inception

in 1959. A committee of computer manufacturers and users and U.S. government organizations established CODASYL (Committee on Data Systems and Languages) to develop and oversee the language standard in order to ensure its portability across diverse systems. COBOL uses an English-like notation—novel when introduced. Business computations organize and manipulate large quantities of data, and COBOL introduced the record data structure for such tasks. A record clusters heterogeneous data such as a name, ID number, age, and address into a single unit. This contrasts with scientific languages, in which homogeneous arrays of numbers are common. Records are an important example of “chunking” data into a single object, and they appear in nearly all modern languages.

SQL:- SQL (structured query language) is a language for specifying the organization of databases (collections of records). Databases organized with SQL are called relational because SQL provides the ability to query a database for information that falls in a given relation. For example, a query might be “find all records with both last_name Smith and city New York.” Commercial database programs commonly use a SQL-like language for their queries.

Education-oriented languages

BASIC:- BASIC (beginner’s all-purpose symbolic instruction code) was designed at Dartmouth College in the mid-1960s by John Kemeny and Thomas Kurtz. It was intended to be easy to learn by novices, particularly non-computer science majors, and to run well on a time-sharing computer with many users. It had simple data structures and notation and it was interpreted: a BASIC program was translated line-by-line and executed as it was translated, which made it easy to locate programming errors. Its small size and simplicity also made BASIC a popular language for early personal computers. Its recent forms have adopted many of the data and control structures of other contemporary languages, which makes it more powerful but less convenient for beginners.

Pascal:- About 1970 Niklaus Wirth of Switzerland designed Pascal to teach structured programming, which emphasized the orderly use of conditional and loop control structures without GOTO statements. Although Pascal resembled ALGOL in notation, it provided the ability to define data types with which to organize complex information, a feature beyond the capabilities of ALGOL as well as FORTRAN and COBOL. User-defined data types allowed the programmer to introduce names for complex data, which the language translator could then check for correct usage before running a program. During the late 1970s and ’80s, Pascal was one of the most widely used languages for programming instruction. It was available on nearly all computers, and, because of its familiarity, clarity, and security, it was used for production software as well as for education.

Logo:- Logo originated in the late 1960s as a simplified LISP dialect for education; Seymour Papert and others used it at MIT to teach mathematical thinking to schoolchildren. It had a more conventional syntax than LISP and featured “turtle graphics,” a simple method for generating computer graphics. (The name came from an early project to program a turtle like robot.) Turtle graphics used body-centered instructions, in which an object was moved around a screen by commands, such as “left 90” and “forward,” that specified actions relative to the current position and orientation of the object rather than in terms of a fixed framework. Together with recursive routines, this technique made it easy to program intricate and attractive patterns.

Hypertalk:- Hypertalk was designed as “programming for the rest of us” by Bill Atkinson for Apple’s Macintosh. Using a simple English-like syntax, Hypertalk enabled anyone to combine text, graphics, and audio quickly into “linked stacks” that could be navigated by clicking with a mouse on standard buttons supplied by the program. Hypertalk was particularly popular among educators in the 1980s and early ’90s for classroom multimedia presentations. Although Hypertalk had many features of object-oriented languages (described in the next section), Apple did not develop it for other computer platforms and let it languish; as Apple’s market share declined in the 1990s, a new cross-platform way of displaying multimedia left Hypertalk all but obsolete (see the section World Wide Web display languages).

Object-oriented languages:-

Object-oriented languages help to manage complexity in large programs. Objects package data and the operations on them so that only the operations are publicly accessible and internal details of the data structures are hidden. This information hiding made large-scale programming easier by allowing a programmer to think about each part of the program in isolation. In addition, objects may be derived from more general ones, “inheriting” their capabilities. Such an object hierarchy made it possible to define specialized objects without repeating all that is in the more general ones. Object-oriented programming began with the Simula language (1967), which added information hiding to ALGOL. Another influential object-oriented language was Smalltalk (1980), in which a program was a set of objects that interacted by sending messages to one another.

C++:- The C++ language, developed by Bjarne Stroustrup at AT&T in the mid-1980s, extended C by adding objects to it while preserving the efficiency of C programs. It has been one of the most important languages for both education and industrial programming. Large parts of many operating systems, such as the Microsoft Corporation’s Windows 98, were written in C++.

Ada:- Ada was named for Augusta Ada King, countess of Lovelace, who was an assistant to the 19th-century

English inventor Charles Babbage, and is sometimes called the first computer programmer. Ada, the language, was developed in the early 1980s for the U.S. Department of Defense for large-scale programming. It combined Pascal-like notation with the ability to package operations and data into independent modules. Its first form, Ada 83, was not fully object-oriented, but the subsequent Ada 95 provided objects and the ability to construct hierarchies of them. While no longer mandated for use in work for the Department of Defense, Ada remains an effective language for engineering large programs.

Java:- In the early 1990s, Java was designed by Sun Microsystems, Inc., as a programming language for the World Wide Web (WWW). Although it resembled C++ in appearance, it was fully object-oriented. In particular, Java dispensed with lower-level features, including the ability to manipulate data addresses, a capability that is neither desirable nor useful in programs for distributed systems. In order to be portable, Java programs are translated by a Java Virtual Machine specific to each computer platform, which then executes the Java program. In addition to adding interactive capabilities to the Internet through Web “applets,” Java has been widely used for programming small and portable devices, such as mobile telephones.

Visual Basic:- Visual Basic was developed by Microsoft to extend the capabilities of BASIC by adding objects and “event-driven” programming: buttons, menus, and other elements of graphical user interfaces (GUIs). Visual Basic can also be used within other Microsoft software to program small routines.

Declarative languages:-

Declarative languages, also called nonprocedural or very high level, are programming languages in which (ideally) a program specifies what is to be done rather than how to do it. In such languages there is less difference between the specification of a program and its implementation than in the procedural languages described so far. The two common kinds of declarative languages are logic and functional languages.

Logic programming languages, of which PROLOG (programming in logic) is the best known, state a program as a set of logical relations (e.g., a grandparent is the parent of a parent of someone). Such languages are similar to the SQL database language. A program is executed by an “inference engine” that answers a query by searching these relations systematically to make inferences that will answer a query. PROLOG has been used extensively in natural language processing and other AI programs.

Functional languages have a mathematical style. A functional program is constructed by applying functions to arguments. Functional languages, such as LISP, ML, and Haskell, are used as research tools in language development, in automated mathematical theorem provers, and in some commercial projects.

Scripting languages:-

Scripting languages are sometimes called little languages. They are intended to solve relatively small programming problems that do not require the overhead of data declarations and other features needed to make large programs manageable. Scripting languages are used for writing operating system utilities, for special-purpose file-manipulation programs, and, because they are easy to learn, sometimes for considerably larger programs.

PERL (practical extraction and report language) was developed in the late 1980s, originally for use with the UNIX operating system. It was intended to have all the capabilities of earlier scripting languages. PERL provided many ways to state common operations and thereby allowed a programmer to adopt any convenient style. In the 1990s it became popular as a system-programming tool, both for small utility programs and for prototypes of larger ones. Together with other languages discussed below, it also became popular for programming computer Web “servers.”

Document formatting languages:-

Document formatting languages specify the organization of printed text and graphics. They fall into several classes: text formatting notation that can serve the same functions as a word processing program, page description languages that are interpreted by a printing device, and, most generally, markup languages that describe the intended function of portions of a document.

TeX:- TeX was developed during 1977–86 as a text formatting language by Donald Knuth, a Stanford University professor, to improve the quality of mathematical notation in his books. Text formatting systems, unlike WYSIWYG (“What You See Is What You Get”) word processors, embed plain text formatting commands in a document, which are then interpreted by the language processor to produce a formatted document for display or printing. TeX marks italic text, for example, as `{\it this is italicized}`, which is then displayed as *this is italicized*.

TeX largely replaced earlier text formatting languages. Its powerful and flexible abilities gave an expert precise control over such things as the choice of fonts, layout of tables, mathematical notation, and the inclusion of graphics within a document. It is generally used with the aid of “macro” packages that define simple commands for common operations, such as starting a new paragraph; LaTeX is a widely used package. TeX contains numerous standards “style sheets” for different types of documents, and these may be further adapted by each user. There are also related

programs such as BibTeX, which manages bibliographies and has style sheets for all of the common bibliography styles, and versions of TeX for languages with various alphabets.

PostScript:- PostScript is a page-description language developed in the early 1980s by Adobe Systems Incorporated on the basis of work at Xerox PARC (Palo Alto Research Center). Such languages describe documents in terms that can be interpreted by a personal computer to display the document on its screen or by a microprocessor in a printer or a typesetting device. PostScript commands can, for example, precisely position text, in various fonts and sizes, draw images that are mathematically described, and specify colour or shading. PostScript uses postfix, also called reverse Polish notation, in which an operation name follows its arguments. Thus, “300 600 20 270 arc stroke” means: draw (“stroke”) a 270-degree arc with radius 20 at location (300, 600). Although PostScript can be read and written by a programmer, it is normally produced by text formatting programs, word processors, or graphic display tools. The success of PostScript is due to its specification’s being in the public domain and to its being a good match for high-resolution laser printers. It has influenced the development of printing fonts, and manufacturers produce a large variety of PostScript fonts.

SGML:- SGML (standard generalized markup language) is an international standard for the definition of markup languages; that is, it is a meta language. Markup consists of notations called tags that specify the function of a piece of text or how it is to be displayed. SGML emphasizes descriptive markup, in which a tag might be “<emphasis>.” Such a markup denotes the document function, and it could be interpreted as reverse video on a computer screen, underlining by a typewriter, or italics in typeset text. SGML is used to specify DTDs (document type definitions). A DTD defines a kind of document, such as a report, by specifying what elements must appear in the document—e.g., <Title>—and giving rules for the use of document elements, such as that a paragraph may appear within a table entry but a table may not appear within a paragraph. A marked-up text may be analyzed by a parsing program to determine if it conforms to a DTD. Another program may read the markups to prepare an index or to translate the document into PostScript for printing. Yet another might generate large type or audio for readers with visual or hearing disabilities.

World Wide Web display languages:

HTML:- The World Wide Web is a system for displaying text, graphics, and audio retrieved over the Internet on a computer monitor. Each retrieval unit is known as a Web page, and such pages frequently contain “links” that allow related pages to be retrieved. HTML (hypertext markup language) is the markup language for encoding Web pages. It was designed by Tim Berners-Lee at the CERN nuclear physics laboratory in Switzerland during the 1980s and is defined by an SGML DTD. HTML markup tags specify document elements such as headings, paragraphs, and tables. They mark up a document for display by a computer program known as a Web browser. The browser interprets the tags, displaying the headings, paragraphs, and tables in a layout that is adapted to the screen size and fonts available to it.

HTML documents also contain anchors, which are tags that specify links to other Web pages. An anchor has the form Encyclopedia Britannica, where the quoted string is the URL (universal resource locator) to which the link points (the Web “address”) and the text following it is what appears in a Web browser, underlined to show that it is a link to another page. What is displayed as a single page may also be formed from multiple URLs, some containing text and others graphics.

XML:- HTML does not allow one to define new text elements; that is, it is not extensible. XML (extensible markup language) is a simplified form of SGML intended for documents that are published on the Web. Like SGML, XML uses DTDs to define document types and the meanings of tags used in them. XML adopts conventions that make it easy to parse, such as that document entities are marked by both a beginning and an ending tag, such as <BEGIN>...</BEGIN>. XML provides more kinds of hypertext links than HTML, such as bidirectional links and links relative to a document subsection. Because an author may define new tags, an XML DTD must also contain rules that instruct a Web browser how to interpret them—how an entity is to be displayed or how it is to generate an action such as preparing an e-mail message.

Web scripting:- Web pages marked up with HTML or XML are largely static documents. Web scripting can add information to a page as a reader uses it or let the reader enter information that may, for example, be passed on to the order department of an online business. CGI (common gateway interface) provides one mechanism; it transmits requests and responses between the reader’s Web browser and the Web server that provides the page. The CGI component on the server contains small programs called scripts that take information from the browser system or provide it for display. A simple script might ask the reader’s name; determine the Internet address of the system that the reader uses, and print a greeting. Scripts may be written in any programming language, but, because they are generally simple text-processing routines, scripting languages like PERL are particularly appropriate.

Another approach is to use a language designed for Web scripts to be executed by the browser. JavaScript is one such language, designed by the Netscape Communications Corp., which may be used with both Netscape’s and

Microsoft's browsers. JavaScript is a simple language, quite different from Java. A JavaScript program may be embedded in a Web page with the HTML tag `<script language="JavaScript">`. JavaScript instructions following that tag will be executed by the browser when the page is selected. In order to speed up display of dynamic (interactive) pages, JavaScript is often combined with XML or some other language for exchanging information between the server and the client's browser. In particular, the XMLHttpRequest command enables asynchronous data requests from the server without requiring the server to resend the entire Web page. This approach, or "philosophy," of programming is called Ajax (asynchronous JavaScript and XML).

VB Script is a subset of Visual Basic. Originally developed for Microsoft's Office suite of programs, it was later used for Web scripting as well. Its capabilities are similar to those of JavaScript, and it may be embedded in HTML in the same fashion.

Behind the use of such scripting languages for Web programming lies the idea of component programming, in which programs are constructed by combining independent previously written components without any further language processing. JavaScript and VB Script programs were designed as components that may be attached to Web browsers to control how they display information.

Language translator:- A computer language translator is a program that translates a set of code written in one programming language into a functional equivalent of the code in another programming language. The different types of computer translators are interpreters, source-to-source compilers, standard compilers, de compilers, assemblers and dis-assemblers.

Computer language translators are the programs that execute instructions written in a high-level language. There are two ways to run programs written in a high-level language. The most common is to compile the program; the other method is to pass the program through an interpreter.

1. Assembler:- An assembler translates assembly language into machine code. Assembly language consists of mnemonics for machine opcodes so assemblers perform a 1:1 translation from mnemonics to a direct instruction. For example:

LDA #4 converts to 0001001000100100

Conversely, one instruction in a high level language will translate to one or more instructions at machine level.

Advantages of using an Assembler:

1. Very fast in translating assembly language to machine code as 1 to 1 relationship.
2. Assembly code is often very efficient (and therefore fast) because it is a low level language.
3. Assembly code is fairly easy to understand due to the use of English-like mnemonics.

Disadvantages of using Assembler:

- Assembly language is written for a certain instruction set and/or processor.
- Assembly tends to be optimized for the hardware it's designed for, meaning it is often incompatible with different hardware.
- Lots of assembly code is needed to do relatively simple tasks, and complex programs require lots of programming time.

2. Compiler:- A Compiler is a computer program that translates code written in a high level language to a lower level language, object/machine code. The most common reason for translating source code is to create an executable program (converting from a high level language into machine language).

In other words we can say, A compiler is a special program that processes statements written in a particular programming language called as source code and converts them into machine language or "machine code" that a computer's processor uses. Compiler translates high level language programs directly into machine language program. This process is called compilation.

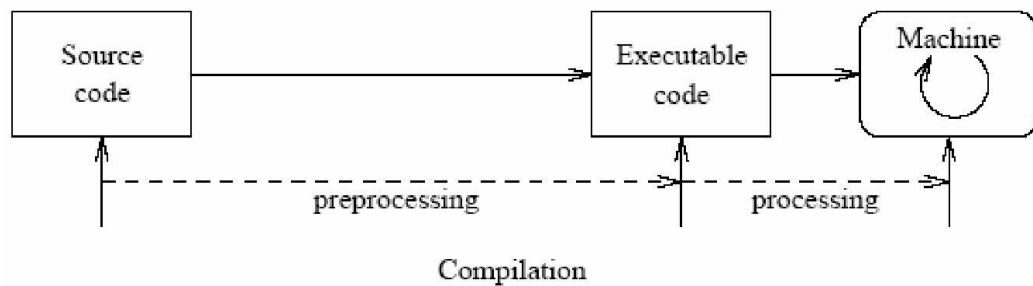


Fig.:- Compilation

Advantages of using a compiler

1. Source code is not included; therefore compiled code is more secure than interpreted code
2. Tends to produce faster code than interpreting source code
3. Produces an executable file, and therefore the program can be run without need of the source code

Disadvantages of using a compiler

1. Object code needs to be produced before a final executable file, this can be a slow process
2. The source code must be 100% correct for the executable file to be produced

3.Interpreter:- An interpreter program executes other programs directly, running through program code and executing it line-by-line. As it analyses every line, an interpreter is slower than running compiled code but it can take less time to interpret program code than to compile and then run it — this is very useful when prototyping and testing code. Interpreters are written for multiple platforms, this means code written once can be run immediately on different systems without having to recompile for each. Examples of this include flash based web programs that will run on your PC, MAC, games console and Mobile phone.

In other words we can say, An interpreter translates high-level instructions into an intermediate form, which it then executes. Compiled programs generally run faster than interpreted programs. The advantage of an interpreter, however, is that it does not need to go through the compilation stage during which machine instructions are generated. This process can be time-consuming if the program is long.

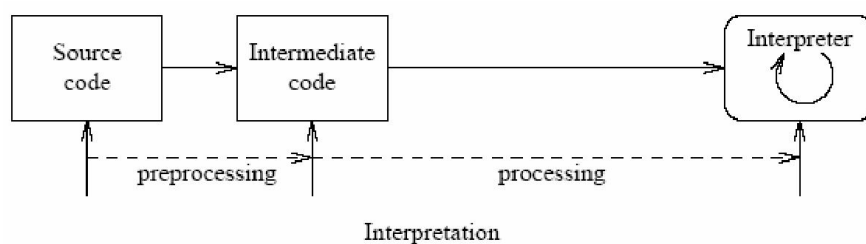


Fig:- Interpretation

Advantages of using an Interpreter

1. Easier to debug (check errors) than a compiler.
2. Easier to create multi-platform code, as each different platform would have an interpreter to run the same code.
3. Useful for prototyping software and testing basic program logic.

Disadvantages of using an Interpreter

1. Source code is required for the program to be executed, and this source code can be read making it insecure.
2. Interpreters are generally slower than compiled programs due to the per-line translation method.

References

1. Silberschatz, A., Galvin, P. B., & Gagne, G. (2018). Operating system concepts (10th ed.). Wiley.
2. Stallings, W. (2018). Operating systems: Internals and design principles (9th ed.). Pearson.
3. Tanenbaum, A. S., & Bos, H. (2015). Modern operating systems (4th ed.). Pearson.
4. Sebesta, R. W. (2016). Concepts of programming languages (11th ed.). Pearson.
5. Backus, J. (1978). Can programming be liberated from the von Neumann style? Communications of the ACM, 21(8), 613–641.

6. Dijkstra, E. W. (1968). Go to statement considered harmful. *Communications of the ACM*, 11(3), 147–148.
7. McIlroy, M. D. (1968). Mass produced software components. NATO Software Engineering Conference.
8. Open Source Initiative. (n.d.). The open source definition. Retrieved from <https://opensource.org>
9. IEEE Computer Society. (n.d.). Software engineering and operating systems. Retrieved from <https://www.computer.org>
10. ACM Digital Library. (n.d.). Programming languages and software systems research. Retrieved from <https://dl.acm.org>

CHAPTER 6: COMPUTER NETWORKING, INTERNET TECHNOLOGIES, AND E- COMMERCE SYSTEMS: CONCEPTS AND APPLICATIONS

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Abstract

This chapter provides a comprehensive introduction to computer networking, Internet technologies, and electronic commerce (e-commerce). It begins by defining computer networks and their importance in enabling communication, resource sharing, and information exchange among connected systems. Various types of networks such as LAN, MAN, and WAN are discussed, along with their characteristics including topology, protocols, and network architecture.

The chapter further explores Internet technology, describing how global networks are interconnected using standard protocols such as TCP/IP. Key components of the World Wide Web (WWW), including browsers, hypertext, HTML, URLs, and HTTP, are explained in detail. Additionally, modern Internet services such as email systems and search engines are examined, highlighting their structure, working mechanisms, and practical applications.

The chapter also introduces the concept of e-commerce, differentiating it from e-business and discussing its benefits, applications, and technological features. Various models such as B2C, B2B, and C2C are analyzed, along with the evolution and growth stages of e-commerce. Finally, the chapter addresses the limitations and challenges in the adoption of e-commerce technologies. Overall, this chapter provides a strong foundation for understanding networking and digital business environments.

Keywords: Computer Networks, LAN, MAN, WAN, Internet, TCP/IP, World Wide Web, HTML, URL, HTTP, Email Systems, Search Engines, E-Commerce, E-Business, Network Topology, Network Protocols, Digital Communication

Introduction to Computer Networking:- A computer network is a group of computer systems and other computing hardware devices that are linked together through communication channels to facilitate communication and resource-sharing among a wide range of users. Networks are commonly categorized based on their characteristics. Computers on a network are sometimes called nodes. Computers and devices that allocate resources for a network are called servers.

Networks are used to:-

- Facilitate communication via email, video conferencing, instant messaging, etc.
- Enable multiple users to share a single hardware device like a printer or scanner
- Enable file sharing across the network
- Allow for the sharing of software or operating programs on remote systems
- Make information easier to access and maintain among network users

There are many types of networks, including:-

- Local Area Networks (LAN)
- Personal Area Networks (PAN)
- Home Area Networks (HAN)
- Wide Area Networks (WAN)
- Campus Networks
- Metropolitan Area Networks (MAN)
- Enterprise Private Networks
- Internetworks
- Backbone Networks (BBN)
- Global Area Networks (GAN)
- The Internet

Network Characteristics

In addition to these types, the following characteristics are also used to categorize different types of networks:

- **Topology** : The geometric arrangement of a computer system. Common topologies include a bus, star, and ring.
- **Protocol** : The protocol defines a common set of rules and signals that computers on the network use to communicate. One of the most popular protocols for LANs is called Ethernet. Another popular LAN protocol for PCs is the IBM token-ring network.
- **Architecture** : Networks can be broadly classified as using either a peer-to-peer or client/server architecture.

Concept of LAN, WAN & MAN:- There are many types of computer networks, including the following:

1. LAN:- A LAN (local area network) is a group of computers and network devices connected together, usually within the same building. By definition, the connections must be high speed and relatively inexpensive (e.g., token ring or Ethernet). Most Indiana University Bloomington departments are on LANs. A LAN connection is a high-speed connection to a LAN. On the IUB campus, most connections are either Ethernet (10 Mbps) or Fast Ethernet (100 Mbps), and a few locations have Gigabit Ethernet (1000 Mbps) connections.

2. MAN:- A MAN (metropolitan area network) is a larger network that usually spans several buildings in the same city or town. The IUB network is an example of a MAN.

3. WAN:- A WAN (wide area network), in comparison to a MAN, is not restricted to a geographical location, although it might be confined within the bounds of a state or country. A WAN connects several LANs, and may be limited to an enterprise (a corporation or an organization) or accessible to the public. The technology is high speed and relatively expensive. The Internet is an example of a worldwide public WAN.

Internet technology:- Internet technology is the ability of the Internet to transmit information and data through different servers and systems. Internet technology is important in many different industries because it allows people to communicate with each other through means that were not necessarily available.

Concept of Internet technology:- The Internet is a global collection of computer networks that are linked together by devices called routers and use a common set of protocols for data transmission known as TCP/IP (transmission control protocol / Internet protocol). The primary purpose of the Internet is to facilitate the sharing of information. There are many different tools used on the Internet to make this possible. Some of the more common tools include email, listservs, newsgroups, telnet, gopher, FTP, and the world wide web. Probably the most popular of all Internet tools is the world wide web.

World Wide Web (WWW):- The WWW is a collection of Internet sites that can be accessed by using a hypertext interface. Hypertext documents on the web contain links to other documents located anywhere on the web. By clicking on a link, you are immediately taken to another file or site to access relevant materials. The interesting thing about Hypertext links is that the links might take you to related material on another computer located anywhere in the world, rather than just to a file on your local hard drive.

Basic WWW Concepts:-

- **BROWSER** -- A WWW browser is software on your computer that allows you to access the World Wide Web. Examples include Netscape Navigator and Microsoft Internet Explorer. Please know that a browser can't work its magic unless you are somehow connected to the Internet. At home, that is normally accomplished by using a modem that is attached to your computer and your phone line and allows you to connect to, or dial-up, an Internet Service Provider (ISP). At work, it may be accomplished by connecting your workplace's local area network to the Internet by using a router and a high speed data line.
- **HYPERTEXT AND HYPERMEDIA** -- Hypertext is text that contains electronic links to other text. In other words, if you click on hypertext it will take you to other related material. In addition, most WWW documents contain more than just text. They may include pictures, sounds, animations, and movies. Documents with links that contain more than just text are called hypermedia.
- **HTML (HYPERTEXT MARKUP LANGUAGE)** -- HTML is a set of commands used to create world wide web documents. The commands allow the document creator to define the parts of the document. For example, you may have text marked as headings, paragraphs, bulleted text, footers, etc. There are also commands that let you import images, sounds, animations, and movies as well as commands that let you specify links to other documents. If you wanted to create your own web page, you would need to know HTML or be able to use a tool that can generate HTML.
- **URL (UNIFORM RESOURCE LOCATOR)** -- Links between documents are achieved by using an addressing scheme. That is, in order to link to another document or item (sound, picture, movie), it must have an address. That address is called its URL. The URL identifies the host computer name, directory path, and file name of the item. It also identifies the protocol used to locate the item such as hypertext, gopher, ftp, telnet or news.
- **HTTP (HYPERTEXT TRANSPORT PROTOCOL)** -- HTTP is the protocol used to transfer hypertext or hypermedia documents.
- **HOME PAGE** -- A home page is usually the starting point for locating information at a WWW site.
- **CLIENTS AND SERVERS** -- If a computer has a web browser installed, it is known as a client. A host computer that is capable of providing information to others is called a server. A server requires special software in order to provide web documents to others.

Email Services:- E-mail, in full electronic mail, messages transmitted and received by digital computers through a network. An e-mail system allows computer users on a network to send text, graphics, and sometimes sounds and animated images to other users. On most networks, data can be simultaneously sent to a universe of users or to a select group or individual. Network users typically have an electronic mailbox that receives, stores, and manages their correspondence. Recipients can elect to view, print, save, edit, answer, forward, or otherwise react to communications. Many e-mail systems have advanced features that alert users to incoming messages or permit them to employ special privacy features. Large corporations and institutions use e-mail systems as an important communication link between employees and other people allowed on their networks. E-mail is also available on major public online and bulletin board systems, many of which maintain free or low-cost global communication networks.

In short electronic mail, email (or e-mail) is defined as the transmission of messages over communications networks.

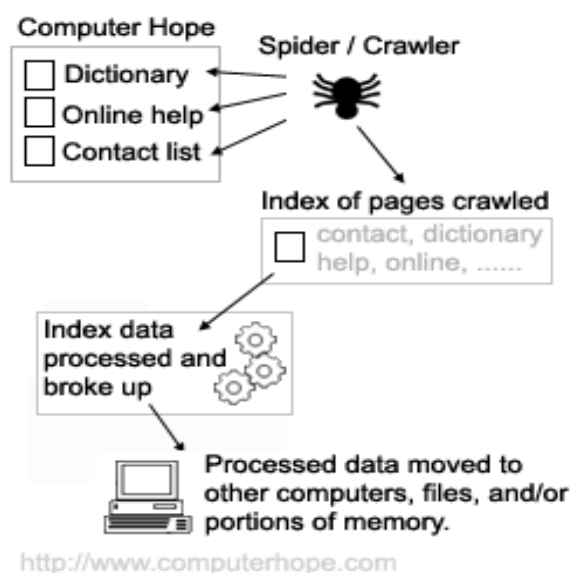
Typical Components of an Email System:- Most email systems include a rudimentary text editor for composing messages, but many allow you to edit your messages using any editor you want. Some systems will also provide basic formatting, including bold, italics, font color and HTML. You can use the program to send the message to a recipient by specifying the recipient's address. You can also send the same message to several users at once. This is called broadcasting.

Sent messages are stored in electronic mailboxes until the recipient fetches them. To see if you have any mail, you may have to check your electronic mailbox periodically, although many systems alert you when mail is received. After reading your mail, you can store it in a text file, forward it to other users, or delete it. Copies of memos can be printed out on a printer if you want a paper copy.

Search Engines:- A search engine is a software program or script available through the Internet that searches documents and files for keywords and returns the results of any files containing those keywords. Today, there are thousands of different search engines available on the Internet, each with their own abilities and features. The first search engine ever developed is considered Archie, which was used to search for FTP files and the first text-based search engine is considered Veronica. Today, the most popular and well-known search engine is Google.

How to access a search engine:- For users, a search engine is accessed through a browser on their computer, smart phone, tablet, or another device.

How a search engine works:- Because large search engines contain millions and sometimes billions of pages, many search engines not only just search the pages but also display the results depending upon their importance. This importance is commonly determined by using various algorithms. As illustrated in the figure below, the source of all search engine data is a spider or crawler, which automatically visits pages and indexes their contents.



Once a page has been crawled, the data contained within the page is processed and indexed. Often, this can involve the steps below.

- Strip out stop words.
- Record the remaining words in the page and the frequency they occur.
- Record links to other pages.
- Record information about images or other embedded media.

The data collected above is used to rank the page and is the primary method a search engine uses to determine if a page should be shown and in what order.

Finally, once the data is processed it is broken up into one or more files, moved to different computers, or loaded into memory where it can be accessed when a search is performed.

What is e-commerce? How does it differ from e-business? Where does it intersect with e-business?

E-commerce, in the popular sense, can be defined as: The use of the Internet and the Web to conduct business transactions. A more technical definition would be: E-commerce involves digitally enabled commercial transactions between and among organizations and individuals. E-commerce differs from e-business in that no commercial transaction, an exchange of value across organizational or individual boundaries, takes place in e-business. E-business is the digital enablement of transactions and processes within a firm and therefore does not include any exchange in value. E-commerce and e-business intersect at the business firm boundary at the point where internal business systems link up with suppliers. For instance, e-business turns into e-commerce when an exchange of value occurs across firm boundaries.

Benefits of E-commerce :- There are many benefits of bringing one's business to the Web. An e-business can offer personalized service, high-quality customer service and improved supply chain management. E-commerce in a way is equivalent to automation and innovation of commercial activities. It is absolutely clear that automation brings a number of distinct advantages including lesser investment. Automation frees valuable labor from menial tasks and also encourages the people concerned to pursue new and ideally beneficial initiatives, which would not have happened previously. We discuss the benefits of each model explained above.

B2C applications are beneficial to existing retail stores and companies as this innovative application allows them to increase their customer base and hence their revenue. E-commerce helps them to reach entire demographics that

they might not be able to reach in a physical or "bricks and mortar" store. B2C is highly beneficial for consumers as it gives them access to a world of stores instead of the stores in their neighborhood. It brings a competitive trend giving consumers access to a wide variety of choices and lower prices. Some B2C web sites allow consumers to name their own prices for a variety of goods and services. Thus e-commerce brings forth such kinds of beneficial, consumers-oriented innovations.

B2C allows companies to extend their existing services to consumers as well. Consumers are able to order a special item to be delivered to a nearby store for pickup is a handy service that increases customer loyalty and this is possible only due to the advent of B2C. B2C applications open up a new world for companies that are not well known to outside world before.

B2B is extremely beneficial to businesses because of its potential to drastically reduce the cost. By making communication easier and faster, using new technologies and standards, the quicker the inventory can move, the more efficient the process. Further on, B2B applications help automate communication between companies. This, apart from streamlining the process, helps reduce the potential for errors and helps provide better goods and services.

B2B2C applications help B2C companies to raise profits. By leveraging the benefits of B2B to streamline and improve business, B2C companies have the ability to make more money by growing revenue and cutting unnecessary costs. Also a company which is successful in one area of e-commerce can capitalize on this success and knowledge gathered to other areas of their e-commerce plan.

C2C and C2B2C applications allow consumers to interact themselves. This helps businesses to have a fairly easy revenue stream and consumers have access to an entirely new way to purchase and sell goods and services.

Unique features of e-commerce technology:- The unique features of e-commerce technology include:

- Ubiquity: It is available just about everywhere and at all times.
- Global Reach: The potential market size is roughly equal to the size of the online population of the world.
- Universal standards: The technical standards of the Internet and therefore of conducting e-commerce, are shared by all of the nations in the world.
- Richness: Information that is complex and content-rich can be delivered without sacrificing reach.
- Interactivity: E-commerce technologies allow two-way communication between the merchant and the consumer.
- Information density: The total amount and quality of information available to all market participants is vastly increased and is cheaper to deliver.
- Personalization/Customization: E-commerce technologies enable merchants to target their marketing messages to a person's name, interests and past purchases. They allow a merchant to change the product or service to suit the purchasing behavior and preferences of a consumer.
- Social technology: User content generation and social networking technologies

Growth of E-commerce:- There are three different stages in the evolution of e-commerce.

The three stages in the evolution of e-commerce are innovation, consolidation, and reinvention. Innovation took place from 1995-2000 and was characterized by excitement and idealistic visions of markets in which quality information was equally available to both buyers and merchants. E-commerce did not fulfill these visions during its early years, however. After 2000, e-commerce entered its second stage of development: consolidation. In this stage, more traditional firms began to use the Web to enhance their existing businesses. Less emphasis was placed on creating new brands. In 2006, though, e-commerce entered its current stage, reinvention, as social networking and Web 2.0 applications reinvigorated e-commerce and encouraged the development of new business models.

Limitations in growth of E-commerce:- One major limitation to the growth of e-commerce is the price of personal computers. Another limitation is the need for many people to learn complicated operating systems, at least in comparison to other technologies such as the television or the telephone. People must also learn a set of sophisticated skills to make effective use of the Internet and e-commerce capabilities. Another limitation is the unlikelihood that the digital shopping experience will ever replace the social and cultural experience that many seek from the traditional shopping environment. Finally, persistent global income inequality will exclude most of the world's population, who do not and probably will not in the foreseeable future, have access to telephones or PCs. Social and cultural limitations are likely to be tougher to overcome than technological limitations.

References

1. Kurose, J. F., & Ross, K. W. (2021). Computer networking: A top-down approach (8th ed.). Pearson.
2. Tanenbaum, A. S., & Wetherall, D. J. (2011). Computer networks (5th ed.). Pearson.

3. Laudon, K. C., & Traver, C. G. (2020). E-commerce: Business, technology, society (16th ed.). Pearson.
4. Stallings, W. (2017). Data and computer communications (10th ed.). Pearson.
5. Berners-Lee, T., Fielding, R., & Masinter, L. (2005). Uniform Resource Identifier (URI): Generic syntax. Internet Engineering Task Force (IETF).
6. Fielding, R. T. (2000). Architectural styles and the design of network-based software architectures. Doctoral dissertation, University of California, Irvine.
7. Cerf, V. G., & Kahn, R. E. (1974). A protocol for packet network intercommunication. IEEE Transactions on Communications, 22(5), 637–648.
8. Internet Engineering Task Force (IETF). (n.d.). TCP/IP protocol suite. Retrieved from <https://www.ietf.org>
9. IEEE Computer Society. (n.d.). Computer networking and communication technologies. Retrieved from <https://www.computer.org>
10. World Wide Web Consortium (W3C). (n.d.). Web standards and technologies. Retrieved from <https://www.w3.org>

CHAPTER 7: MICROSOFT WINDOWS OPERATING SYSTEM: STRUCTURE, FEATURES, AND SYSTEM UTILITIES

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Abstract

This chapter provides a comprehensive understanding of the Microsoft Windows operating system, focusing on its structure, features, and essential utilities. It begins with an introduction to Windows as a graphical user interface (GUI)-based operating system that enables users to interact with computer systems through point-and-click operations. The chapter explains the organization of Windows, including different types of windows such as program, document, and folder windows, along with their key components like title bars, menu bars, and scroll bars.

The chapter further explores the concept of the desktop environment, including icons, taskbar, start menu, and system tray, which collectively enhance user interaction and system navigation. It also explains fundamental file management operations such as copying, moving, renaming, and deleting files and folders.

Additionally, the chapter provides detailed insights into various Windows accessories and system tools, including Calculator, Notepad, Paint, Snipping Tool, Disk Cleanup, Disk Defragmenter, and System Restore. Accessibility tools such as Magnifier, Narrator, and On-Screen Keyboard are also discussed, highlighting their role in supporting users with special needs. The chapter concludes with an overview of Control Panel and Windows Explorer, emphasizing their importance in system configuration and file management. Overall, this chapter equips learners with practical knowledge for efficient use of the Windows operating system.

Keywords: Windows Operating System, GUI, Desktop, Taskbar, Start Menu, File Management, Icons, Control Panel, Windows Explorer, System Tools, Disk Cleanup, Disk Defragmenter, System Restore, Windows Accessories, Accessibility Tools

What is Windows?

Window is an operating system and Graphical User Interface (GUI) created by Microsoft and found on most computer systems.

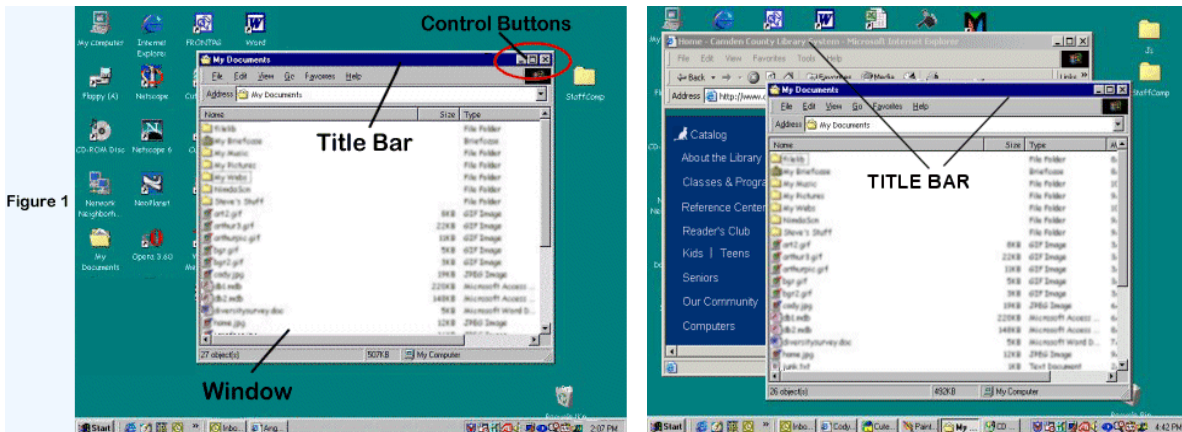
- It allows for easy “point and click” operations between the user and the different files and programs with which they wish to work.

- While there are many different versions of Windows, the fundamentals are the same.

An understanding of the below tools and features will make it easier to use windows.

Windows structure:

The “window” refers a program or document or other object that is open. We can have multiple windows open at once and easily switch back and forth between them. We can move windows around, resize them or have a particular window expand onto the entire screen.



Types of Windows:-

1. Program Windows –Applications like Word, Internet Explorer are comes under the program windows.
2. Document Windows–these windows are Opens to a specific document within the applicable program window.
3. Folder Windows –A folder, like “My Documents” that may contain other folders, documents, programs, etc. are comes under this category.

Parts of a Window:-

1. **Title Bar** –it appears at the top of the window. It has mainly contained these buttons:-

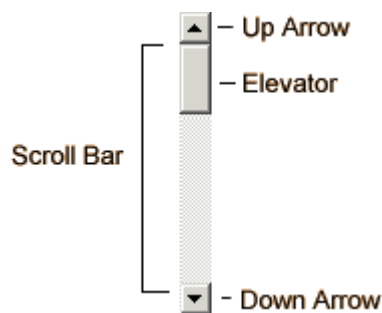


1. Minimize. 2. Maximize 3. Restore 4. Close

To adjust the size and position of a window, we can click and drag on the title bar. When window is smaller we can also move our window to another position by dragging it by toolbar. Also we can resize our window by clicking on the “resize” button.

2. **Menu bar**: - every window has a menu bar, which allows to access features within that particular program. For example office 2010 programs also have a menu bar and is called “the ribbon”.

3. **Scroll Bars**: - Scroll bars often appear at the bottom and even more often on the right hand side of a window, if there is a lot of content. Scroll bars are disabled when the content displayed is limited enough to fit within the dimensions of the window.



4. Cut/Copy/Paste:-

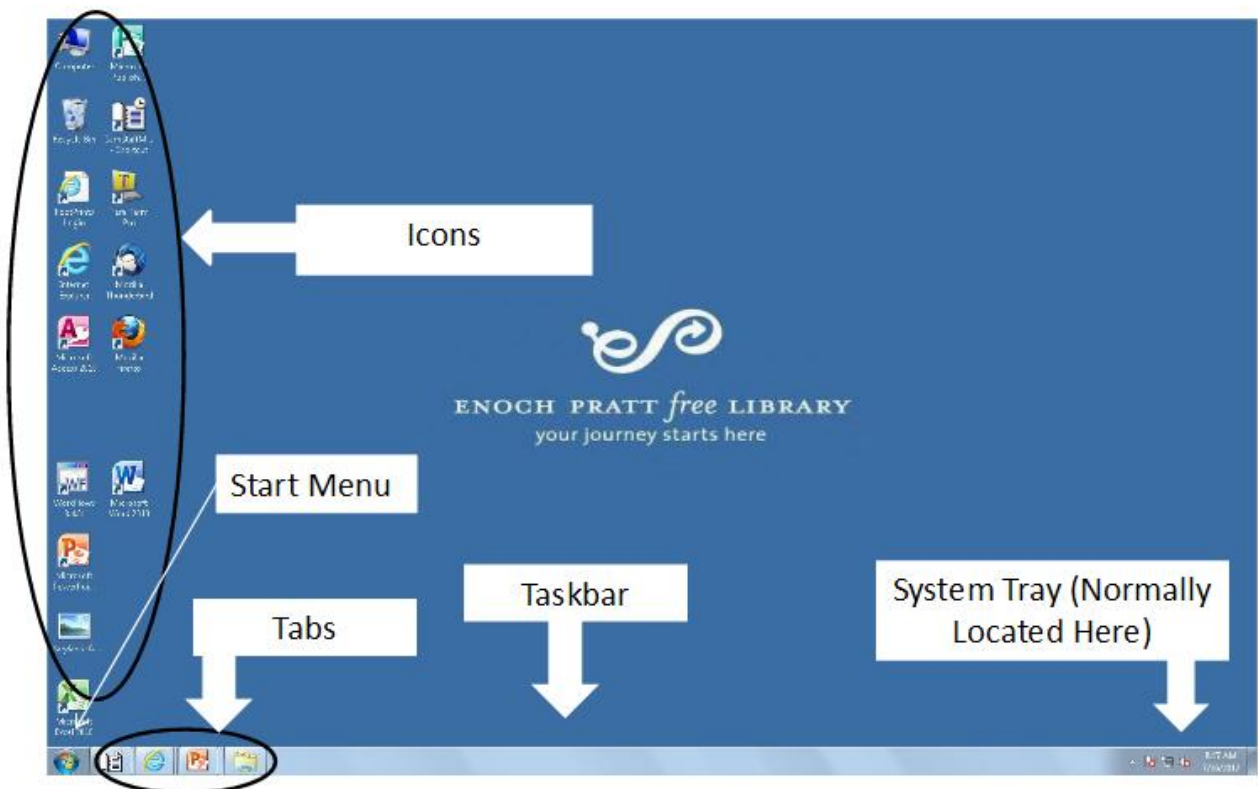
Cut, copy, and paste commands can be used with to move text, graphics and other items from one application to the next (Internet Explorer to Microsoft Word, for instance). Copied or cut items are placed in temporary storage (the Clipboard) and can be retrieved as long as the computer is on or if the item hasn’t been replaced by another that you select. An item on the Clipboard can be pasted multiple times.

Performing Cut/Copy/Paste:-

1. Select the item (text or graphic) to be copied by either highlighting the text or right clicking on the graphic.
2. Once we have made your selection, in the case of text, notice that it remains highlighted
3. We can now right click on your selection and select Copy OR Press [Ctrl] + [C]
4. Now we have copied the material and we can use it to paste into another application.

5. Once we have copied the item, go to the application where we would like to paste it.
6. Place your cursor where you want to paste the item in the document (a word file, email, etc.)
7. Right Click and then select
Paste OR Press [Ctrl] + [V].
5. Moving/copying files and folders: - Similar to cutting and pasting text/graphics.
6. Renaming files/folders.
7. Creating new folders and shortcuts

The Desktop: - The “Desktop” is the general work area of your computer. It gives you access to programs, folders and documents that you use frequently. This area is customizable on your own computer, though it is not something that can be changed on a public computer at the library.



1. Icons: - An icon is a symbol/picture that acts as a button to open up a folder, document, application or other object. All icons need to be double clicked in order to open.

Different Types of Icons

1. Application Icons open up a program (an executable file), like Internet Explorer, Microsoft Word, etc.
2. Folder Icons store and organize documents and applications. Often you will find folders within folders.
3. Document icons represent a specific file, like a word document, picture, etc. These files typically have an association with the program that is used to open them.



Windows operating system uses different icons to represent files, folders and applications. Icons found on the desktop are normally left aligned. The desktop icons basically provided by windows are:

1. My Documents
2. My Computer

3. My Network Places
4. Recycle Bin
5. Internet Explorer

Recycle Bin:- Recycle bin makes it easy to delete and undelete files and folders. When a file or folder is deleted from any location, Windows stores it in the recycle bin. If a file is deleted accidentally, you can move it back from the recycle bin. We can also empty recycle bin to save disk space.

Steps to move back the file or folder from the recycle bin:-

1. Open Recycle bin by double clicking on its icon.
2. Select the file or folder you want to move back.
3. Click the right mouse.
4. A menu will appear, choose restore from it.
5. Windows will move the file or folder back to the location from where it was deleted.

My Computer: - My computer lets you browse the contents of your computer. The common tasks that we can perform through my computer are:

1. Access information stored as different storage devices connected with the computer, such as hard disk, floppy disk or CD ROM.
2. Create, move, copy, delete or rename files, folders and programs from one disk to another disk.
3. Execute or run programs from the disks.
4. Configure devices of the computer.
5. Add or remove a printer.

Icons vs. Programs

1. You double click on the icon to execute the program.
2. When inside of the program, you single click on the commands or icons for that program. (Examples: MS Office, Internet Explorer, Firefox, Windows Media Player, etc.)

2. The Taskbar: - The task bar is at the bottom of the desktop but you can move it to the top or either side of the screen by clicking and dragging it to the new location. Buttons representing programs currently running on your computer appears on the task bar. At the very left of the task bar is the start button, which allows access to other Windows programs and features that are not on the desktop. At the right side is an area called the system tray. System tray shows programs running in the background, the clock, volume control, etc.



3. Start Button:- Start button is found at the lower left corner of the screen. Click once on the start button to open a menu of choices. Through this button we can open the programs, installed on your computer and access all the utilities available in the windows environment. We can shutdown, restart and/or standby the computer by using the start button.

Start menu displays a menu of choices:

1. Default Programs: - choose default programs for web browsing, e-mail, playing music and other activities. Place the mouse pointer to the programs entry and a sub menu will open, showing all programs or applications currently installed. To open a program, which has been installed on your computer, click on it and the program will open.

2. Favorites: - Favorites menu present a list of the Internet addresses that you have added to your Internet Explorer Favorite List.

3. Documents: - Access letter, reports, notes and other kind of documents. The Documents menu lists the files you have recently worked on. You can open the most recently used document directly from here. To open a document from this list, simply click on it and the document will open.

4. Control Panel: - one can change setting and customize the functionality of the computer by using this button. This menu provides the facility to change or configure the hardware or software settings of the computer. This menu leads to several choices. The individual icons in the Control Panel refer to a variety of tools to control the way of your computer, its components presents information, as well as the tools to control the behavior and appearance of the Windows interface.

5. Find and search: - This option of the start menu helps in locating files or folders stored on the hard disk or

network. This command is very helpful in case we forget the exact location of a file or folder that we want to access. The search option presents different ways for finding a file or folder. These options include search based on name, type, size, and date and storage location of the file or folder. It opens a dialog box, where the user can type a name of the file or folder to search for. The procedure of using this command is given below:

1. Click on Find option of the start menu, the Find dialog box will appear.
2. Enter the name of the file or folder in the Named text box.
3. From the Look in drop down list box choose the location where you imagine that your desired file or folder may be present.
4. Click on the Find now button to start search.
5. If find dialog box successfully searches the location of the desired file or folder, it will display it in the window below this dialog box.

6. Help and support: - Find help topics, tutorials, troubleshooting and support services. To access the Help system of windows, you can select Help from the start menu. Help option helps us how to use the commands and menus and in case of problems how to trouble shoot the windows operating system.

7. Run: - This command is used to execute a command or program directly instead of using the icon or program menu. Press the “Browse” button to locate the program you want to open through Run command.

8. Shutdown:- Shutdown is a process in which computer closes all programs currently running and disconnects the devices connected with it and turns itself off. Following steps are followed to shutdown the computer:-

1. Click on the start button to open the Start Menu.
2. Click on the Shut Down.
3. Shut down dialog box will appear.
4. Choose the shut down option from the list and click the “OK” button.

9. Devices and Printers:-view and manages devices, printers and printers job.

10. Computer: - see the disk drive and other hardware connected the computer

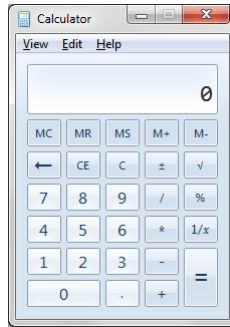
11. Music: - Play music and other audio files

12. Pictures: - view and organize digital pictures.



Windows Accessories :- Windows operating system ships with some handy applications known as Windows accessories. Calculator, Notepad, Paint, Explorer, WordPad are some of the most frequently used accessories. Apart from above mentioned applications, Windows has a few tools for Ease of Access and some System Tools. We'll be briefly talking about them here.

1. Calculator:-



Windows Calculator is a calculating application included in all the versions of Windows. It can be used to perform simple calculation, scientific calculation and Programming calculation.

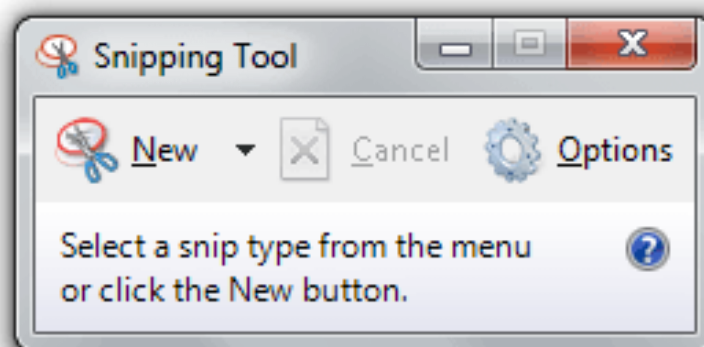
- Choose Start >> Programs >> Accessories >> Calculator to start Calculator application, or
- Alternately you can open Run dialog box (Start >> Run) dialog box then type calc and hit enter.
- From View menu choose the required type of calculator – Standard, Scientific, Programmer, Statistical
- Edit >> Copy and Paste commands can be used to input the numbers into calculator or paste the result to other applications

Calculator was first included with Windows 1.0 as a simple arithmetic calculator. In Windows 3.0, a Scientific mode was added, which included exponents and roots, logarithms, factorial-based functions, trigonometry (supports radian, degree and gradients angles), base conversions (2, 8, 10, 16), logic operations, Statistic functions such as single variable statistics and linear regression.

In Windows 7, separate Programmer, Statistics, Unit Conversion, Date Calculation, and Worksheets modes were added. Calculator's interface was revamped for the first time since its introduction.

On the right of the main Calculator, one can add a panel with Date Calculation, Unit Conversion, and Worksheets. The included Worksheets allow one to calculate a result of a chosen field based on the values of other fields. Pre-defined templates include calculating a car's fuel economy (mpg and L/100 km), a vehicle lease, and a mortgage. In pre-beta versions of Windows 7, Calculator also provided a Wages template.

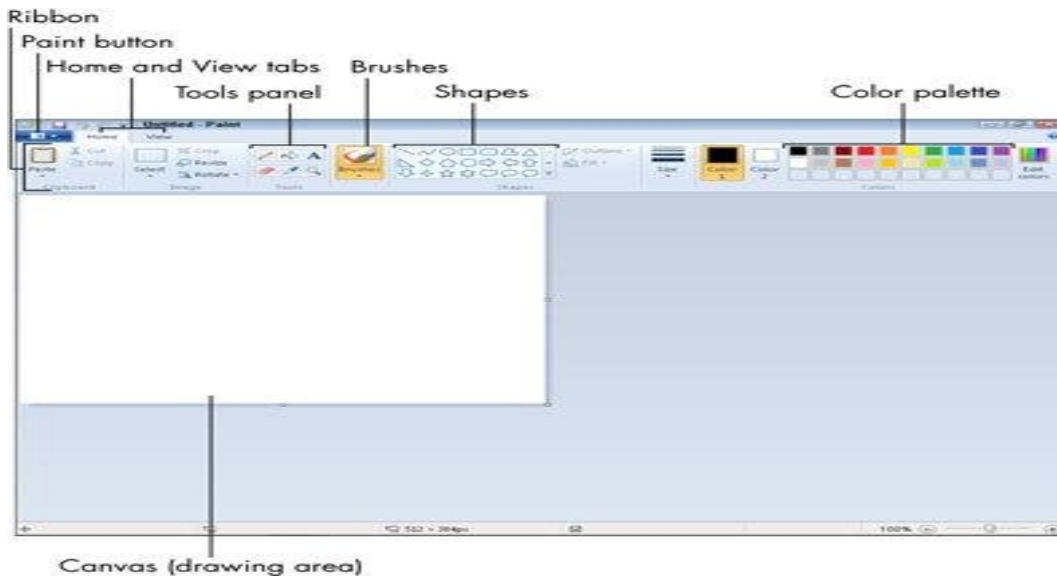
2.Snipping Tool:- Snipping Tool is another useful of Windows accessories included in Windows 7, Windows Vista, and Experience Pack for Windows XP Tablet PC Edition 2005. It was originally released as a powertoy for the Tablet PC. The program is a screen-capture tool that allows taking screenshots (called snips) of an open window, rectangular areas, a free-form area, or the entire screen. Snips can then be annotated using a mouse or a tablet, saved as an image file (PNG, GIF, or JPEG file) or an HTML page, or e-mailed.



The Snipping Tool captures all or part of the computer display screen as a picture. You can save the picture and attach it to an e-mail or paste the picture into a document. Click the Start button, type snip, and click the Snipping Tool from the search results. The screen fades slightly, and the Snipping Tool toolbar appears.

Snipping tool can be used to PrintScreen, annotate and use in other applications.

3. Paint:-



Paint (formerly Paintbrush for Windows) is a simple graphics painting program that has been included with all versions of Microsoft Windows. It is often referred to as MS Paint or Microsoft Paint. The program opens and saves files as Windows bitmap (24-bit, 256 colors, 16 color, and monochrome) .BMP, JPEG, GIF. Paintbrush supports GIF without animation or transparency. Since Windows 98 Paint supports GIF with transparency. It also supports PNG (without alpha channel), and TIFF (without multiple page support).

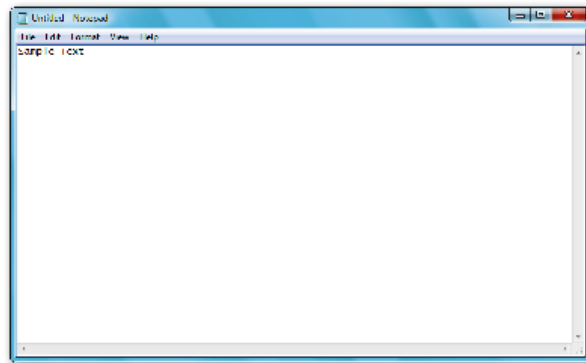
The program can be in color mode or two-color black-and-white, but there is no grayscale mode. For its simplicity, it rapidly became one of the most used applications in the early versions of Windows—introducing many to painting on a computer for the first time—and still has strong associations with the immediate usability of the old Windows workspace.

4. Character Map:- Character Map is a utility included with Microsoft Windows operating systems and is used to view the characters in any installed font, to check what keyboard input (Alt code) is used to enter those characters, and to copy characters to the clipboard in lieu of typing them.



The tool is usually useful for entering special characters. It can be opened via the command line or Run Command dialog using the 'charmap' command.

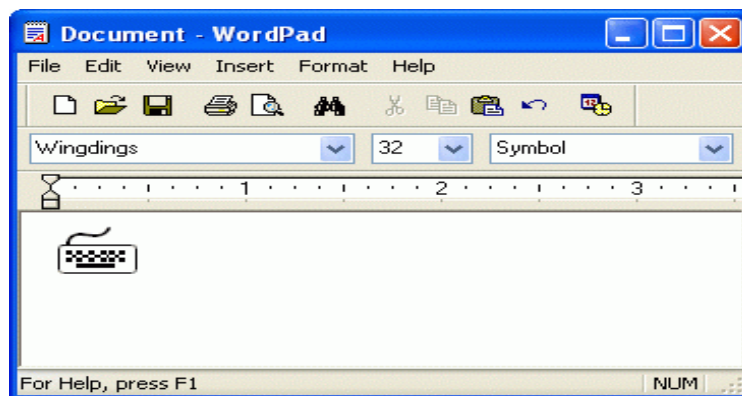
5. Notepad:-



Notepad is a common text-only (plain text) editor. The resulting files—typically saved with the .txt extension—have no format tags or styles, making the program suitable for editing system files that are to be used in a DOS environment.

Notepad supports both left-to-right and right-to-left based languages, and one can alternate between these viewing formats by using the right or left Ctrl+Shift keys to go to right-to-left format or left-to-right format, respectively.

6. WordPad:-



Microsoft WordPad is a free rich text editor included with Microsoft Windows 95 and the later. Earlier to Windows 95 there used to be an application called Write for the same task. Although capable of doing much more than Notepad, WordPad is not as advanced as Microsoft Word.

WordPad can format and print text, but lacks intermediate features such as a spell checker, thesaurus, and support for tables. As such, it is suitable for writing letters or short pieces, but underpowered for work that relies heavily on graphics or typesetting.

7. System Tools:-

For a smooth performance of a system, periodic maintenance is necessary. Tools like Disk Check, Disk Derangement, etc., helps in system maintenance. Windows includes some of the system utilities such as Disk Cleanup, Disk Defragment, System Restore, Control Panel and so on.

1. Disk Cleanup:- In Windows 7, Vista, and XP, Disk Cleanup frees disk space by cleaning areas that gather unneeded files. Using Disk Cleanup regularly, along with ScanDisk, DEFRAG, and up-to-date virus patterns, will help keep your computer running smoothly.



To run Disk Cleanup:

- From the Start menu, select Programs or All Programs, then Accessories, then System Tools, and then Disk Cleanup.
- Select the drive on which you would like to clear disk space (usually your C: drive), and click OK.
- Select from the four areas that Disk Cleanup will check and clean up:

Temporary Internet Files: Files stored on your local drive that allow web pages to load more quickly.

Downloaded Program Files: A storage location for programs downloaded when you visit specific web sites that use ActiveX and Java applets.

Recycle Bin: Files that have been marked as deleted.

Temporary Files: Items in the TEMP folder.

2.Disk Defragment:- Disk Defragmenter consolidates files so that each is saved in contiguous physical space on the hard drive. When your computer crashes or freezes, the drive becomes fragmented. This means the files may be broken up and stored in different locations in your computer. This causes programs and files to run more slowly.



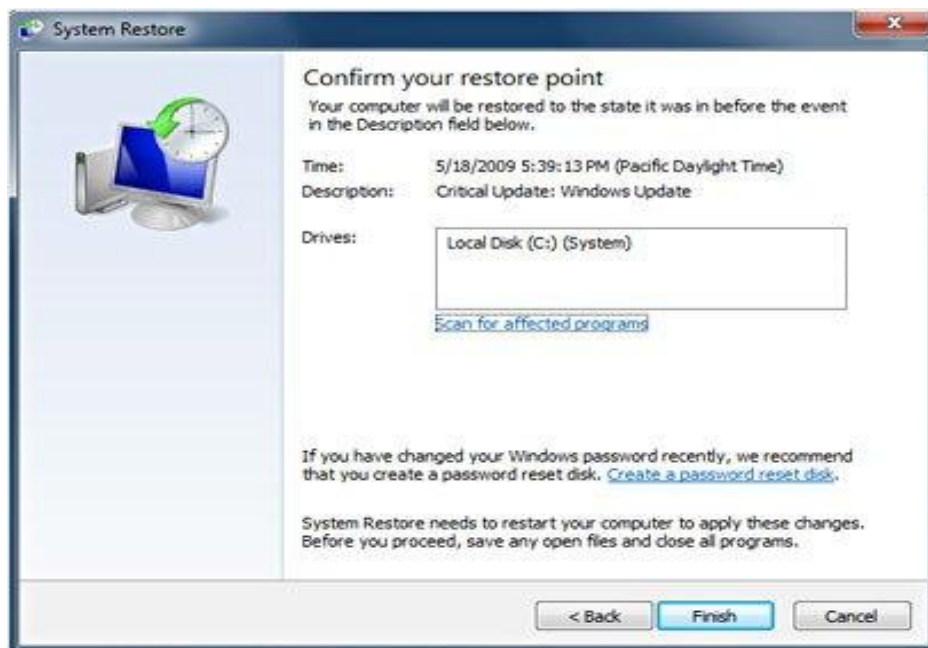
To run Disk Defragmenter:

- Close all programs.
- Choose Start menu | All Programs | Accessories | System Tools | Disk Defragmenter.
- Select the drive you want to clean and click OK.
- Click Analyze. This may take several minutes.
- Click Close or Defragment. If the drive needs defragmented and you choose Defragment, this may take several minutes to several hours, depending on the number of files to consolidate.

3.System Restore:- System restore is a feature of Windows that allows you to roll back the system to the same configuration it had at an earlier time. If this feature is turned on (which it is by default) Windows will take periodic snapshots (called restore points) of your installation. It can use the information gathered in these snapshots to restore your system to a previous configuration. It is a good idea to create a restore point before you make major changes to your system, such as before installing new hardware or doing any major updates.

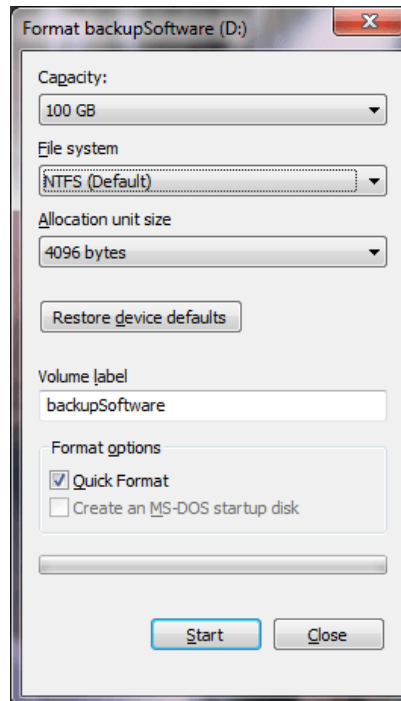
To run System Restore:

- Go to Start > Programs > Accessories > System Tools > System Restore.
- The System Restore screen will come up.
- Follow the on screen instructions



4.Format:- There are times when Windows becomes so damaged or so compromised by hackers and Trojan programs that the only thorough solution is to essentially start all over. This is accomplished by formatting your hard drive, which means erasing all of the programs and the data on your machine, and re-installing Windows.

The format creates a new root directory and file system for the disk. It can also check for bad areas on the disk, and it can delete all data on the disk. To be able to use a new disk, you must first use this command to format the disk.



8.Control Panel:- The Control Panel is a part of the Microsoft Windows graphical user interface. It allows users to view and manipulate basic system settings and controls via applets. You can use control panel for the tasks such as adding hardware, adding and removing software, controlling user accounts, and changing accessibility options. Additional applets can be provided by third party software.

In recent versions of Windows, the Control Panel has two views, Classic View and Category View, and it is possible to switch between these through an option that appears on either the left side or top of the window.

The classic view consists of shortcuts to the various control panel applets, usually without any description (other than the name). The categories are seen if the user use “Details” view.

The category view consists of categories, which when clicked on display the control panel applets related to the category. In Windows Vista, the category used applets below the name of the category.

9.Accessories also have few vision, hearing and ability tools. The first one is:

1.The Magnifier:- The Magnifier is a display utility that makes the computer screen more readable by people who have low vision by creating a separate window that displays a magnified portion of the screen. Magnifier provides a minimum level of functionality for people who have slight visual impairments.

Usually the Magnifier by default is set to show up at the top of the screen, but you can move it around by using your left mouse button: Click and hold down the left button and move the magnifier window to where you want it, then let go of the button.

When you open the Magnifier a new window appears: The Magnifier Settings window. From that window you can change the level of magnification, change the tracking and the presentation. To get out of the magnifier mode simply click Exit.

2.The Narrator:- It is available From Windows 2000 and newer. The Narrator is a text-to-speech utility for people who are blind or have low vision. Narrator reads what is displayed on the screen—the contents of the active window, menu options, or text that has been typed.

The Narrator is designed to work with Notepad, WordPad, Control Panel programs, Internet Explorer, the Windows desktop, and some parts of Windows Setup. Narrator may not read words aloud correctly in other programs. Narrator has a number of options that allow you to customize the way screen elements are read.

3.The On-screen Keyboard:- On-Screen Keyboard is a utility that displays a virtual keyboard on the computer screen. This tool allows people with mobility impairments to type data by using a pointing device or joystick. Besides providing a minimum level of functionality for some people with mobility impairments, On-Screen Keyboard can also be helpful for people who do not know how to type.

The program in which you want to type characters must be active while you are using On-Screen Keyboard. The accessibility tools in the Windows operating system are intended to provide a minimum level of functionality for users

with special needs.



10.Windows explorer:- The tool's fundamental purpose is to let you view, open, copy, move, and otherwise manage your files and folders. So learning how to use it is key for tasks like importing photos from the aforementioned memory card, copying files to a flash drive, setting up folders to keep your data organized, and so on.

References

1. Silberschatz, A., Galvin, P. B., & Gagne, G. (2018). Operating system concepts (10th ed.). Wiley.
2. Stallings, W. (2018). Operating systems: Internals and design principles (9th ed.). Pearson.
3. Norton, P. (2006). Introduction to computers (6th ed.). McGraw-Hill.
4. Sinha, P. K., & Sinha, P. (2007). Computer fundamentals (6th ed.). BPB Publications.
5. Cutler, D., & Solomon, D. A. (2005). Inside the Windows operating system. Microsoft Press Journal.
6. Russinovich, M. E., Solomon, D. A., & Ionescu, A. (2012). Windows internals. Microsoft Press.
7. Dijkstra, E. W. (1968). The structure of the "THE" multiprogramming system. Communications of the ACM, 11(5), 341–346.
8. Microsoft Corporation. (n.d.). Windows operating system overview. Retrieved from <https://www.microsoft.com>
9. IEEE Computer Society. (n.d.). Operating systems and user interfaces. Retrieved from <https://www.computer.org>
10. ACM Digital Library. (n.d.). Operating system research and development. Retrieved from <https://dl.acm.org>

CHAPTER 8: WORD PROCESSING AND MICROSOFT WORD: CONCEPTS, FEATURES, AND DOCUMENT MANAGEMENT TECHNIQUES

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Abstract

This chapter provides a comprehensive understanding of word processing and Microsoft Word, focusing on its role in creating, editing, formatting, and managing documents efficiently. It begins by explaining the concept of word processing as an evolution from traditional typing methods to digital document creation, emphasizing flexibility and ease of editing.

The chapter further explores the features of Microsoft Word, including text formatting, table creation, AutoCorrect, mail merge, templates, macros, and large document management tools. It also explains essential document operations such as creating, saving, editing, and formatting documents.

In addition, the chapter provides a detailed overview of the Microsoft Word interface, including components such as the title bar, menu bar, toolbars, status bar, and ruler. Various menus such as File, Edit, View, Insert, Format, Tools, and Table are discussed, along with their functions and commands. The chapter also highlights the role of toolbars and their customization for efficient task execution. Overall, this chapter equips learners with practical knowledge and skills required for professional document preparation and office productivity.

Keywords: Word Processing, Microsoft Word, Document Editing, Text Formatting, Toolbars, Menu Bar, File Management, Mail Merge, Templates, Macros, Document Interface, Office Applications, Desktop Publishing

WORD Processing : MS WORD

Word Processing:-

The act of writing is the continuous processing of words. Usually, we start with a rough draft. Then we change things: we move text around, insert new text, delete some text and so on and so forth, until we are satisfied with the final document.

Doing all this with a typewriter requires constant marking and retyping of drafts, mainly because you are typing directly onto the paper and the only way to change what's on the paper is to start all over again and with a new piece of paper. But with word processing, you type your material into the computer's memory (and view your work on the screen). As you are not typing directly onto the paper, you can replace, move, copy, insert, delete, overwrite or correct any words, sentences, paragraphs, pages - any amount of text - at any time, before your material becomes the document on paper.

In a word processing software or word processor, you can format your text with a variety of typefaces, add graphics, and set your work in sophisticated formats, such as newspaper like columns. When you are done, you print it. And with a high-quality inkjet or laser printer, your final document can look as if it were professionally printed.

Best of all, a word processor lets you make changes to your work with amazing ease. All word processors let you delete, insert, copy, and move text whenever you get a new idea, and this will change the way you write.

MS Word:-

MS Word or in short Word enables you to accomplish all of your basic word processing tasks and fulfill most of your desktop publishing needs. You can use word to generate all your memos, letters, reports, and other text intensive documents. Word's most valuable contribution is its flexibility with text and its ability to incorporate data from other MS Office components in their original format to produce comprehensive documents.

Important features of Word:- Besides Basic features of any word processing S/W package, MS word has features like:

1. Easy table creation and formatting features such as table AutoFormat, which allows you to focus on your data and let Word handle that formatting.
2. AutoCorrect and AutoFormat features that catch typographical errors automatically and allow you to use predefined shortcuts and typing patterns to quickly format your documents.
3. Large-document management features, like the ability to create tables of contents, index, list of figures and cross references.
4. Mail-Merge Helper which allows you to quickly create merged documents like master mailing and mailing labels.
5. Automation by means of macro creation.
6. The ability to insert fields that make your documents more dynamic by facilitating user input, system input for data (like date), and other special features that need to be updated regularly.
7. Built-in and custom templates that allow fast document creation based on boilerplate text and styles, Auto text, macros, and tool bars stored with individual templates.
8. Master document view that allows you to manage very large documents by incorporating subdocuments into one primary master document.

Create a document:-

The following procedure creates a new, blank document.

On the Standard toolbar, click New Blank Document.

To use templates, wizards, and existing documents as a starting point, do one of the following:

From a template or wizard

1. On the File menu, click New.
2. In the New Document task pane, under New from template, click General Templates.
3. Click the tab for the type of document you want to create, and then double-click the icon for the template or wizard you want.

Tips:

Creating file from a copy of an existing document

1. On the File menu, click New.
2. In the New Document task pane, under New from existing document, click Choose document.
3. Click the document you want to create a new document from.

If you want to open a document that was saved in a different folder, locate and open the folder.

4. Click Create New.

This document is created in the folder that contains the original document.

Save a document:-

To quickly save a document, click Save on the Standard toolbar. To save a document in a different location or format, use the procedures below.

Saving a document with different name

On the File menu, click Save As.

1. In the File name box, enter a new name for the file.
2. Click Save.

Saving a document with different format and file name

On the File menu, click Save As.

1. The File name box, enter a new name for the file.

2. From Save as Type select the format.
3. Click on Save.

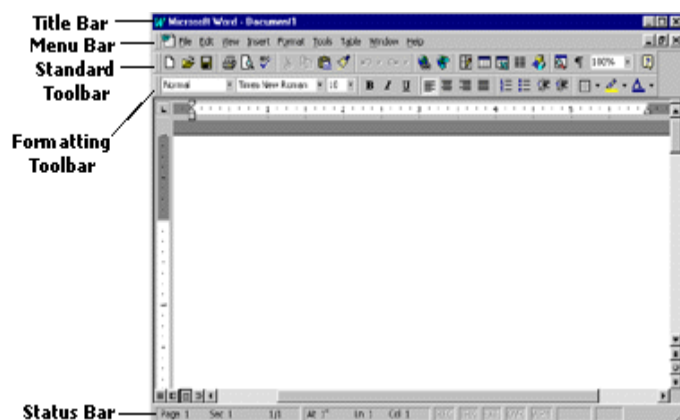
Editing a document:-

- (a) Deleting text: Select the text and press Delete key.
 - (b) Deleting characters: Press Backspace key to delete character before insertion point or press Delete Key to delete character at insertion point position.
 - (c) Inserting character: Position insertion point where you want to insert character, make sure Insert key is On type the character you want to insert.
 - (d) Overtyping character: Position insertion point from where you want to overtype character, make sure Insert key is Off, type the character you want to overtype.
- Note: if OVR is display in black in status bar it means overtyping mode is on. Overtyping mode can be turned on/off by press Insert Key.
- (e) Inserting paragraph: To insert paragraph position, the insertion point and press enter, and then start typing the text for new paragraph.
 - (f) Splitting paragraph: To split paragraph position the insertion point from where you want to split the paragraph and press enter key. To join the splitted paragraph press Backspace Key.
 - (g) Replacing Text: To replace text, select the text and start typing new text.
 - (h) Finding text using find command
 1. On the Edit menu, click Find.
 2. In the Find what box, enter the text that you want to search for.
 3. Select any other options that you want.

Microsoft Word Interface:-

Microsoft Word is a word processing program that allows for the creation of both simple and sophisticated documents. The program is equipped with templates and wizards to help you create useful documents such as resumes, letters and fax cover sheets. There are also features that allow you to add professional looking graphics to your documents.

Below is an image of the Microsoft Word Interface.



Title Bar: This bar lists the name of the program and the title of the current document.

Menu Bar: This bar displays the headings for each drop-down menu. Commands are grouped under each of these menu headings according to function.

Standard Toolbar: This toolbar contains short cuts to some of the most frequently used commands from the menu bar.

Formatting Toolbar: This toolbar contains short cuts to some of the most frequently used commands found under the FORMAT menu item.

Status Bar: This bar displays information about the active document.

1.Title Bar:-



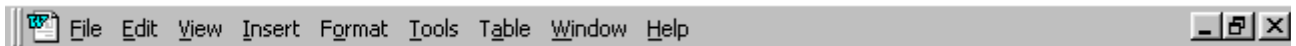
At the top of the Word interface is the title bar. This bar is present on all Windows applications and acts as a reminder of the program that you are using, as well as the title of the document that you are editing. In this particular

example, the document has not been named so it has the default name of Document1.

In the upper right hand corner of the interface you will notice a set of 3 buttons. The button with the flat piece (_) on it is the minimize button. The button in the middle is the resize button and may have one square or two squares on it. The last button has an X on it and is called the close button.

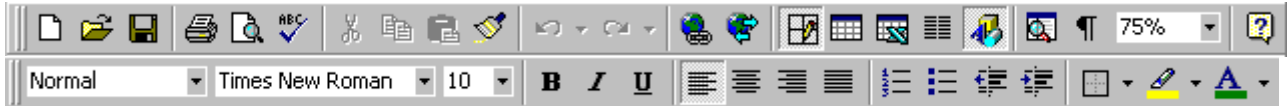
In the image of the full screen shown at the top of this page you will notice that there are two sets of these buttons. The top set of these is for the program, Microsoft Word. The bottom set of these is for the document that you are currently viewing. For the top set, minimize will drop the program MSWord from your view, but will not close the program. Hold down the ALT key on your keyboard and press the TAB key to bring MSWord back into your view. The resize button will either make the MSWord window large enough to fit the full monitor (the single square) or small enough to where you can see it and whatever is behind it (the two squares). These work in a similar fashion for the document that you are working on. The minimize button will drop your document to the bottom of the page, where it will only be represented by a small title bar. The resize button will either make the document large enough to fit the full MSWord window (the single square) or small enough to where you can see it and other documents that you have opened simultaneously (the two squares). The close button will close the document, just as if you went to FILE | CLOSE on the menu or it will close the program, just as if you went to FILE | EXIT on the menu.

2.Menu Bar:-



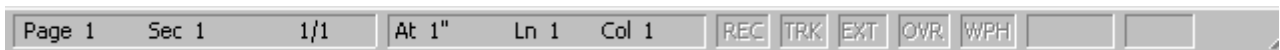
The menu bar is below the title bar. There are nine menu options on the menu bar. When you click on any of these options (File, Edit, View, Insert, Format, Tools, Table, Window or Help) a drop-down menu of commands will appear below it.

3.Standard and Formatting Toolbar:-

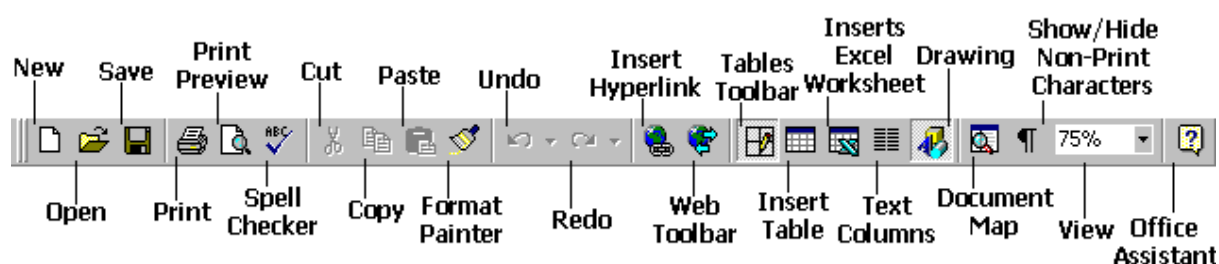


Below the menu bar are the toolbars. Toolbars consist of icons that act as short-cuts to the commands found under the menus. The icons on the toolbars are organized according to function and according to the most commonly used commands in MSWord. The toolbar that usually appears directly below the menu bar is called the Standard Toolbar. The toolbar just below that is called the Formatting Toolbar. These toolbars can be customized and moved around on the screen. The option for displaying or hiding a toolbar is found under the menu item VIEW | TOOLBARS. The toolbar will be discussed in more detail in the next section of the MSWord tutorial. A ToolTip (yellow tag) appears when you move the mouse over any of the icons on the toolbar. The ToolTip explains what function that particular icon performs.

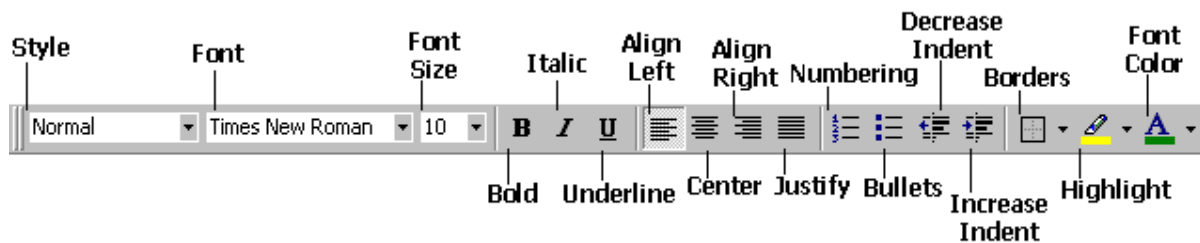
4.Status Bar:-



At the bottom of the Word interface is the status bar. This bar displays information about your document such as the page that is currently displayed on the screen (Page 1), the total number of pages in the document (1/1, i.e. 1 of 1) and the line in which the cursor is currently positioned (Ln 1). The right side of the status bar shows whether keys such as OVERTYPE are active or inactive. All of these keys in this example are inactive.



Name	Function	Menu Location
New	Creates a new, blank document	FILE NEW
Open	Displays the Open dialog box so that you can retrieve an existing document	FILE OPEN
Save	Saves the active document to a specified location	FILE SAVE
Print	Prints active document	FILE PRINT
Print Preview	Displays what the document will look like when you print it	FILE PRINT PREVIEW
Spell Checker	Checks active document for spelling and grammatical errors	TOOLS SPELLING
Cut	Cuts the selected text and places it on the clipboard	EDIT CUT
Copy	Copies the selected text and places it on the clipboard	EDIT COPY
Paste	Pastes the contents of the clipboard to a new location	EDIT PASTE
Format Painter	Copies the formatting of the selected text to a new text selection	
Undo	Undoes the last document change	EDIT UNDO
Redo	Redoes the last action that was undone	EDIT REDO
Insert Hyperlink	Creates a hyperlink from the selected text	INSERT HYPERLINK
Web Toolbar	Shows web toolbar	VIEW TOOLBARS WEB
Tables Toolbar	Shows tables toolbar	VIEW TOOLBARS TABLES
Insert Table	Inserts a table	TABLE INSERT TABLE
Insert Excel Worksheet	Inserts an Excel Worksheet	
Text Columns	Changes the number of text columns per page	FORMAT COLUMNS
Drawing	Shows drawing toolbar	VIEW TOOLBARS DRAWING
Document Map	Changes the view of the document	VIEW DOCUMENT MAP
Show/Hide Non-Print Characters	Shows and hides non-print characters (for example the symbol for new paragraph)	
View	Magnifies or reduces the document contents by the specified zoom percentage	VIEW ZOOM
Office Assistant	Help function	HELP



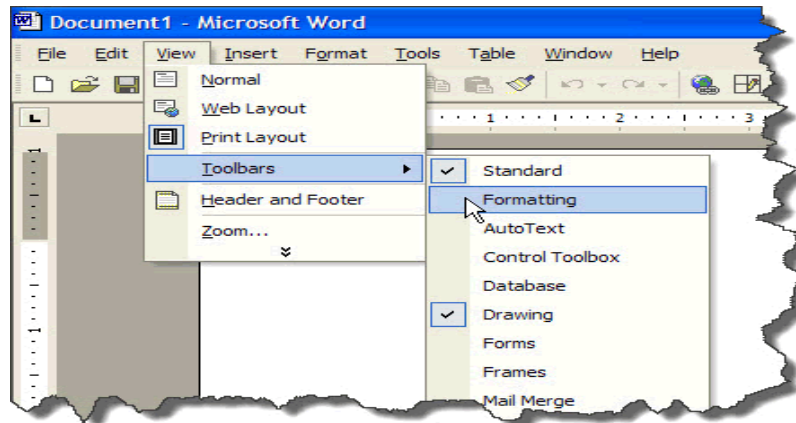
Name	Function	Menu Location
Style	Changes the style of the selected text	FORMAT FONT
Font	Changes the font for the selected text	FORMAT FONT
Font Size	Changes the point size of the selected text	FORMAT FONT
Bold	Makes the selected text bold	FORMAT FONT
Italic	Makes the selected text italic	FORMAT FONT
Underline	Underlines the selected text	FORMAT FONT
Align Left	Aligns the selected text/paragraph(s) left	FORMAT PARAGRAPH
Center	Centers the selected text/paragraph(s)	FORMAT PARAGRAPH
Align Right	Aligns the selected text/paragraph(s) right	FORMAT PARAGRAPH
Justify	Justifies the selected text/paragraph(s)	FORMAT PARAGRAPH
Numbers	Creates a numbered list or numbers the selected paragraph(s)	FORMAT BULLETS AND NUMBERING
Bullets	Creates a bulleted list or adds bullets the selected paragraph(s)	FORMAT BULLETS AND NUMBERING
Decrease Indent	Decreases the indentation of the selected paragraph(s)	FORMAT PARAGRAPH
Increase Indent	Increases the indentation of the selected paragraph(s)	FORMAT PARAGRAPH
Borders	Creates a border around the selected text/paragraph(s)	FORMAT BORDERS AND SHADING
Highlight	Allows you to highlight specified text	
Font Color	Allows you to change the color of the text	FORMAT FONT

The Toolbar:-

A toolbar is a bar containing buttons and options that you use to carry out commands. With toolbars, commands become just handy and easily accessible to users. The buttons contained in them are used to access commands more quickly than by opening the menus and the respective dialog boxes.


















Displaying A Toolbar Using the View Menu





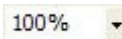


- On the Menu bar, click View. This displays the View menu.
- Then, on the View menu, point to Toolbars item.
- Select and click the name of the desired toolbar from the Toolbars sub-menu. The toolbar you selected will then appear on screen.



There are multiple toolbars options are available, some of them are frequently used. They are as followed:-


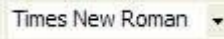







1.Standard Toolbar:- the Standard toolbar is, by default, docked directly below the Menu bar, and it contains buttons used for performing tasks similar to the commands available in the Menu bar. the name and purpose/use of each of the buttons on the Standard toolbar are as follows.









NAME	ICON	USE
New		Creates a new blank document based on the default or current template.
Open		Opens a document previously created and saved in Word.
Save		Saves new changes to the current document or file, with its filename, location and document format.
E-mail		Sends the content of the current document as the body of an E-mail message.
Search		Finds files, Web pages and Outlook items based on the search criteria you enter.
Print		Prints the active document or selection.
Print Preview		Shows how a document or file will look when you print it.
Spelling		Checks spelling in the active document, file or item.
Cut		Removes the selected item from the active document and places it in the Clipboard.
Copy		Copies selected text or object to the Clipboard.
Paste		Pastes the item you cut or copied into (the position of the insertion point) the document from the Clipboard.
Format Painter		Copies the format from a selected text or object and applies it to the text or object you click.
Undo		Reverses the last action or deletes the last entry you typed. Click the arrow next to this icon to select and reverse multiple actions at a time.
Redo		Reverses the action of the last Undo command. Click the arrow next to this icon to select and reverse multiple Undo command actions.
Insert Hyperlink		Inserts a new hyperlink or edits the selected hyperlink.
Tables and Borders		Displays Tables and Borders toolbar, which offers tools for editing/formatting a table and its content.
Insert Table		Inserts a table in the document. Click and drag

		to specify the number of rows and columns.
Insert Microsoft Excel Worksheet		Inserts a new Microsoft Excel worksheet at the insertion point. Click and drag to specify the number of rows and columns. Use the Excel tools on the toolbar to edit the table.
Columns		Changes the number of columns in a document or a section of a document.
Drawing		Shows or hides the Drawing toolbar.
Document Map		Used to turn on or off the Document Map. Document Map shows the outline structure of a document so that you can quickly navigate through the document and keep track of your location in it.
Zoom		Used to "zoom in" to get a close-up view of a document or "zoom out" to see more of the page at a reduced size.
Show/Hide		Shows or hides non-printing characters, such as tab characters, paragraph marks and hidden text.
Office Assistant (Microsoft Office Help)		Opens Help or invokes the Office Assistant to provide help topics and tips to help you accomplish your task.

2. Formatting toolbar:- The Formatting toolbar offers shortcut buttons to help format a document quickly. From the Formatting toolbar, you can quickly apply formatting attributes such as Font; Font Color; Alignment; Line Spacing; Bullets and Numbering, etc, document text, to save time.

The following table provides a list of Formatting toolbar buttons and a brief description of each.

NAME	ICON	USE
Style		Opens a Style drop-down list from which you can select one.
Font		Changes the font of the selected text or number. Click the drop-down arrow beside the box and select a font from the list.
Font Size		Changes the size of the selected text or number. Enter a size value in the box, or select an appropriate size from the drop-down list.
Bold		Applies or removes bold formatting to or from a selected text or number.
Italic		Makes selected text or number italic, but removes italic from selected text or number if it's already italic.
Underline		Underlines (rules a line) or removes underline formatting from selected text or number.
Align Left		Aligns the selected text, number or inline object to the left with a jagged edge.
Center		Aligns selected text, numbers or inline objects to the center.
Align Right		Aligns the selected text, number or inline objects to the right, with a jagged edge.





Justify		Aligns the selected paragraphs to both the left and right margins or indents.
Numbering		Adds numbers to or removes numbers from selected paragraphs.
Bullets		Adds bullets to or removes bullets from the selected paragraphs.
Decrease Indent		Indents the selected paragraph to the previous tab stop or indents the content of the selected item to the left by one character width of the standard font.
Increase Indent		Indents the selected paragraph to the next tab stop or indents the content of the selected item to the right by one character width of the standard font.
Outside Border		Adds or removes a border around the selected text, paragraphs, cells, pictures or other objects.
Highlight		Marks text so that it is highlighted and stands out from the surrounding text.
Font Color		Formats the selected text with the color you click















3.Drawing Toolbar:- The Drawing toolbar is located at the bottom of the window, between the Horizontal Scroll bar and the Status bar. Like every other toolbar, this also contains smart icons representing shortcuts to Main menu commands in Word.



It holds buttons/tools used in creating drawings, such as rectangles, ovals, lines, arrows, WordArt text, etc. It also offers tools for inserting organizational charts and ready-made pictures and Clip Arts from their different locations.

Also included in this toolbar are tools for formatting inserted objects and for adding special effects such as shadow or 3-D to lines, rectangles, ovals, etc. Like every other toolbar also, the Drawing toolbar can be displayed or hidden.

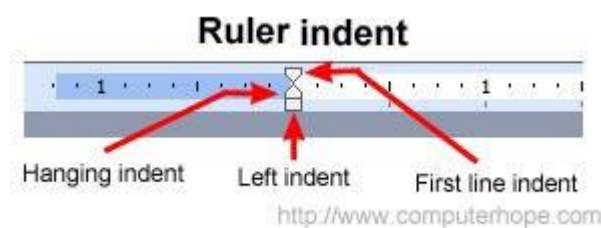
The following table shows a list of tools offered on the Drawing toolbar, and their functions:

NAME	ICON	USE
Draw		Offers a number of options for defining the relative positions, arrangements, rotation, etc, of drawings in a document. It also offers tools for changing the shape of AutoShapes.
Select Objects		Changes the pointer to a selection arrow so you can click to select objects in the active window.
AutoShapes		Offers a group of ready-made shapes that include basic shapes, such as rectangles and circles, including a variety of lines and connectors, block arrows, flowchart symbols, stars and banners, and callouts.
Line		Allows you to draw a straight line where you click or drag in the active window.

Arrow		Draws or inserts a line with an arrow head where you click or drag in the active window.
Rectangle		Draws a rectangle where you click and drag on the active window. You can also draw a square using this tool by holding SHIFT while you drag.
Oval		Draws an oval where you click and drag in the active document. To draw a (perfect) circle, hold down SHIFT while you drag.
Text Box		Draws a text box with horizontal direction where you click and drag in the active document.
Insert WordArt		Creates decorative text by inserting a Microsoft Office drawing objects.
Insert Diagram		Creates an organizational chart or a circle, radial, pyramid, or Venn or target diagram in your document.
Clip Art		Opens the Clip Gallery where you can select the clip art image you want to insert in your document or update your clip art collection.
Insert Picture		Inserts an existing picture in your active document at the insertion point.
Fill Color		Adds, modifies, or removes the fill color or effects from the selected object.
Line Color		Adds, modifies, or removes the line color from the selected object.
Font Color		Allows you to add, modify, or remove the text color of the selected text.
Line Style		Used to select a thickness for the selected line.
Dash Style		Allows you to control the appearance of the selected line.
Arrow Style		Allows you to select the style of arrowhead.

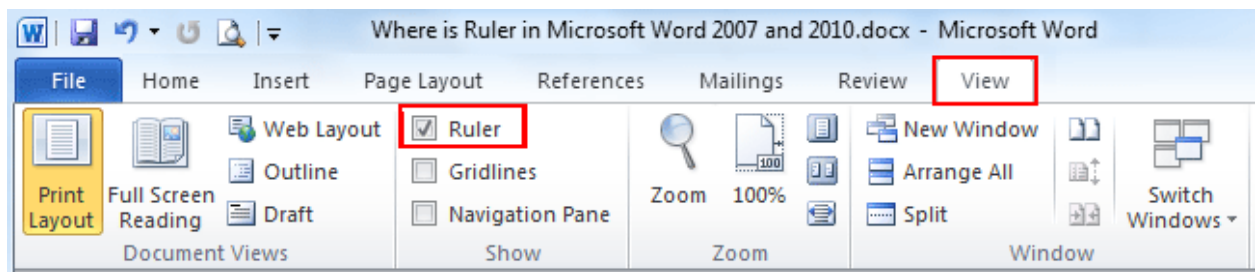
Shadow Style		Allows you to select the shadow appearance of the selected drawing object.
3-D Style		Allows you to add depth to drawing objects such as lines, AutoShapes, and freeform objects.

Ruler:- The ruler is a measurement tool found with some software programs that allow the program's user to align graphics, text, tables, or other elements on a page. When enabled the horizontal ruler appears at the top of the document, and the vertical ruler is on the left-side of the document. In the pictures below are examples of how the ruler may appear in Microsoft Word.



How to enable and disable the Ruler in Microsoft Word:-

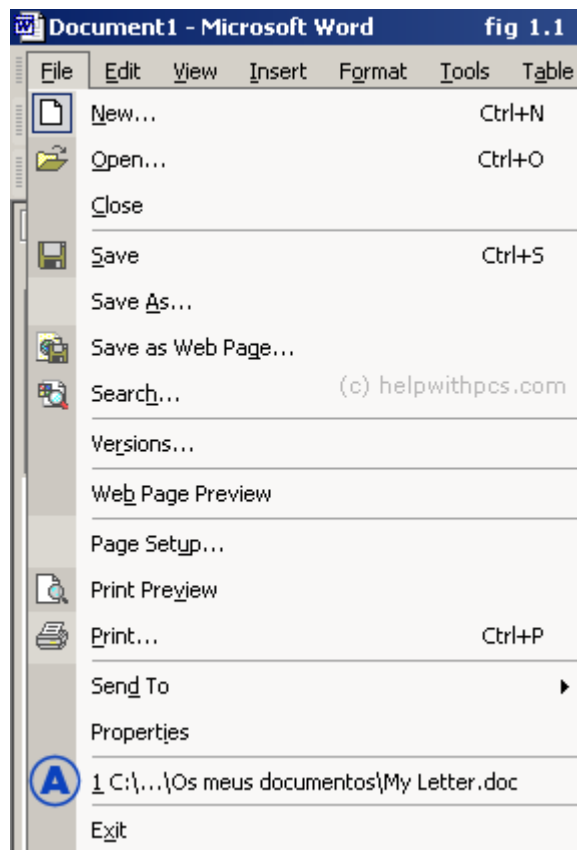
- Click the View drop-down-menu at the top of Word.
- Check Ruler to enable the Ruler or uncheck Ruler to disable the Ruler.
-



Menu(Menu Bar):- The menu bar is the part of a browser or application window, typically at the top left side, that houses drop-down menus that allow the user to interact with the content or application in various ways.

In Microsoft Word, for example, the "File" menu, for example, provides options to open a file, create a new one, and save or print -- among others. The "Edit" menu allows the user to perform such functions as copying and pasting, finding and replacing text. Some of them are as follows:-

1.The File Menu:-The file menu is one you will find yourself using extensively. It is used to create new documents, open existing documents and saving your new/updated documents. It also includes the page setup, print preview, and other important functions relating to your document and its properties.



New: This creates a new Microsoft Word document. The page setup of the new document, ie, the size, margins, etc, will depend on your page settings.

Open: This opens an existing Microsoft Word document, it will open a file explorer window allowing you to navigate to the file you want to open.

Close: This will close the current word document. Microsoft Word may prompt you to save the file, if you have made changes to the document since the last save.

Save: Saves the current document, replacing the existing file (if previously saved).

Save As: This allows you to save the document as a different file. This is very useful, imagine you open your letterhead template and write a letter that you want to save, if you just saved it (using the option above), it would replace your letterhead template. When you click on Save As you will be able to choose the new filename and location for your document.

Save As Web Page: This option will save the current document with the HTM(L) extension, allowing it to be viewed by a web browser.

Search: Clicking Search will open the basic search window, allowing you to search your computer for documents containing certain text.

Versions: This feature allows you to save different versions of the current Microsoft Word document. For example, if you changed your letterhead and wanted to keep the older version too.

Web Page Preview: Clicking on this option will display your current document as it would look in a web browser. When you click, Microsoft Word will open the document in your default web browser.

Page Setup: This opens the page setup options dialogue box. It allows you to set the properties (dimensions, margins, etc) of the current document and change the default for new Microsoft Word documents.

Print Preview: Selecting this option opens the print preview window, allowing you to preview how your document will look when printed.

Print: Opens the print dialogue box allowing you to print the current document.

Send To: Hovering your mouse over this option will allow you to send your document via email, or export it to Microsoft Powerpoint (if installed).

Properties: This will open the Microsoft Word document properties dialogue box, allowing you to view/edit various properties of the document. Including author information, statistics, type, location and filesize of the document.

Exit: Clicking this will exit Microsoft Word, it may prompt you to save any unsaved documents.

2.The Edit Menu:-The edit menu, as its name suggests, includes commands relating to the editing of your document. It includes important editing features such as undo, repeat, cut, copy, paste, select all, find, replace and more.

Undo (last task): This option allows you to undo the last thing you did in your Microsoft Word document, in our example (fig 1.1) you can see our last action was to type some text. This is a handy command, especially if you delete something by accident.

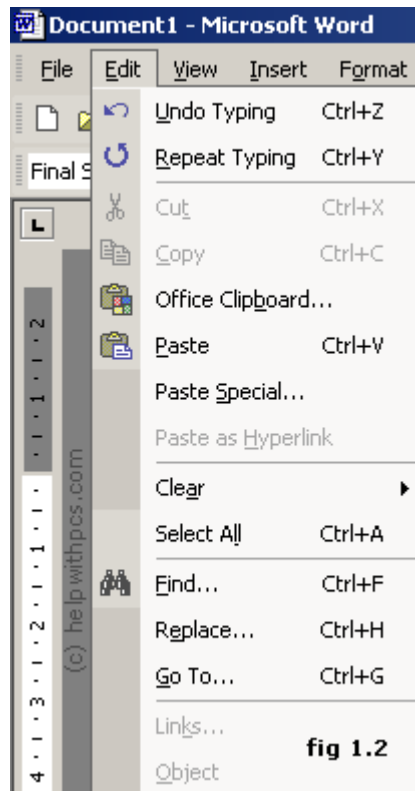


fig 1.2

Repeat (last task): This repeats your last action. In our example clicking on the Repeat Typing will repeatedly insert the same piece of text into the document.

Cut: This command will cut (delete) the currently selected element. For example if you highlight (select) some text and then click on cut, it will be deleted.

Copy: The Copy command will copy the currently selected element (text, image, etc) into the office clipboard. It can then be inserted (pasted) into a document using the Paste command (see below), which will appear in the edit menu once you have copied something to the office clipboard.

Office Clipboard: This command will display the current contents of the office clipboard, allowing you to click on the stored elements to insert (paste) them directly into the current document. Elements (text, images, etc) can be added to the clipboard using the Copy command (see above), this clipboard will also show any elements stored in the Windows Clipboard.

Paste: This will paste (insert) into the current document the last element to be stored in the Office Clipboard.

Paste Special: Clicking on this command will bring up the Microsoft Word Paste Special dialogue box, it allows you to control the format of the text that will be inserted (pasted) from the Office/Windows clipboard.

Paste as Hyperlink: This command allows you to link (create a hyperlink) to a certain place in another Microsoft Word document, Excel worksheet, PowerPoint slide, or Access database. To achieve this, first copy the element that you want to link to into the clipboard, and then select the Paste as Hyperlink command.

Clear: This command allows you to remove any formatting from the currently selected (highlighted) element (text/image). It also allows you to delete the selected element.

Select All: This will select (highlight) every element in the current document.

Find: Find allows you to search the current document for a certain word or phrase.

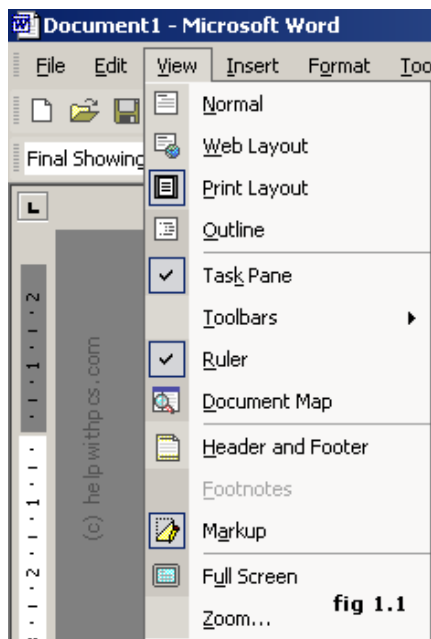
Replace: Replace allows you to replace a given text with a substitute of your choice.

Goto: Goto allows you to go directly to a certain page, section, line, bookmark, comment, footnote, endnote, field, table, graphic, equation, object, or heading.

Links: This allows you to manage any linked objects in the current document. A linked object is information (data) that is stored in another file, for example a Microsoft Excel spreadsheet, Microsoft Access database, or other compatible source. We will be covering linked objects in a future Microsoft Word tutorial.

Objects: This command allows you to manage any embedded objects within the current document.

3.The View Menu:- This menu is used to control not only the visual layout of your Word document but also the printing configuration. It is also used to select which toolbars are visible in the Word environment. Commands include web layout, print layout, outline, task pane, toolbars, ruler, header and footer, footnotes, full screen view and zoom.



Normal: Selecting this will show your current document in a layout without the document margins.

Web Layout: The Web Layout view will show you how the current document will look on a web browser, a full-screen layout.

Print Layout: This view will show the document in a layout including all margins and page breaks.

Outline: The Outline view allows you to change the structure of your document, when selected it will open the Outline Toolbar. The Outline Toolbar allows you to, amongst other things, move headings up or down and/or change the heading types.

Task Pane: This command toggles (shows/hides) the Task Pane. The task pane is designed to give you quick access to frequently used commands, including Document Commands, The Office Clipboard, Basic Search, Style and Formatting and more.

Toolbars: When you hover your mouse pointer over Toolbars you will be presented with a submenu, this includes all of the different toolbars that are available. You can toggle (hide/show) the different toolbars by simply clicking on them within the submenu.

Ruler: Clicking on this will toggle (hide/show) the document ruler which appears across the top and down the side of the Microsoft Word document.

Document Map: The document map is a handy feature which allows you to navigate the current document, it will list the headings (heading 1, heading 2, etc) in the current document. To go directly to a certain paragraph heading, simply click on it in the left hand pane that opens.

Header and Footer: This allows you to edit the header and footer of the current document. We show you how to edit the header and footer in our letterhead tutorial here.

Footnotes: This command will show all footnotes and endnotes (you will be promoted for which) within the current document. Footnotes and Endnotes will be covered in a future Microsoft Word tutorial.

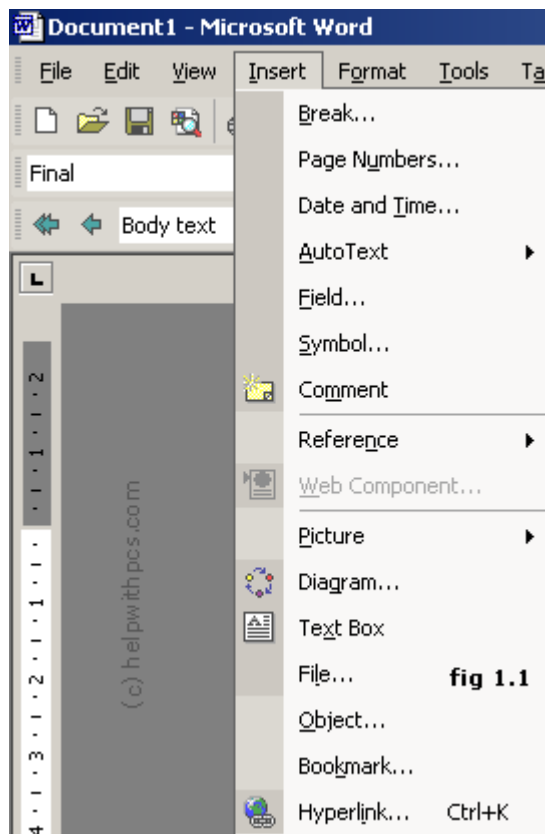
Markup: This will toggle (hide/show) any Markup (comments and tracked alterations/additions) in the current document.

Full Screen: This will show the current Microsoft Word document in full screen mode.

Zoom: This will open the zoom dialogue box, enabling you to change the percentage of zoom for the current view.

4. The Insert Menu:-

The insert menu is used to place various objects into your document, such as page numbers, pictures, symbols, comments and other objects. Commands include break, date and time, field, symbol, reference, web component, text box, file and hyperlink.



Break: This command opens the Break dialogue box, allowing you to insert page breaks and section breaks into the current document.

Page Numbers: Clicking on Page Numbers will open a dialogue box, which allows you to insert page numbers into the document using various options.

Date and Time: This command will open the Date and Time dialogue box. You can choose from many different date and time formats, you may also have different languages to choose from.

Autotext: Choosing this option will open the Microsoft Word Autotext dialogue box. We will cover Autotext in a future tutorial.

Field: This command allows you to enter specified fields into your document. The available fields include Date & Time, Document Automation, Document Information, Equations and Formulas, Index and Tables, Links and References, Mail Merge, Numbering and User Information.

Symbol: This allows you to insert symbols and special characters into your document. For example, if you wanted to include a copyright symbol or a trademark symbol, then you would use this feature. Other symbols (special characters) include currency symbols, mathematical symbols and foreign language alphabet characters.

Comment: This command will place a comment into the document at the location of the cursor. You will be able to type your comment into the comment box, once done, simply click anywhere outside of the comment box.

Reference: The Reference command will allow you to insert a footnote, caption, cross-reference, index, and tables.

Web Component: This command is used to insert any web components into your Microsoft Word document.

Picture: Allows you to insert a picture into your document. You will be offered various locations to locate the image, including clip art, the file system on your computer, and a digital camera or scanner.

Diagram: The Diagram command will open the diagram gallery dialogue box. You can choose from a selection of diagrams to insert into your document, including an organization chart, cycle diagram, radial diagram, pyramid diagram, venn diagram and a target diagram. You may have less or more diagrams available to insert, depending on your Microsoft Word installation.

Text Box: This allows you to insert text boxes, we will be covering text boxes in a future tutorial.

File: Enables you to insert part or all of a file into the current document.

Object: This command will insert an object of your choice, including media clips, Microsoft Excel charts and worksheets, Microsoft Powerpoint slides and presentations.

Bookmark: This handy feature allows you to bookmark a certain element (text, image, etc). You can name the bookmark and then return to it at any time by using the goto command in the edit menu.

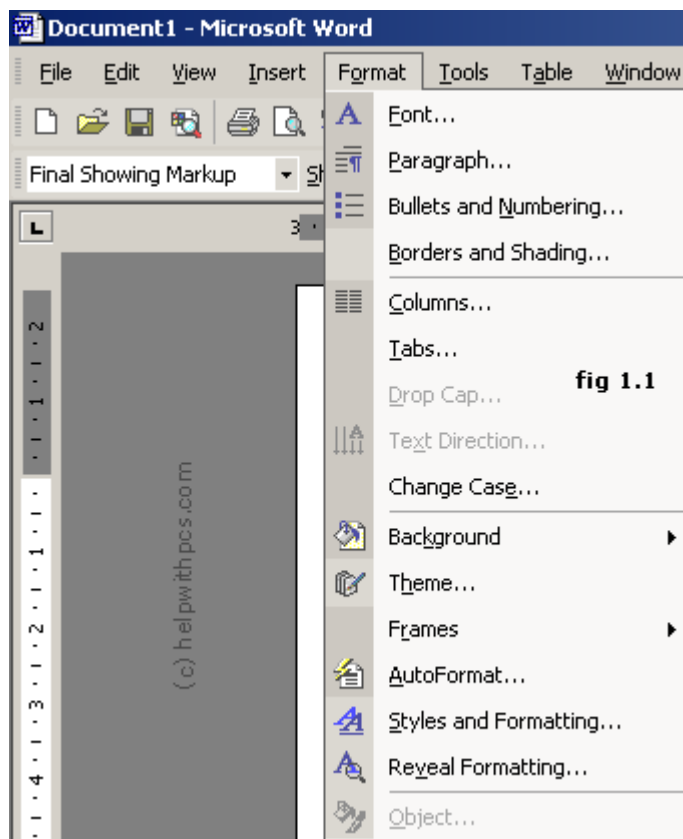
Hyperlink: The Insert Hyperlink dialogue box allows you to add a hyperlink to an existing file, web page, certain place in the current document, a new document, or an email address.

5.The Format Menu:-

A guide to the format menu which controls your font's properties along with the borders and shading options. Commands include paragraph, bullets and numbering, columns, tabs, text direction, background, autoforamt, reveal formatting and more.

Font: This will change the font attributes of either the currently selected text, or any subsequent text, using the font dialogue box.

Paragraph: This command will open the Paragraph dialogue box, allowing you to make changes to either existing text or subsequent text. To change an existing paragraph, select the text you wish to change and then use this command to make the alterations, such as alignment, indentation, and spacing.



Bullets and Numbering: This is a handy command, it creates indented lists with various formats. You can either click the command and then start typing your list (pressing enter for the next line), or you can select some existing text to convert to a list. The listing format options include bulleted, numbered, outline numbered, and other styles.

Borders and Shading: This command allows you to create borders and shading on elements within your Microsoft Word document. The borders and shading can be applied to text, paragraphs, pictures, and more.

Columns: The Columns command will split the current document into the number of columns you specify. You can either split the whole page, or just from that point onwards.

Tabs: This command allows you to manage tabs, including the alignment, spacing, and whether the tab has a leader or not.

Drop Cap: A drop cap is a letter at the start of a paragraph of text that spans 2 or more rows of text, you will often see a drop cap in a book at the start of a chapter. This tool allows you to either add a drop cap character to your document or change an existing letter (at the start of a sentence) to a drop cap.

Text Direction: This allows you to change the text direction of a text object, for example a text box.

Change Case: The Change case tool allows you to alter the case of existing text. Options include sentence case, lowercase, uppercase, title case, and toggle case.

Background: This changes the background colour (color) of your Microsoft Word document. It also allows you to add watermarks and use different gradient effects.

Theme: The themes command will open the theme dialogue box, allowing you to change the theme of your document, including heading style, hyperlinks and background colour (color).

Frames: This command opens the Frames dialogue box.

AutoFormat: The AutoFormat feature will format a whole document with preset attributes.

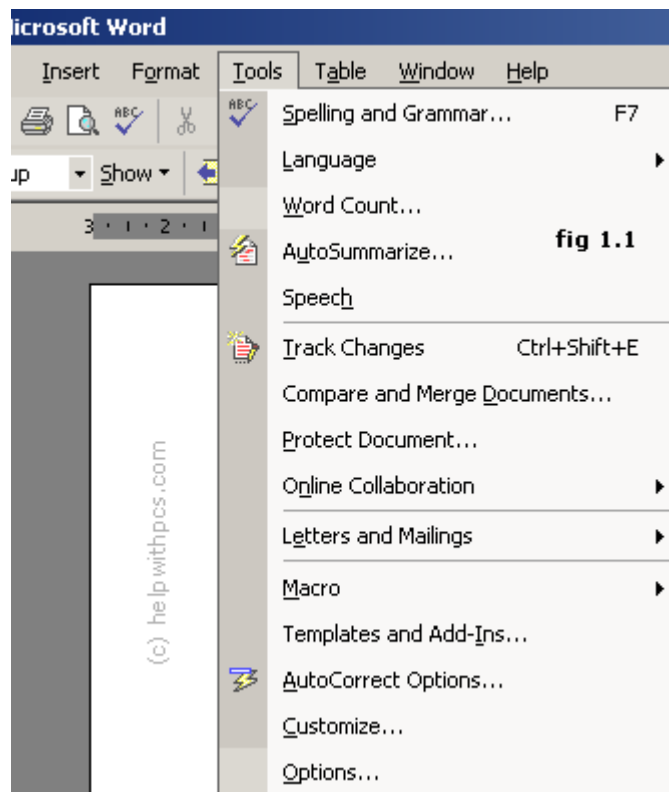
Styles and Formatting: This will open the Styles and Formatting toolbar, allowing you create headings, lists and more.

Reveal Formatting: Clicking on this will show a dialogue box detailing the format attributes of the selected element.

Object: Allows you to make changes to any existing objects within the current document.

6.The Tools Menu:-

The tools menu will also be one you may use regularly, it includes the options command which controls spelling and grammar, security and more. Commands include language, word count, speech, letters and mailing, macro, customize and more.



Spelling and Grammar: This command will check the spelling and grammar of the current Microsoft Word document. It also allows you to add words to the dictionary, as well as changing the dictionary language (if available).

Language: The language tool has various options, including setting the language of the document, translating text, open the thesaurus and manage hyphenation.

Word Count: This will open the Word Count dialogue box, enabling you to count the amount of words in the whole document, or the currently selected text.

AutoSummarize: This can be a handy feature of Microsoft Word, depending on the type and format of your document. It will summarize a document using the attributes you give it, for example, you can choose the percentage of the document to be used for the summary, as well as the format of the summary.

Speech: This will open the Speech Recognition feature of Microsoft Word (if installed/available).

Track Changes: Clicking on this command will cause Microsoft Word to track any subsequent changes to the document. These changes can then be viewed by turning on the Markup option on the Edit menu.

Compare and Merge Documents: This feature enables you to easily compare and/or merge 2 documents.

Protect Document: This command allows you to control the protection of the document, including tracked changes, comments and forms.

Online Collaboration: Enables NetMeeting allowing you to communicate with others in real time via the internet or local network.

Letters and Mailing: Gives you access to various features, including the Mail Merge Wizard, the Letter Wizard, the Envelopes and Labels tool, and the Mail Merge Toolbar.

Macro: This opens the Macro Dialogue box, allowing you to manage subsequent and existing macros. We will be covering Microsoft Word macros in a future tutorial.

Templates and Add-Ins: Opens the Templates and Add-Ins Dialogue box, allowing you to add, remove or update styles and template.

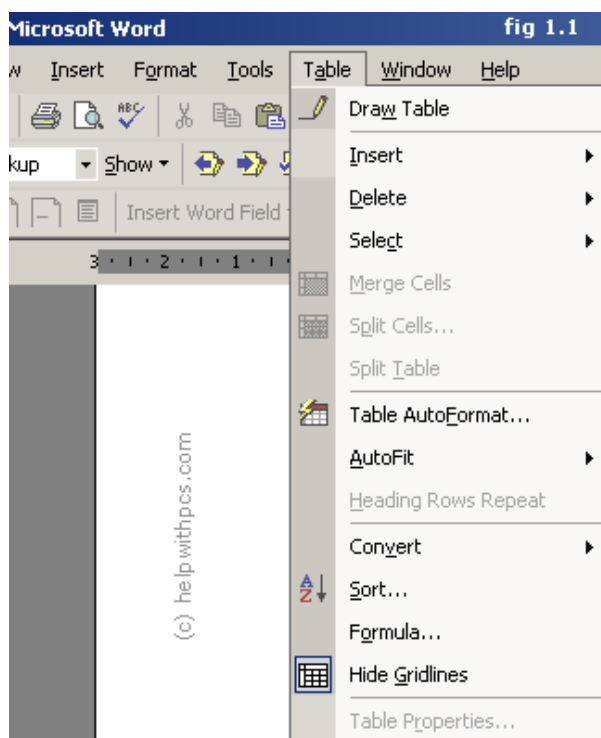
AutoCorrect Options: Opens the AutoCorrect dialogue box, enabling you to manage capitalisation, and also the replace text as you type settings.

Customize: Allows you to customize the Microsoft Word toolbars, commands, and other options.

Options: This opens the main options dialogue box in Microsoft Word. It allows you to change many aspects of the current document and Microsoft Word environment.

7.The Table Menu:-

Tables are a great way of laying out content within your document. The table menu provides all you need to manage your tables and cells. Includes draw table, insert, delete, merge cells, split cells, split table, autoformat, convert, sort and more.



Draw Table: This command opens the Tables and Borders dialogue box with the draw table tool active. First you draw the outline of your table, then using the same tool, you can create cells by vertical or horizontal movements within the table.

Insert: Allows you to insert a whole table or just columns, rows and cells into the current document.

Delete: Delete complete tables, columns, rows and selected cells.

Select: This command allows you to select the current table, column, row or cell.

Merge Cells: This tool will merge the currently selected cells into one.

Split Cells: This will split the selected cell/s into your chosen amount of columns and rows, it will also offer (if more than one cell selected) to merge the selected cells before the split.

Split Table: This command will split the current table, making the split at the currently selected cells.

Table AutoFormat: This command will open the Microsoft Word Table AutoFormat dialogue box, where you can choose from a number of different table templates, including preset fonts and cell background colours (colors).

AutoFit: This tools gives you several options for resizing the selected table in relation with the contents or window.

It also allows you to automate the distribution between columns and rows.

Heading Rows Repeat: This handy tool will repeat the currently selected row at the top of every page for the length of the table.

Convert: This command will convert existing text into a table format. The text will have to have a common separator to indicate the different columns, it will also needs new paragraphs where you would like each row.

Sort: This opens the Sort Table dialogue box. You can choose which column you would like to sort and by what order.

Formula: This tool allows you to apply a formula to the selected cell. For example, if you wanted to add up the contents of several rows in a specific column, you could use the SUM formula in the Formula dialogue box.

Hide Gridlines: This simply hides the gridlines of the selected table.

Table Properties: This will display the various properties of the selected table.

Keyboard Shortcuts in MS Word:-

Commonly used keyboard combinations

Ctrl+N	Open a new word document quickly.	Ctrl+X	Cut- Removes the selection from the active document and places it on the clipboard.
Ctrl+O	Opens a previously saved document.	Ctrl+C	Copies the selection to the clipboard
Ctrl+W	Closes the active window, but does not Exit Word.	Ctrl+V	Paste - Inserts the contents of the clipboard at the insertion point (cursor) or whatever is selected.
Ctrl+S	Saves the active document with its current file name, location and format.	Ctrl+A	Selects all text and graphics in the active window.
Ctrl+P	Prints the active file, also gives the opportunity to change print options	Ctrl+F	Find - Searches for specified text in the active document
Alt+F4	Exit - Closes Microsoft Word.	Ctrl+B	Bold - Formats selected text; make text bold, or remove bold formatting
Ctrl+Z	Undo the last action. This selection can be repeated several times.	Ctrl+I	Italic - Formats selected text; make text italic or remove italic
Ctrl+Y	Redo - After an action has been undone, it can be reinstated in the document.	Ctrl+U	Underline - Formats selected text; make text underlined or remove underline

Less commonly used keyboard combinations

Ctrl+Shift+>	Increase selected text in increments like the drop down font menu (Thanks Daniel)	Ctrl+Shift++	Apply superscript formatting
Ctrl+Shift+<	Decrease selected text in increments like the drop down font menu	Ctrl+=	Apply subscript formatting
Ctrl+]]	Increase selected text one point	Ctrl+Shift+C	Copy formats
Ctrl+[[Decrease selected text one point	Ctrl+Shift+V	Paste formats
Shift+F3	Change case of the letters	Ctrl-I	Single space lines
Ctrl+Shift+W	Underline words but not spaces	Ctrl-5	Set 1.5 line spacing

Ctrl+Shift+D	Double underline text	Ctrl+2	Double space lines
Ctrl+E	Center a paragraph	Ctrl+Backspace	Delete one word to the left
Ctrl+J	Justify a paragraph	Ctrl+Del	Delete one word to the right
Ctrl+L	Left align a paragraph	Ctrl+R	Right align a paragraph
Ctrl+M	Indent a paragraph from the left	Shift+Enter	Insert a line break
Ctrl+T	Create a hanging indent	Ctrl+Shift+T	Reduce a hanging indent
If text is already selected and you want to extend the selection area			
Shift+←	Extend selection one character to the left	Shift+→	Extend selection one character to the right
Ctrl+Shift+→	Extend selection to the end of a word	Ctrl+Shift+←	Extend selection to the beginning of a word
If you want to move the cursor			
→	One character to the right	←	One character to the left
Ctrl+→	One word to the right	Ctrl+←	One word to the left
Ctrl+End	To the end of a document	Ctrl+Home	To the beginning of a document

References

- Shelly, G. B., Cashman, T. J., & Vermaat, M. E. (2011). Microsoft Office 2010: Introductory. Cengage Learning.
- Beskeen, D. W., Duffy, J. L., & Friedrichsen, L. J. (2014). Microsoft Office 2013: A skills approach. McGraw-Hill Education.
- Norton, P. (2006). Introduction to computers (6th ed.). McGraw-Hill.
- Sinha, P. K., & Sinha, P. (2007). Computer fundamentals (6th ed.). BPB Publications.
- McCullough, M. (1996). Abstracting craft: The practiced digital hand. MIT Press.
- Myers, B. A. (1988). A taxonomy of user interface tools. *ACM Transactions on Computer-Human Interaction*, 1(1), 64–103.
- Shneiderman, B., & Plaisant, C. (2010). *Designing the user interface: Strategies for effective human-computer interaction*. Pearson.
- Microsoft Corporation. (n.d.). Microsoft Word documentation and features. Retrieved from <https://www.microsoft.com>
- IEEE Computer Society. (n.d.). Human-computer interaction and office productivity tools. Retrieved from <https://www.computer.org>
- ACM Digital Library. (n.d.). Word processing and document systems research. Retrieved from <https://dl.acm.org>

CHAPTER 9

EDITING AND FORMATTING IN MICROSOFT WORD: TECHNIQUES FOR EFFICIENT DOCUMENT PROCESSING

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Abstract

This chapter provides a detailed understanding of editing and formatting operations in Microsoft Word, which are essential for creating professional and well-structured documents. It begins by explaining the concept of editing, including fundamental operations such as adding, deleting, copying, moving, and pasting text. These operations form the basis of document modification and content management in word processing.

The chapter further explores various formatting techniques, including character formatting, paragraph formatting, page formatting, and the use of bullets and numbering. It highlights the importance of formatting in enhancing document readability and presentation. Advanced features such as borders and shading, headers and footers, footnotes and endnotes, and page setup options are also discussed.

In addition, the chapter explains document previewing and printing processes, including print preview features, print dialog options, and page range selection. These tools help users ensure accuracy and layout correctness before producing a hard copy. Overall, this chapter equips users with practical skills required for efficient document editing, formatting, and printing in Microsoft Word.

Keywords

Document Editing, Text Formatting, Microsoft Word, Copy Paste, Cut Operation, Paragraph Formatting, Page Setup, Print Preview, Headers and Footers, Footnotes, Document Processing, Office Applications.

Editing A Word Document:-

Editing a word file means making changes in the text contained in a file. Everyone needs to edit a word file at some point or other to incorporate the changes which may arise. Editing a word file is one of the most basic MS office word operations. Editing a file covers these basic areas.

- Adding new text.
- Deleting a part of the text
- Copying a text.
- Moving text.
- Pasting text.
- Formatting text.

Thus, following are the simple operations for editing a word file.

1.For Adding New Text

If you want to add new text at the end of a file, simply place the cursor to the end part and start typing using the keyboard.

For adding text in between a document, place the cursor to the required portion and start typing.

2. Deleting A Part of The File

If you wish to delete some parts from the end of the file, take the cursor to the end point and keep pressing “Backspace” till the text is cleared.

You can also select the part you want to clear by left clicking on the text and dragging the mouse along. After the part has been selected, simply click “Backspace” and the text gets deleted.

3. Copying A Text

If you want to copy an entire word file, simply select the whole file or use keyboard shortcut Control + A and then right click to select the option “Copy”. You can also use keyboard shortcut Control + C. Doing so will copy the entire text.

If you want to copy selected text, you need to select the part of the text initially by left clicking and dragging the mouse and then follow the same procedure.

4. Moving Text

- If you want to move some text from one part of the document to another, simply select the part.
- Right click upon the selected part and choose “Cut”.
- Move to the desired location where you want to move the cut part. Place the cursor at the desired place.
- Click paste or use Control + V.
- The text block has moved from one part to another.

5. Pasting Text

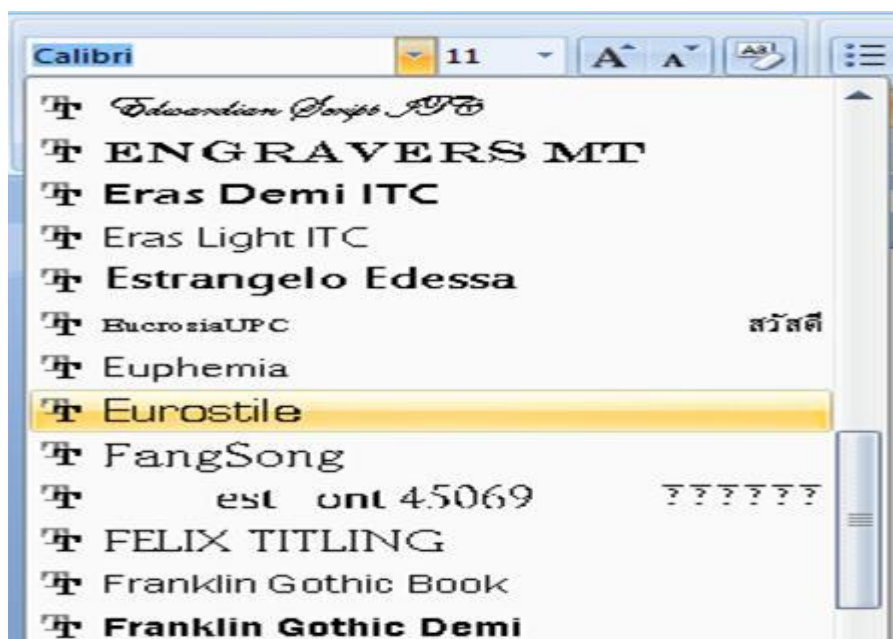
Pasting a text is also simple as the copied contents simply need to be put in the desired place by right clicking and using “Paste” option. Keyboard shortcut Control + V also does the same.

6. Formatting A Text

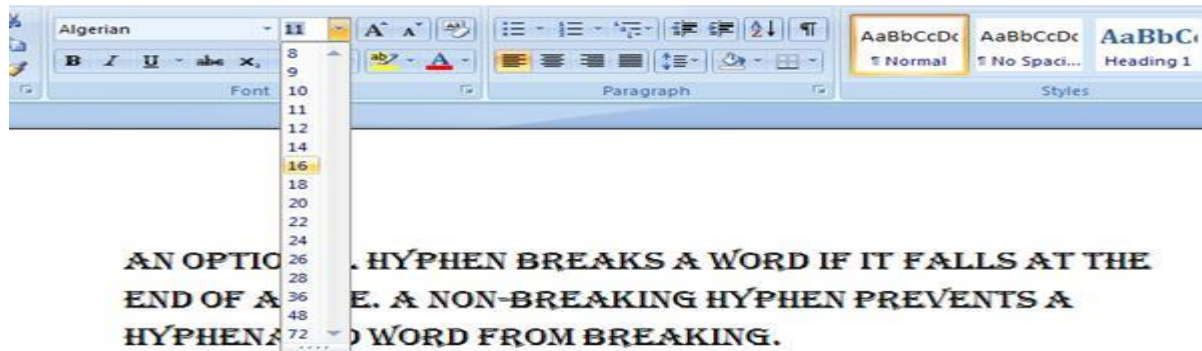
Formatting refers to changing the font style, size, italics and other related parameters. A good formatted text can help in creating a nice impression. Further, formatting is required to highlight certain important factors and points.

The main steps to consider while formatting are as follows.

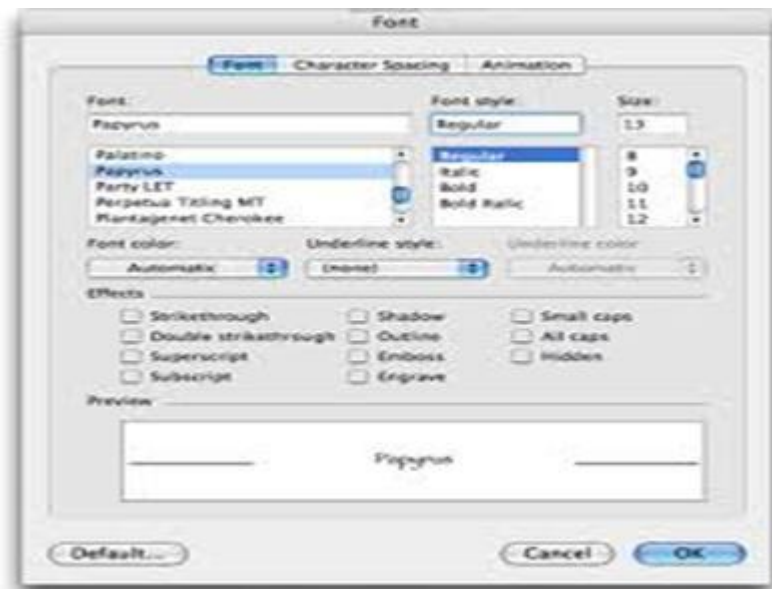
- Select the text that you want to format. If it is the entire document, click Control + A or select the specific portion.
- After you have selected the part, you want to format, click on the Home tab in the top row.
- You can see a dropdown list with font name and adjacent to it you have another drop down list displaying font size.



As you can see, there are various fonts and you may select the one you want.



As you can see in the above screenshot, you may alter font size with the drop box. You can change either of them if you want another font or different size.



- You can adjust more with advanced font settings.
- Just below the font name and size, you have another row with options like
- Bold: if you want to bold some points, click on the icon. To remove bold, click again.
- Italics: for italicizing a portion, click “I”. For removing the italics, click it again.
- Underline: if you wish to underline a part, click on the “U” button. Clicking on the same button again will remove the underline.



As you can see, the different options like Bold, Italics, and Underline are present in the home tab itself. There are

other options as well, like make a strikethrough, use subscript, change case from lowercase to uppercase or vice versa. You can even capitalize the first letter of each word or highlight a certain part using different colors.

Formatting document:-

(i) Character Formatting: before applying character formatting you have to select the text, after selecting the text click on Font on Format menu and provide required settings such as:

- (a) Under font tab: font, font style, size, font color, under-line.
- (b) Under font tab: effects – emboss, shadow, superscript, subscript etc.
- (c) Under character spacing tab: scale, positioning etc.
- (d) Under text effect tab: las vegas light etc.

(ii) Border and Shading: to apply border and shading, select the text and click on Border and Shading on Format menu.

- (a) use Border tab: to apply border color, border type etc.
- (b) use Page Border tab: to apply border color, border type to the whole page.
- (c) use Shading tab: to apply fill color and pattern.

(iii) Paragraph Formatting: before apply paragraph formatting select the paragraph if formatting is to be applied on multiple paragraph or, position insertion point on paragraph if formatting is to be applied on single paragraph then click on Paragraph on Format menu and provide required settings such as:

- a) Under Indent and Spacing tab: Set alignment of paragraph, specify paragraph alignment such as left, right, center, justify and outline level
- b) Under Indent and Spacing tab: Set paragraph indentation or margin such as left indent, right indent, under special specify first line indent, hanging indent.
- c) Under Indent and Spacing tab: Set paragraph spacing such as paragraph before space, paragraph after space, spacing between lines in paragraph.

(iv) Bullets and Numbering: Select the items you want to add bullets or numbering to. On the Formatting toolbar, click Bullets or Numbering to apply bullets and numbering. To remove bullets and numbering from items select the items, on the Formatting toolbar, click Bullets or Numbering.

(v) Page Formatting: formatting of page can be performed using following commands and their settings:

(a) Page Setup:

Under Margin tab specify, left, top, right, bottom margin, gutter margin(margin for binding the pages), orientation of page (portrait or landscape). If you select mirror margin from Multiple pages, left and right margin becomes inside and outside margin and gutter position is set to left, mirror margin and gutter margin are useful when book is going to be prepared with bindings.

Under Paper tab specify paper size, paper source for first page and remaining page, height and width of custom paper size.

Under Layout tab specify margin for header and footer text. page if you want to set different header and footer text for first page, odd page and even page tick mark the option different odd and even, different for first. You can set line numbers and border for page.

(b) Setting Header, Footer and Page no.: Header is the text that appears on top of page and footer is the text that appears on bottom of the page. You can set title of chapter, author of the chapter or publisher, page no., date, time or any thing that you want as header or footer text.

1. On the View menu, click Header and Footer to open the header or footer area on a page.
2. To create a header, enter text or graphics in the header area click on Insert Page No. icon on Header and Footer toolbar .
3. To create a footer, click Switch Between Header and Footer icon on the Header and Footer toolbar to move to the footer area, and then enter text or graphics.
4. If necessary, format text by using buttons on the Formatting toolbar.
5. When you finish, click Close on the Header and Footer toolbar.

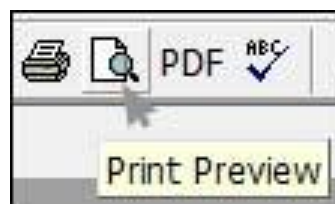
Setting Footnote and Endnote:

Footnotes and endnotes are used in printed documents to explain, comment on, or provide references for text in a document. You might use footnotes for detailed comments and endnotes for citation of sources.

1. In print layout view, click where you want to insert the note reference mark.
2. On the Insert menu, point to Reference, and then click Footnote.
3. Click Footnotes or Endnotes. By default, Word places footnotes at the end of each page and endnotes at the end of the document. You can change the placement of footnotes and endnotes by making a selection in the Footnotes or Endnotes box.
4. In the Number format box, click the format you want.
5. Click Insert. Word inserts the note number and places the insertion point next to the note number.
6. Type the note text

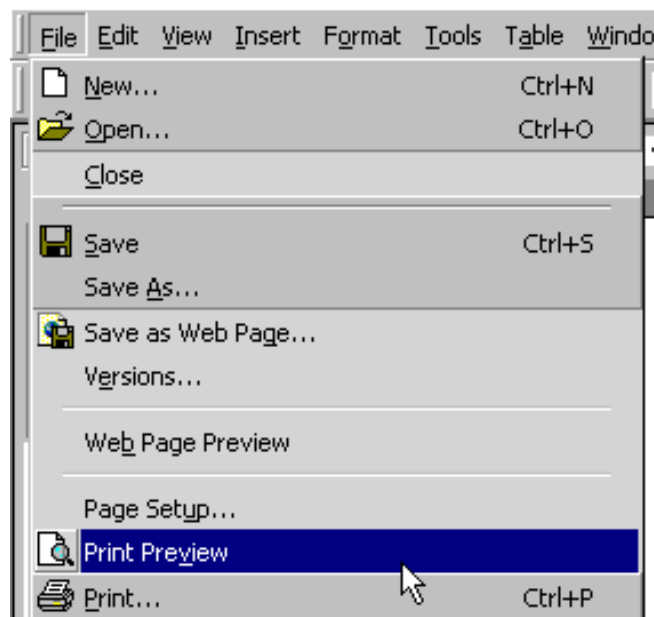
Print preview:- Print preview is a feature that allows you to view what a printed version of the document would look like on the screen before printing a hard copy. By using print preview, you can find any errors that may exist or fix the layout before printing, which can save ink or toner and paper by not having to print more than once.

To open the print preview feature, click the print preview icon on the toolbar, like that shown in the picture or click File and choose the Print Preview option.

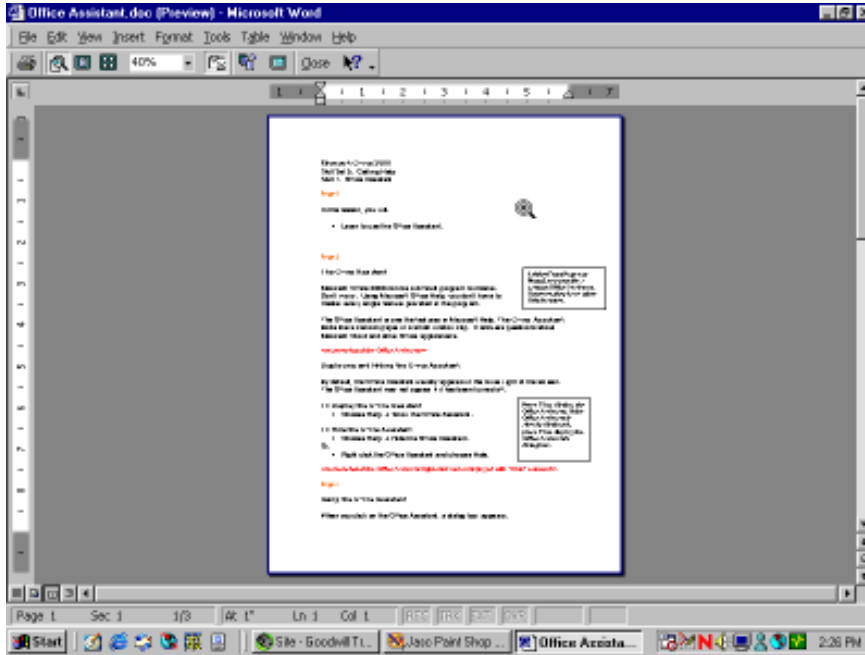


Shortcut keys

Microsoft Word - Press Ctrl + F2 to open the print preview for the document you're currently viewing.
Or Choose **File** → **Print Preview** from the menu bar.

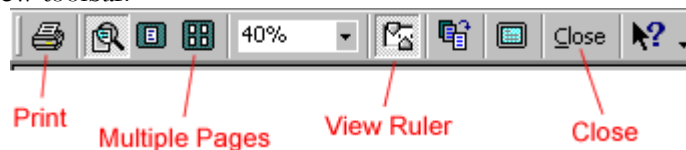


Once you have accessed Print Preview, your document will now be in **Print Preview mode**. It will look something like this:



Print Preview mode displays how your file is formatted. If you want to take a closer look, use the **zoom** feature. The zoom feature zooms in closer, giving you a better view of your file.

Following is the **Print Preview** toolbar:

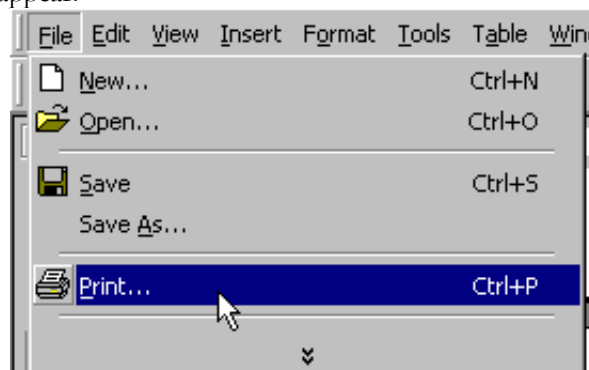


- The **Print** button prints a file.
- The **View Ruler** button displays the vertical and horizontal rulers. Rulers help edit margin settings.
- If your file consists of multiple pages, the **Multiple Pages** button allows you to either view **one page** or several pages at a time.
- Use **zoom**, then use the **scroll bars** to view your file.
- Use the **Shrink to Fit** button to fit your information to one page.
- If you want to **exit or close** Print Preview, click **Close** on the **Print Preview** toolbar.

Print :- To print the work following commands can be used :

1. Choose **File → Print** from the menu bar (Ctrl+P).

✓ The print dialog box **will** appear.



Or Click the **Print** button  on the **Standard** toolbar.

✓ The file automatically prints. The print dialog box will **not** appear.

The Print dialog box:- Following image shows that how the **Print** dialog box looks like and has following options in Word :

Printer selection

In the **Name:** drop-down box, the name(s) of your printer display(s). When working in an office environment, it is possible that your computer is part of a network that accesses several printers. Make sure you direct your print job to the correct printer.

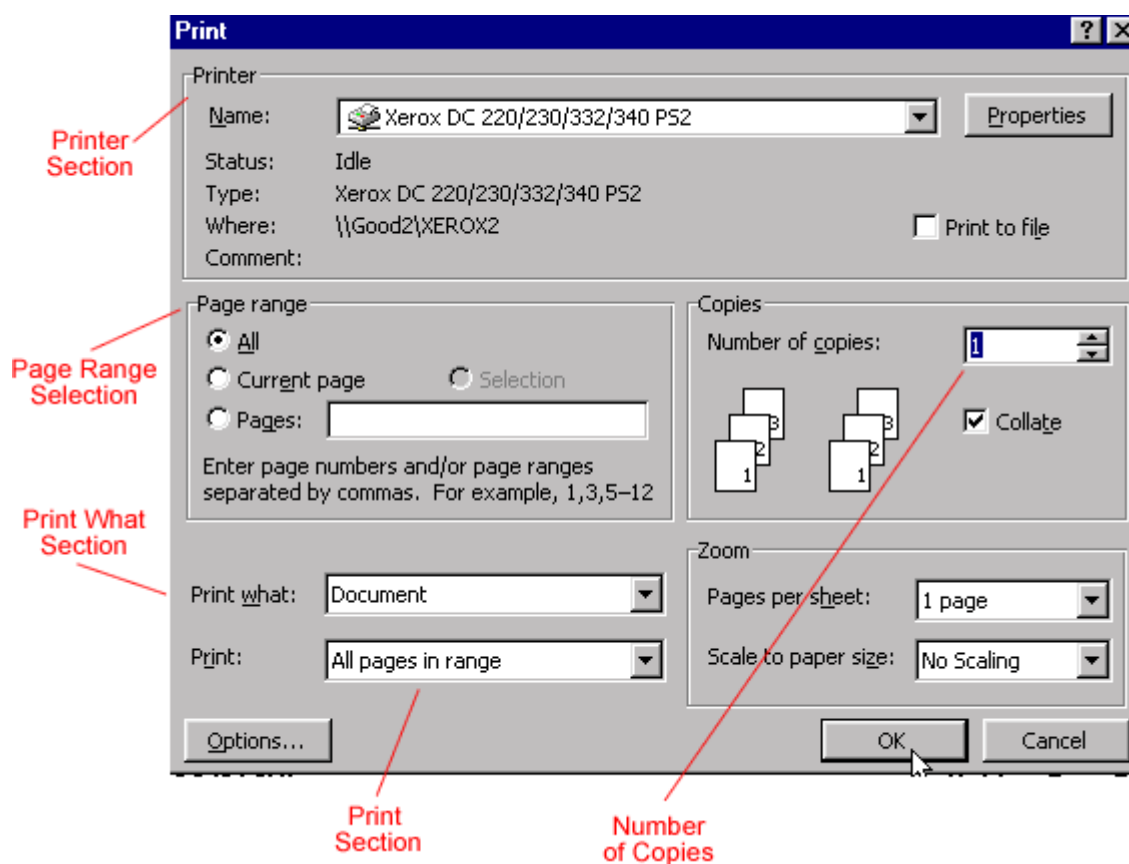
Page range selection

The default setting is **all**. If you want to print only the current page, select the **current page** radio button. If you want to print only part of a document but it is more than one page, select the **Pages** radio button and enter the page numbers you want to print.

Copies selection

In this section, there is a **Number of copies:** box. The default setting is **1 copy**. Manually enter the number you want to print by highlighting the number. Enter the number of copies you want to print. You can use the **up** or **down** arrows to indicate the desired number of copies.

Collate is the default setting. Collate means to put pages in the proper order. If you want to turn off the collating feature, deselect the radio button. This means if you print more than one copy of a document, all of the first pages will print together, all of the second pages will print together, and so on.



Print what section

- You want to print a document. Leave this at the default setting.
- Print section
- The default setting is **all pages in range**. However, in the drop-down box, select even pages or odd pages if you want, or select a range of pages.

References

1. Shelly, G. B., Cashman, T. J., & Vermaat, M. E. (2011). Microsoft Office 2010: Introductory. Cengage Learning.
2. Beskeen, D. W., Duffy, J. L., & Friedrichsen, L. J. (2014). Microsoft Office 2013: A skills approach. McGraw-Hill

Education.

3. Norton, P. (2006). Introduction to computers (6th ed.). McGraw-Hill.
4. Sinha, P. K., & Sinha, P. (2007). Computer fundamentals (6th ed.). BPB Publications.
5. Shneiderman, B., & Plaisant, C. (2010). Designing the user interface: Strategies for effective human-computer interaction (5th ed.). Pearson.
6. Myers, B. A. (1988). A taxonomy of user interface tools. *ACM Transactions on Computer-Human Interaction*, 1(1), 64–103.
7. Carroll, J. M. (1997). Human-computer interaction: Psychology as a science of design. *Annual Review of Psychology*, 48, 61–83.
8. Microsoft Corporation. (n.d.). Microsoft Word documentation and support. Retrieved from <https://www.microsoft.com>
9. IEEE Computer Society. (n.d.). Human-computer interaction and productivity tools. Retrieved from <https://www.computer.org>
10. ACM Digital Library. (n.d.). Research on document editing and user interfaces. Retrieved from <https://dl.acm.org>

CHAPTER 10

ADVANCED FEATURES OF MICROSOFT WORD: AUTOMATION, DATA HANDLING, AND DOCUMENT ENHANCEMENT TECHNIQUES

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Abstract

This chapter provides an in-depth exploration of advanced features of Microsoft Word, focusing on tools that enhance productivity, automation, and document quality. It begins by introducing advanced functionalities such as styles, tables, bookmarks, watermarks, hyperlinks, templates, and document conversion into formats like PDF. These features enable users to create structured and professional documents efficiently. The chapter further explains powerful tools such as Find and Replace, which facilitates quick navigation and modification within large documents, and the Thesaurus, which assists in improving vocabulary and writing quality. It also covers automation features including AutoText, AutoCorrect, and AutoFormat, which streamline repetitive tasks and improve consistency.

A significant portion of the chapter is dedicated to Mail Merge, explaining its process and applications in generating personalized documents such as letters, labels, and emails. Additionally, the chapter discusses working with tables, graphics, charts, and macros, highlighting their role in organizing data and automating complex tasks.

Finally, the chapter covers document conversion techniques and file format compatibility, enabling users to adapt documents across different platforms. Overall, this chapter equips users with advanced skills required for efficient document creation, automation, and professional communication.

Keywords: Advanced Microsoft Word, Mail Merge, Find and Replace, AutoText, AutoCorrect, AutoFormat, Templates, Macros, Tables, Charts, Document Conversion, Hyperlinks, Word Processing Automation, Office Productivity Tools

Advanced Microsoft Word Features:- Some of the advanced features of Microsoft Word 2010 are listed below:

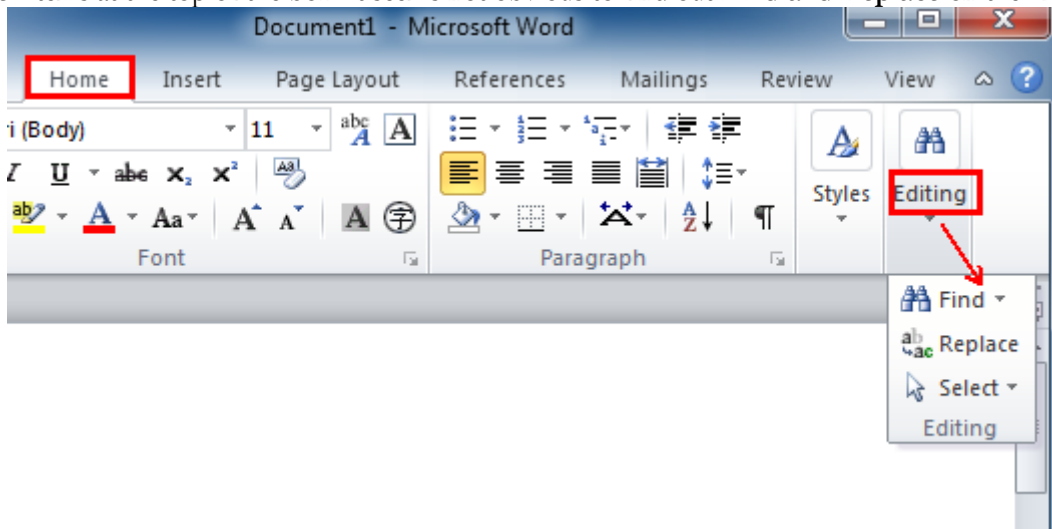
- Using Styles
- Using Tables
- Creating a Table of Contents
- Creating and Using Bookmarks
- Inserting Watermarks
- Creating Hyperlinked Text
- Importing Files in Other Formats
- Creating Symbol Shortcuts
- Using Document Templates
- Saving as PDF
- Using Comments and Changes

Find and Replace:-

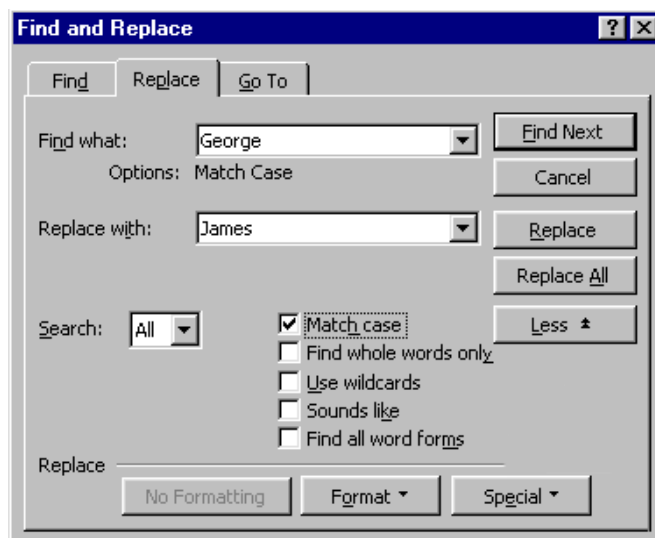
Microsoft Word's Find feature, search through lengthy documents for a particular word, phrase, or character string. We can choose to selectively or automatically replace the searched text with a different word, phrase, or character string. To access the "Find" and "Find and Replace" feature following steps are used.

1. Go to the "**Home**" tab menu on the Ribbon of Microsoft Word 2007/2010/2013, at the furthest right of the

group is the "Editing" options. Click the Editing item, a popup menu will appear and now you can see the "Find" and "Replace" items at the top of the box. It seems not obvious to find out **Find and Replace** on the Ribbon.



2.A dialog Box will be open. To locate a word or phrase in a Word document, Find. Enter the word or phrase into the Find what: field and select Find Next. To replace a word or phrase, select the Replace tab and enter the text to be found and the text to be replaced. Select Replace for one instance at a time or Replace All to change all at once.



Where to Search

Find and Find and Replace can be applied to an entire document or to just a portion of it. That choice is made from the Search drop-down menu, which is viewed on the left side of the dialog box about half way down. If this option is not shown, click the More button to display the bottom half of the dialog with more options.



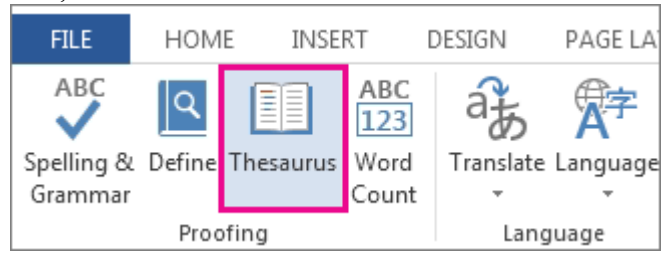
Search Direction

If this feature is not visible, click the more buttons on the Find & Replace dialog box to make the options visible.

Using Thesaurus:- A thesaurus is a software tool included with some word processors that provides synonyms for selected words on command. Users using Microsoft Word can open a thesaurus by highlighting the word one want to look up and pressing the shortcut key Shift+F7.

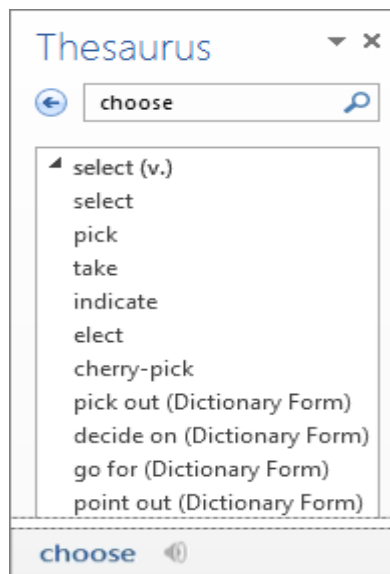
There are a couple of ways to find synonyms in Word 2013.

1.To go straight to the thesaurus, click Review > Thesaurus.

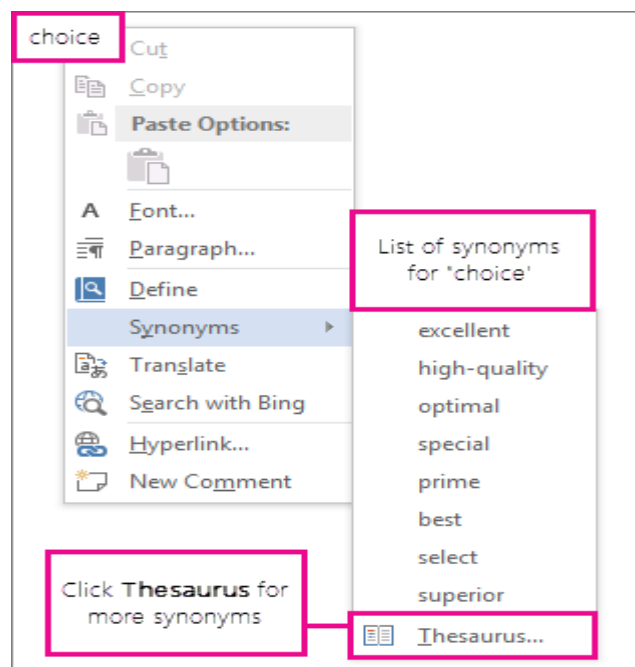


The Thesaurus list opens with a list of synonyms for any selected word. To insert or copy a word from the Thesaurus, pause over the word so you can click the dropdown arrow, and then click Insert or Copy. To keep looking, click any word in the Thesaurus list to switch to synonyms for that word.

2. The other way to find synonyms is to simply right-click any word in your document and click Synonyms. This opens a short list. If you see a word you like, click it to replace the original word.



3.If none of the words is quite right, click Thesaurus at the bottom of the list to see more possibilities.



Using Auto (Automatically insert/Formatting text):- There's more than one way to automatically enter text in Word.

1.Auto Text:-we can insert blocks of preformatted text using AutoText from our AutoText gallery. This is useful, for example, when we need to repeatedly enter the same large block of text and the text contains a lot of formatting. we create AutoText entries by adding selected text to the AutoText gallery.

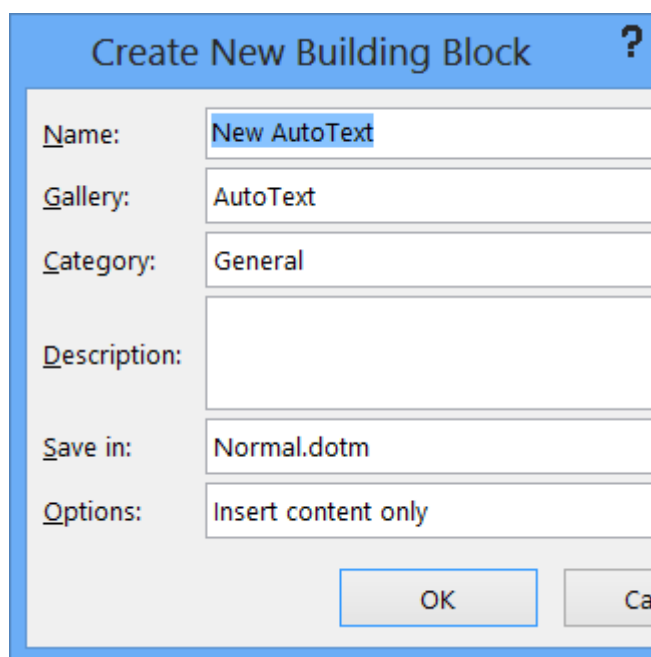
2.Auto Correct:-Word can also automatically complete a word, phrase, or sentence after we've typed only a few characters. To do this, we first add the text entries in the AutoCorrect dialog box.

3. Auto format:- Word also have AutoFormat settings, such as automatic formatting of hyphens and dashes, fractions, hyperlinks, quotation marks, and bulleted or numbered lists.

1.Auto Text:-

1. Add text to the AutoText gallery

- AutoText entries are stored as building blocks. To create a new entry, use the Create New Building Block dialog box.
- In your document, select the text that you want to add to your gallery of AutoText entries.
- On the Insert tab, in the Text group, click Quick Parts, point to AutoText, and then click Save Selection to AutoText Gallery.
- Fill out the information in the Create New Building Block dialog box. Most of the default values are fine, but including a unique name and description makes the AutoText easier to use.



- Name: Type a unique name for the AutoText building block.
- Gallery: Select the AutoText gallery.
- Category: Select the General category, or create a new category.
- Description: Type a description of the building block.
- Save in: Click the name of the template in the drop-down list. For example, click Normal.
- A template must be open to be displayed in the drop-down list of template names.
- Options: Choose one of the following:
 - Select Insert content in its own page to place the building block on a separate page, set off from the rest of your content with page breaks.
 - Select Insert content in its own paragraph to make the content into its own paragraph, even if the user's cursor is in the middle of a paragraph.
 - Select Insert content only for all other content.

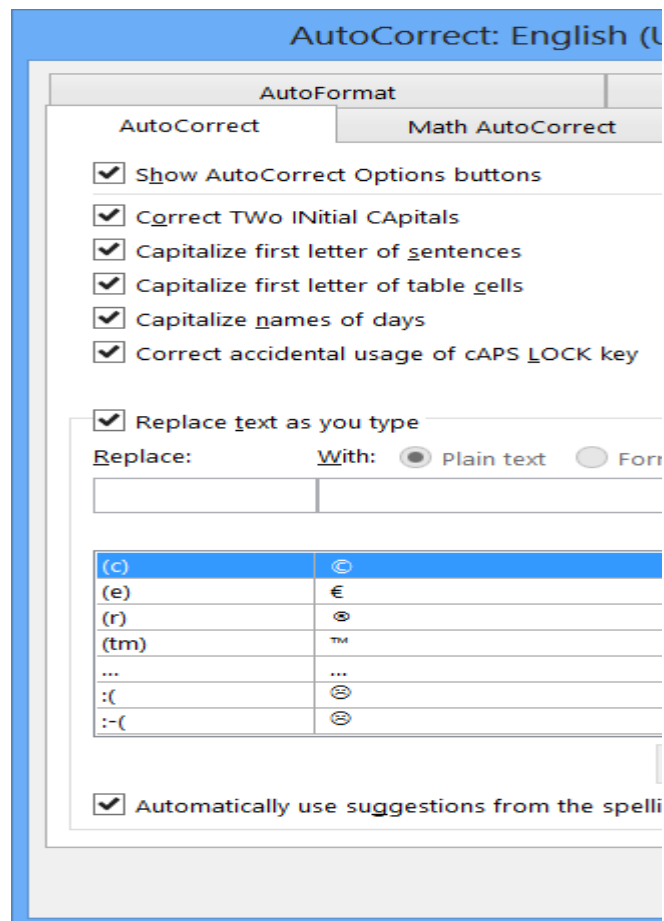
2.Enter text using AutoText

- On the Insert tab, click Quick Parts, and then point to AutoText.
- Click the entry that you want to add.

2.Auto Correct:-

1.Add text to the AutoCorrect list

- To add text entries that are inserted automatically when you type a specific set of characters, use the AutoCorrect list in the AutoCorrect dialog box.
- Select the text you want to automatically insert.
- Click the File tab.
- Click Options.
- Click Proofing.
- Click AutoCorrect Options, and then click the AutoCorrect tab.



- Select the Replace text as you type check box, if it is not already selected.
- Under Replace, type the characters that you want to use for your automatic text. The text that you selected in your document should appear under With.
- The AutoCorrect list is global across the Office programs that support this feature. When you add or delete a word from the list in one program, the other Office programs are also affected.

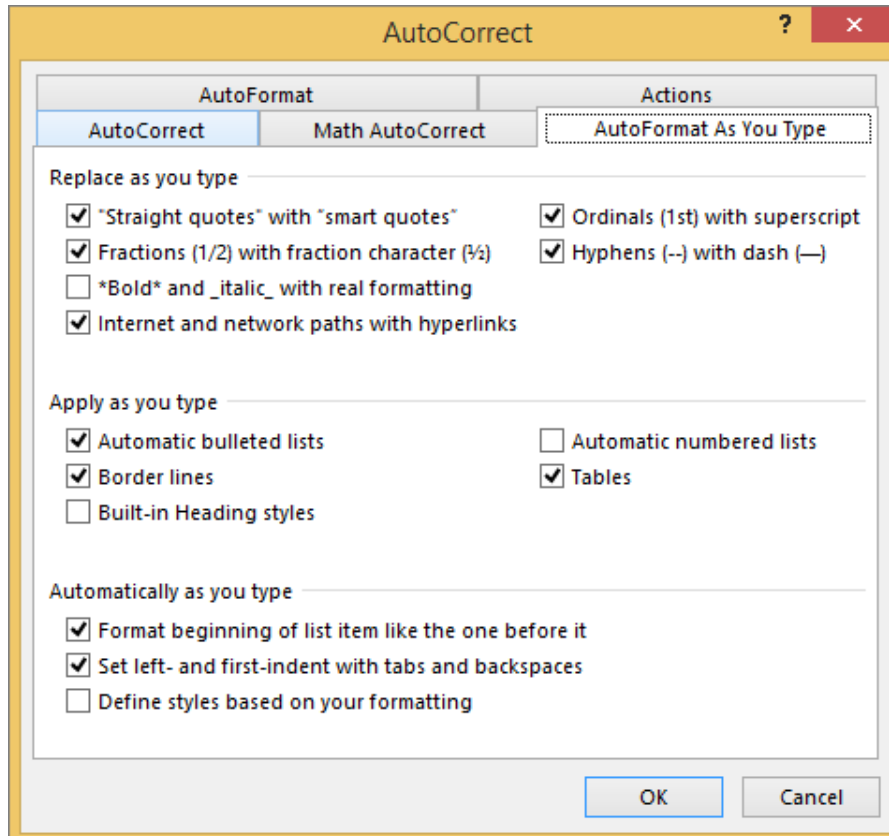
2. Enter text using AutoCorrect

As you type in your document, the text in the left column of the AutoCorrect list, under Replace, is automatically replaced with the text in the right column, under With.

3. AutoFormat :- AutoFormat feature is used to quickly apply or change automatic formatting such as hyphens and dashes, fractions, hyperlinks, quotation marks, and bulleted or numbered lists. To turn off automatic formatting, simply clear each option you want to turn off on the AutoFormat As You Type tab.

a. The AutoFormat As You Type options are global options that apply to all files for a program.

b. The AutoFormat As You Type options can't be applied to previously written text in Outlook, PowerPoint, Excel, Publisher, and Visio.



Mail Merge:-

Mail Merge is a powerful tool for writing and sending a personalized letter or e-mail to many different people at the same time. You can also use it to create envelopes or labels with each recipient's information. Mail Merge imports data from another source such as Excel and then uses that data to replace placeholders throughout your message with the relevant information for each individual you are messaging. You can use it to quickly create personalized messages for hundreds of people at once.

Mail merge process

The mail merge process has three documents involved in creating and printing letters and emails, or labels and envelopes.

main document

This document contains text and graphics (a logo or an image, for example) that are identical for each version of the merged document. An example of identical content is the return address on the envelope or in the body of a letter or an email message.

mailing list

This document contains the data that is used to fill in information in your main document. For example, your mailing list contains the addresses to be printed on the labels or envelopes.

merged document

This document is a combination of the main document and the mailing list. Information is pulled from your mailing list and inserted in your main document, resulting in the merged document—the letter, email, labels, or envelopes—personalized for different people on the mailing list.

Mail Merge

Use the Mail Merge Wizard to create form letters, mailing labels, envelopes, directories, and mass e-mail and fax distributions. To complete the basic process, you:

- Open or create a main document.
- Open or create a data source with individual recipient information.
- Add or customize merge fields in the main document.
- Merge data from the data source into the main document to create a new, merged document.

(a) Writing the form letter

Write the form letter then

1. On the Tools menu, point to Letters and Mailings, and then click Mail Merge Wizard.
2. Under Select document type, click Letters.
3. The active document becomes the main document.
4. Click Next: Starting document.
5. Click on Use the current document
6. Click Next: Select recipients.

(b) Working with mailing list and data source (creating new list)

7. Under Select recipients, click Type a new list.
8. Click Create.
9. In the New Address List dialog box, type the information you want to include for the first entry under Enter Address information; for example, title, names, and address information. You do not have to fill in every field.
10. To complete the first entry and move on to a new entry, click New Entry.
11. Repeat steps 9 and 10 until you've added all the address entries you want, and then click Close.
12. In the Save Address List dialog box, type a name for the address list in the File name box, and select a folder to save the list in.
13. Click Save.

(b) Selecting merge records

14. Place tick mark in front of the records you want to include in mail merge.

(c) Merging form document

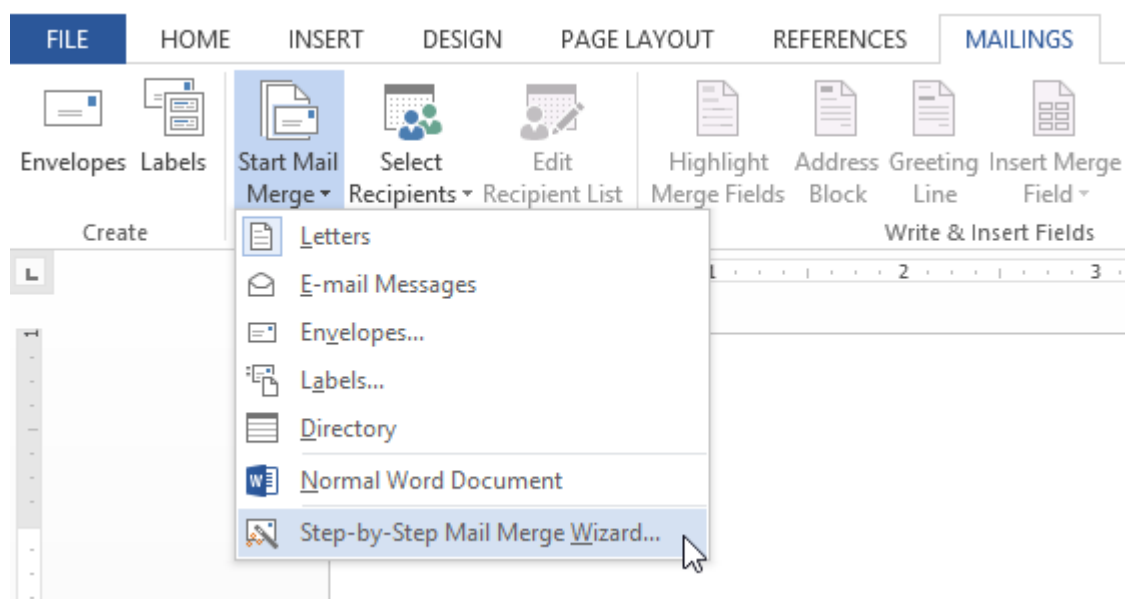
15. Click on Next: Write your letter.
16. click on More items and when dialog box appears, select the merge field and click on Insert.

(d) Printing merge document or sending to new document

17. Click on Next: Complete the merge
18. Click on Print to print the merge document or click on Edit individual letters to merge to new document.

To use Mail Merge:

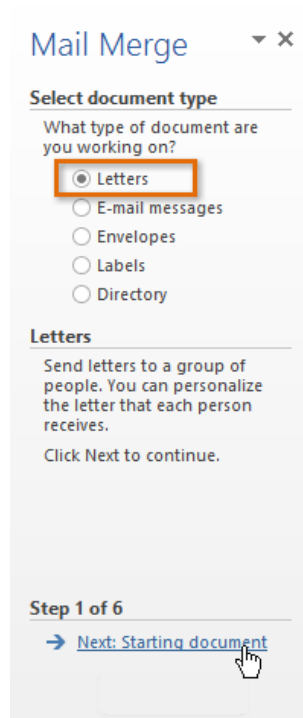
- Open an **existing** Word document, or create a **new** one.
- From the **Mailings** tab, click the **Start Mail Merge** command and select **Step by Step Mail Merge Wizard** from the drop-down menu.



The Mail Merge pane appears and will guide you through the **six main steps** to complete a merge. The following example demonstrates how to create a form letter and merge the letter with a **recipient list**.

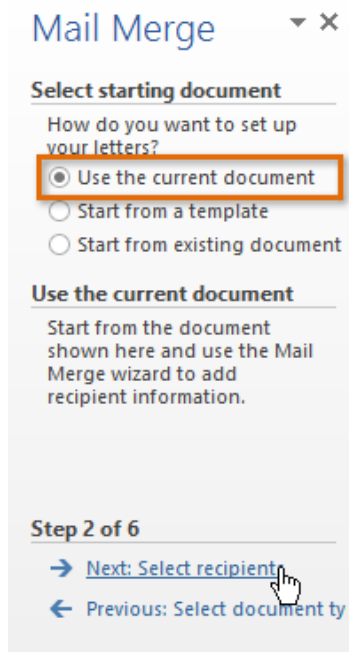
Step 1:

Choose the **type** of document you want to create. In our example, we'll select **Letters**. Then click **Next: Starting document** to move to Step 2.



Step 2:

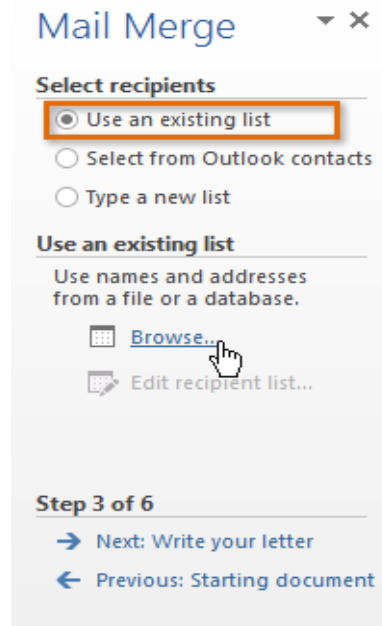
Select **Use the current document**, then click **Next: Select recipients** to move to Step 3.



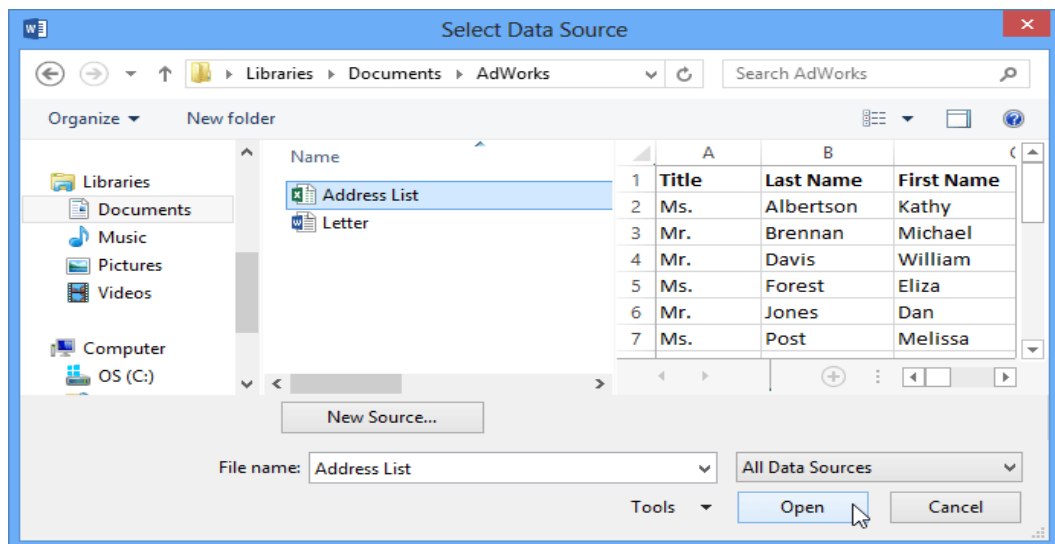
Step 3:

Now you'll need an address list so Word can automatically place each address into the document. The list can be in an existing file, such as an **Excel workbook**, or you can **type a new address list** from within the Mail Merge Wizard.

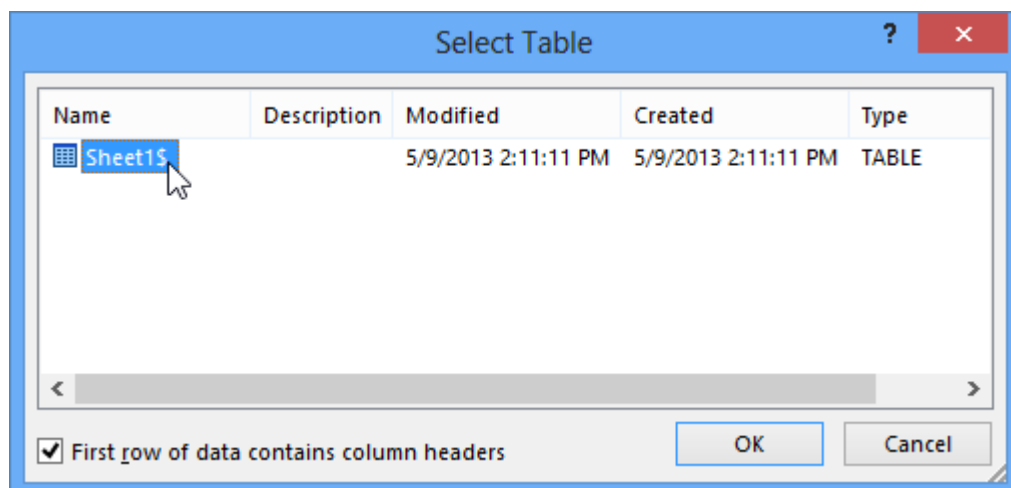
From the **Mail Merge** task pane, select **Use an existing list**, then click **Browse...** to select the file.



Locate your file and click **Open**.

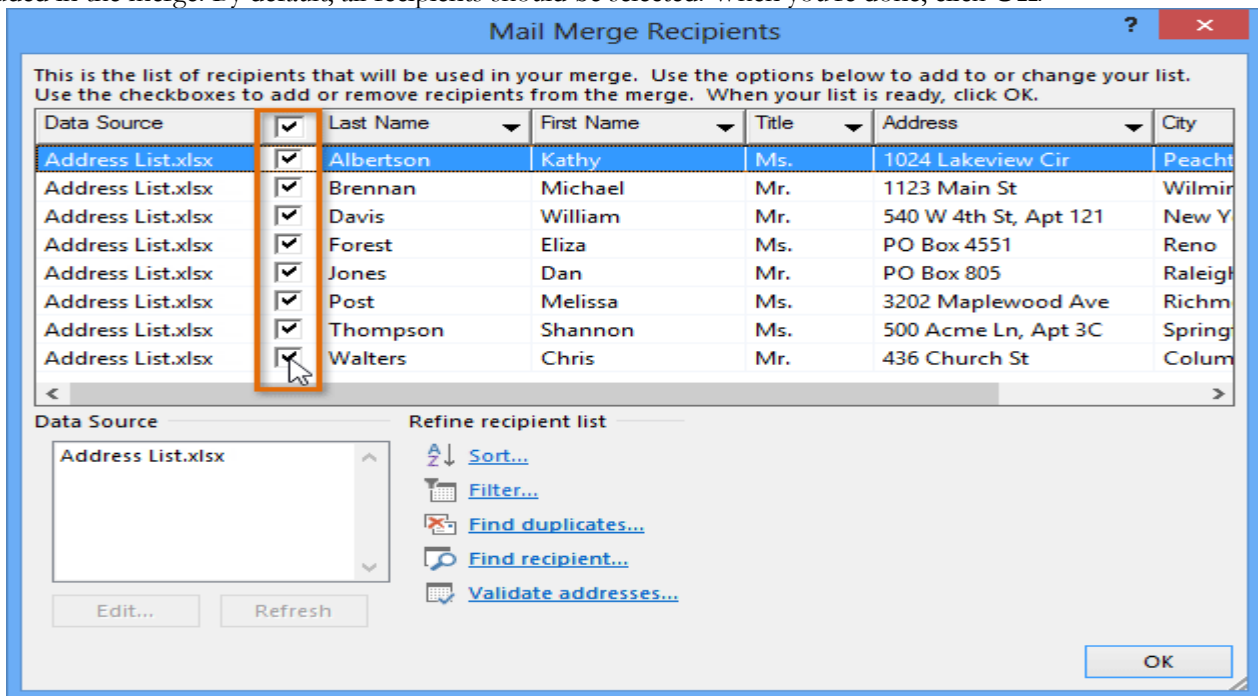


If the address list is in an Excel workbook, select the **worksheet** that contains the list and click **OK**.

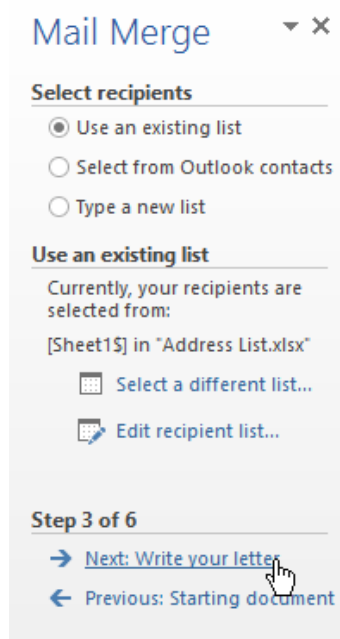


In the **Mail Merge Recipients** dialog box, you can **check** or **uncheck** each box to control which recipients are

included in the merge. By default, all recipients should be selected. When you're done, click **OK**.



From the **Mail Merge** task pane, click **Next: Write your letter** to move to Step 4.



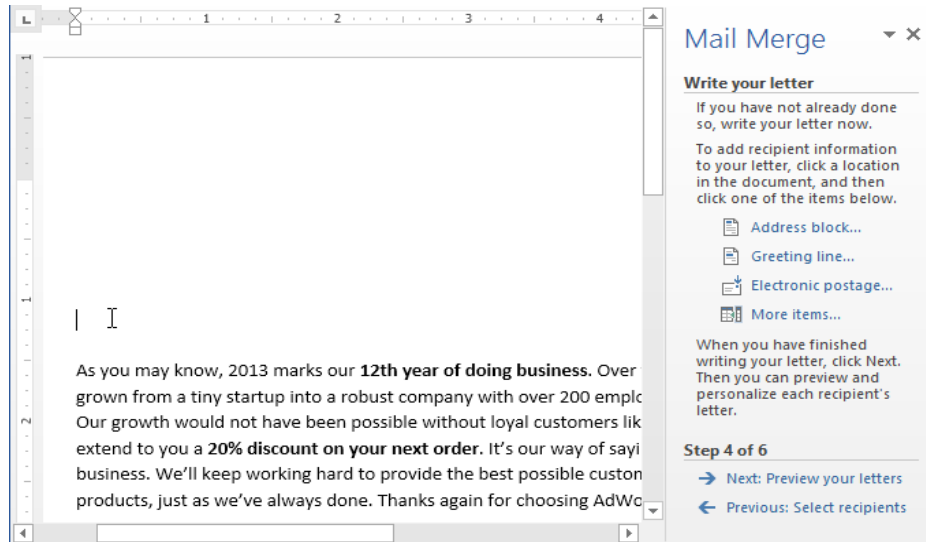
If you don't have an existing address list, you can click the **Type a new list** button and click **Create**. You can then type your address list.

Step 4:

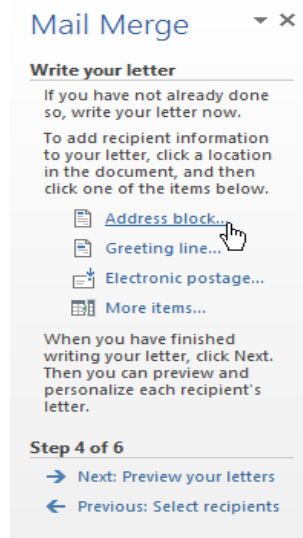
Now you're ready to write your letter. When it's printed, each copy of the letter will basically be the same; only the **recipient data** (such as the **name** and **address**) will be different. You'll need to add **placeholders** for the recipient data so Mail Merge knows exactly where to add the data.

To insert recipient data:

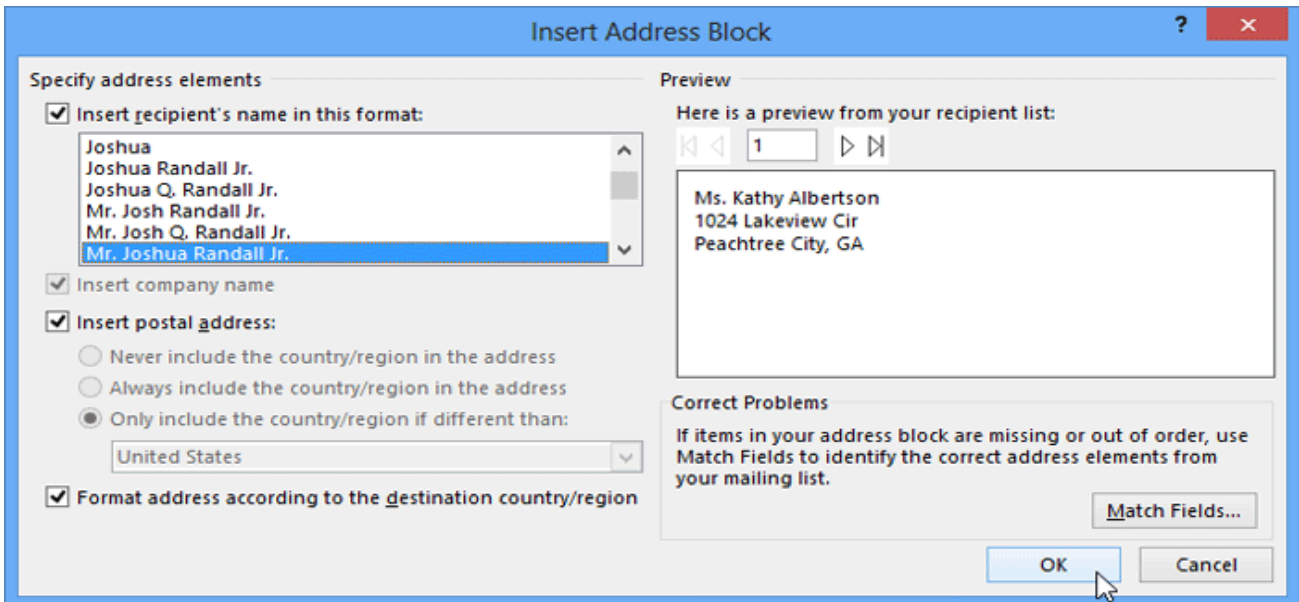
Place the insertion point in the document where you want the information to appear.



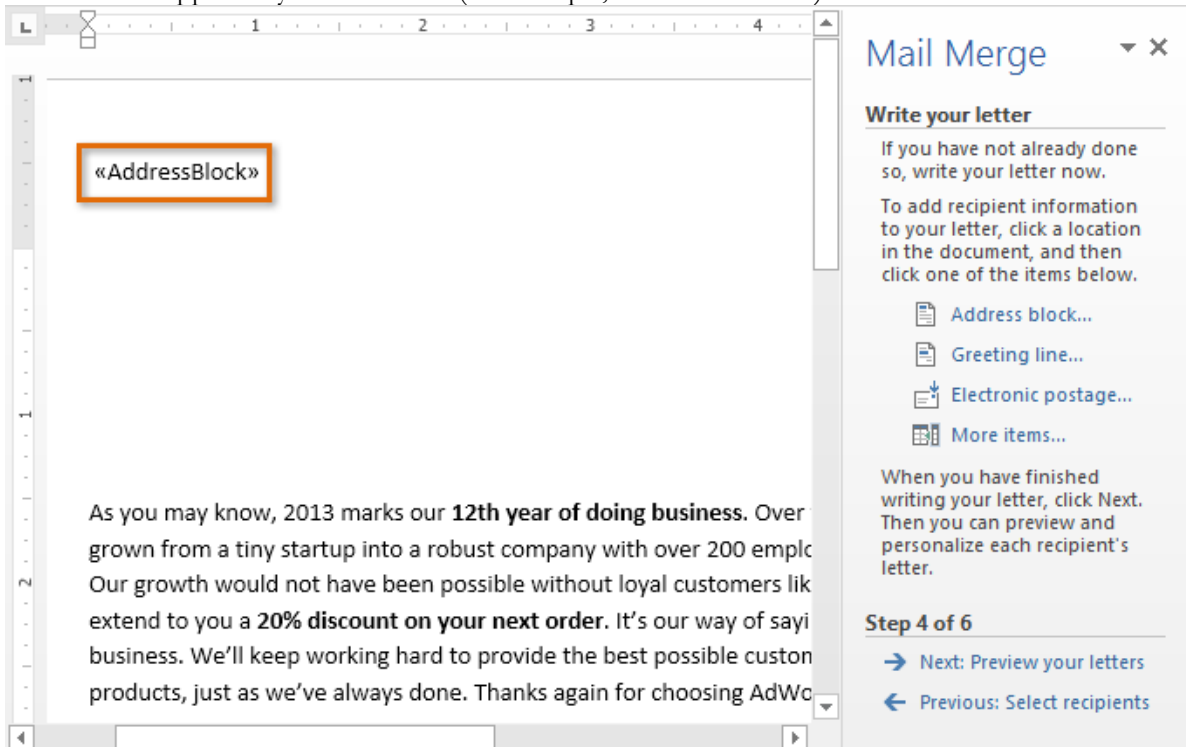
Choose one of the four **placeholder** options: **Address block**, **Greeting line**, **Electronic postage**, or **More items**.



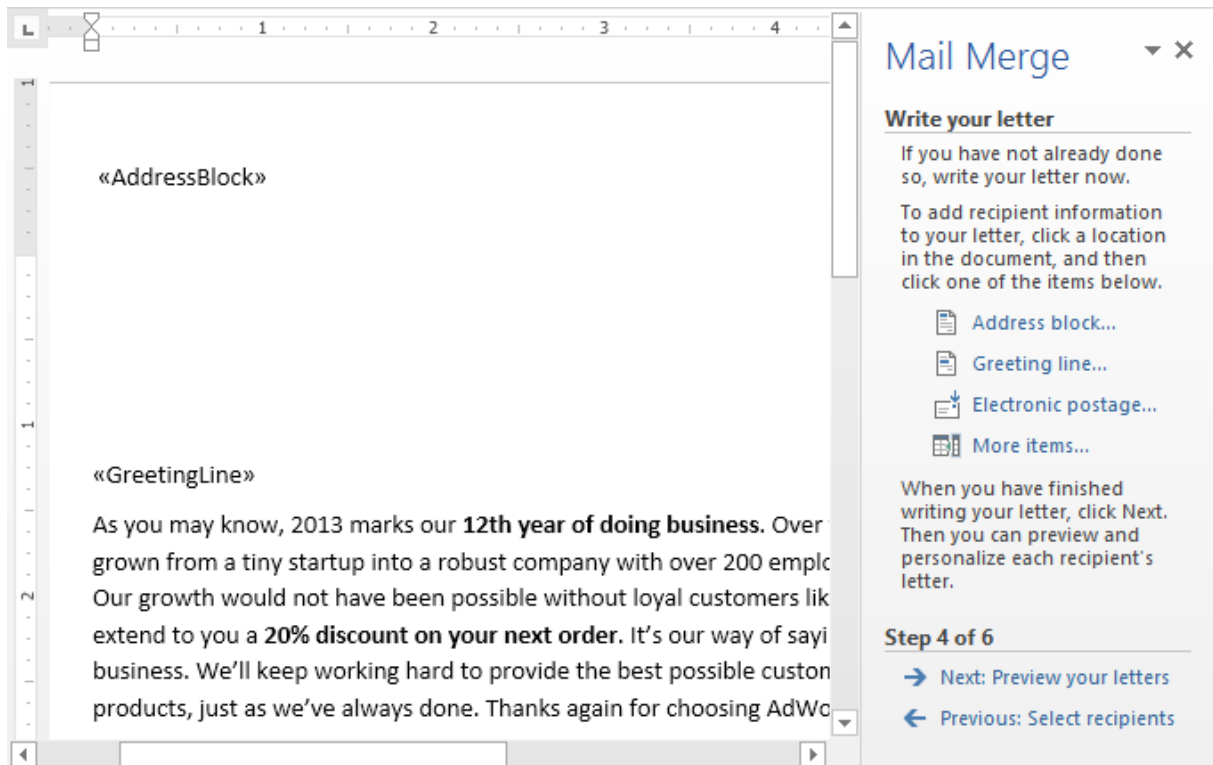
Depending on your selection, a dialog box may appear with various options. Select the desired options and click **OK**.



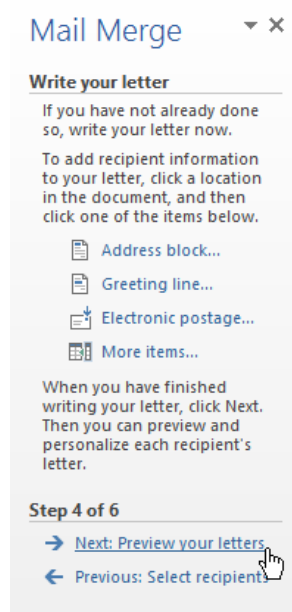
A placeholder will appear in your document (for example, «AddressBlock»).



Repeat these steps each time you need to enter information from your data record. In our example, we'll add a **Greeting line**.



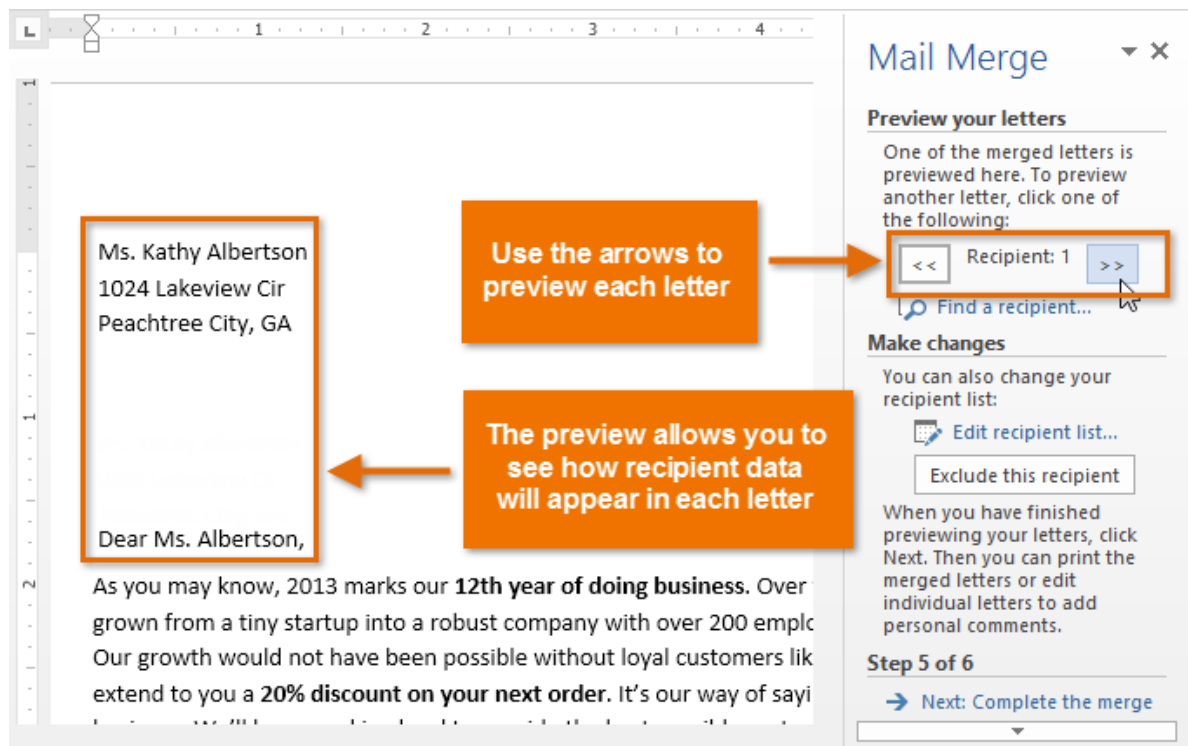
When you're done, click **Next: Preview your letters** to move to Step 5.



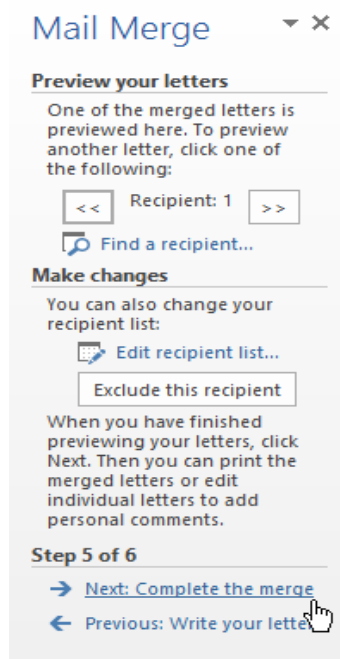
For some letters, you'll only need to add an **Address block** and **Greeting line**. Sometimes, however, you may want to place **recipient data** within the body of the letter to **personalize it** even further.

Step 5:

Preview the letters to make sure the information from the recipient list appears correctly in the letter. You can use the left and right scroll arrows to view each document.

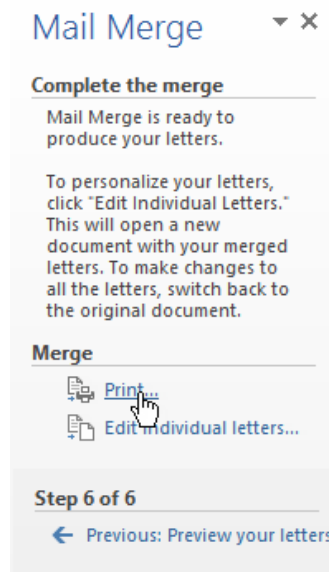


Click **Next: Complete the merge** to move to Step 6.

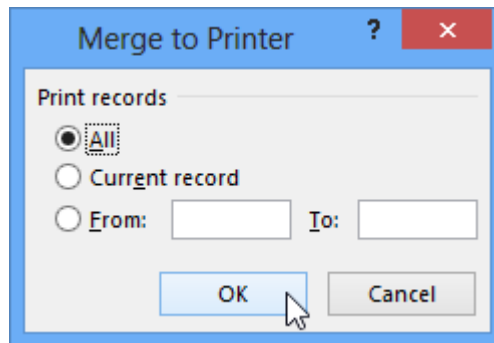


Step 6:

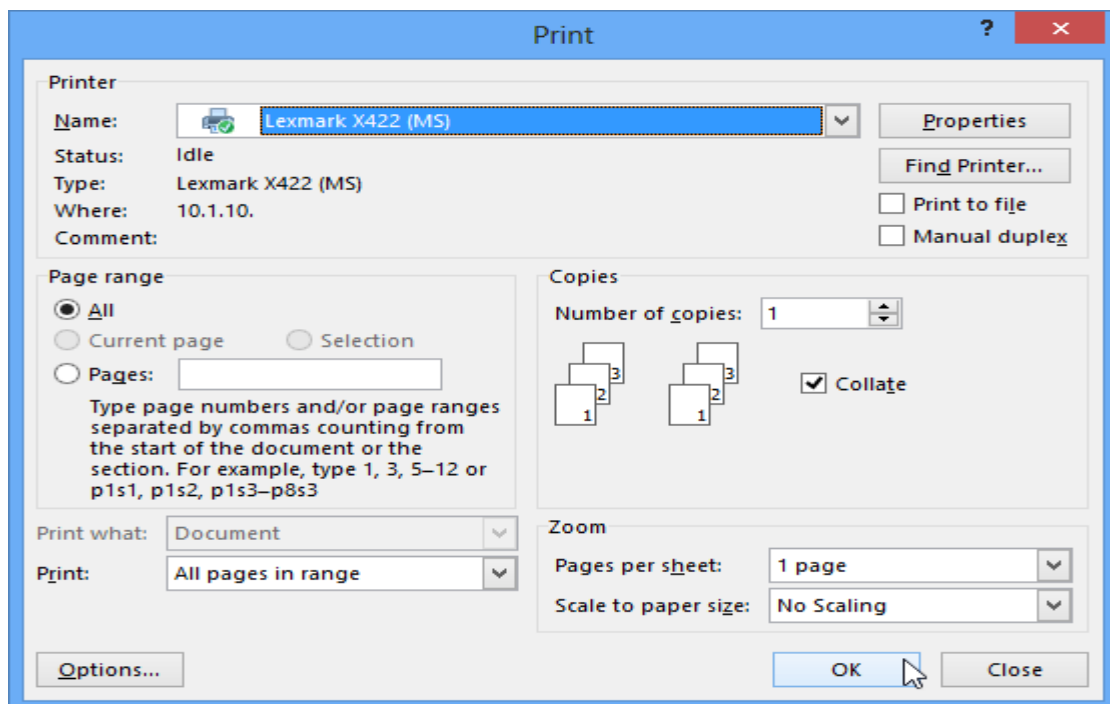
Click **Print...** to print the letters.



A dialog box will appear. Click **All**, then click **OK**.



The **Print** dialog box will appear. Adjust the print settings if needed, then click **OK**. The letters will be printed.



Working with tables:-

A table is made up of rows and columns of cells that you can fill with text and graphics. Tables

are often used to organize and present information.

(a) Inserting table:

Use this procedure to make choices about the table dimensions and format before the table is inserted into a document.

1. Click where you want to create a table.
 2. On the Table menu, point to Insert, and then click Table.
 3. Under Table size, select the number of columns and rows.
 4. Under AutoFit behavior, choose options to adjust table size.
 5. To use a built-in table format, click AutoFormat.
- Select the options you want.

(b) Selection in table: to select

- (a) A cell: Click the left edge of the cell.
- (b) A row: Click to the left of the row.
- (c) A column: Click the column's top gridline or border.
- (d) Multiple cells, rows, or columns: Drag across the cell, row, or column.
- (e) Multiple items that are not necessarily in order: Click the first cell, row, or column you want, press CTRL, and then click the next cells, rows, or columns you want.

Note You can also select rows, columns, or the entire table by clicking in the table and then using the Select commands on the Table menu.

(c) Inserting row, column or cell:

1. Select the same number of cells, rows, or columns as the number of rows or columns you want to insert.
2. On the Table menu, point to Insert, and then click an option.

(d) Deleting row, column or cell:

1. Select the cells, rows, or columns you want to delete.
2. On the Table menu, point to Delete, and then click either Columns, Rows, or Cells.
3. If you are deleting cells, click the option you want.

(e) Merging Cells

You can combine two or more cells in the same row or column into a single cell. For example, you can merge several cells horizontally to create a table heading that spans several columns.

1. Select the cells you want to merge.
2. On the Table menu, click Merge Cells

(f) Splitting cell

1. Click in a cell, or select multiple cells that you want to split.
2. On the Table menu, click Split Cells.
3. Select the number of columns or rows you want to split the selected cells into.

(g) Auto-formatting table: You can quickly give your table a professional design by using any of the built-in table formats.

1. Click the table.
2. On the Table menu, click Table AutoFormat.
3. In the Table styles box, click the format you want.
4. Select the options you want.
5. Click Apply.

(h) Repeating Heading row: if table spans over multiple pages, position the insertion point on heading row and click on Repeating Heading row on Table menu the heading row automatically repeats on following pages and does not require typing of heading row on top of every page.

Spell checking and grammar:-

By default, Microsoft Word checks spelling and grammar automatically as you type, using wavy red underlines to

indicate possible spelling problems and wavy green underlines to indicate possible grammatical problems.

You can also check spelling and grammar all at once.

1. On the Standard toolbar, click Spelling and Grammar.
2. When Word finds a possible spelling or grammatical problem, make your changes in the Spelling and Grammar dialog box.

Finding Synonyms:-

You can use the thesaurus to check synonyms. The thesaurus provides a list of synonyms for the text you look up, and highlights the one that is closest to what you have typed.

1. Select the word whose synonym is required.
2. Click on Tools, point to Language then click on Thesaurus.
3. Select the word and click on Replace.

Working with Graphics:-

There are two basic types of graphics that you can use to enhance your Microsoft Word documents: drawing objects and pictures. Drawing objects include AutoShapes, diagrams, curves, lines, and WordArt drawing objects. These objects are part of your Word document. Use the Drawing toolbar to change and enhance these objects with colors, patterns, borders, and other effects.

(a) Inserting picture:

1. Click where you want to insert the picture.
To insert the picture on a drawing canvas, select the canvas.
2. On the Insert menu, point to Picture, and then click From File.
3. Locate the picture you want to insert.
4. Double-click the picture you want to insert

(b) Inserting Clipart

1. On the Insert menu, point to Picture, and then click Clip Art.
2. In the Insert Clip Art task pane, in the Search text box, type a word or phrase that describes the clip you want or type in all or some of the file name of the clip.
3. To narrow your search, do one or both of the following:
 - a. To limit search results to a specific collection of clips, in the Search in box, click the arrow and select the collections you want to search.
 - b. To limit search results to a specific type of media file, in the Results should be box, click the arrow and select the check box next to the types of clips you want to find.
4. Click Search.

(c) Inserting WordArt

1. click Insert menu, point to Picture, then click on WordArt
2. Click the WordArt effect you want, and then click OK.
3. In the Edit WordArt Text dialog box, type the text you want.
4. Do any of the following:
 - o To change the font type, in the Font list, select a font.
 - o To change the font size, in the Size list, select a size.
 - o To make text bold, click the Bold button.
 - o To make text italic, click the Italic button.

Macro:-

If you perform a task repeatedly in Microsoft Word, you can automate the task by using a macro. A macro is a series of Word commands and instructions that you group together as a single command to accomplish a task automatically.

Here are some typical uses for macros:

1. To speed up routine editing and formatting
2. To combine multiple commands; for example, inserting a table with a specific size and borders, and with a specific number of rows and columns
3. To make an option in a dialog box more accessible
4. To automate a complex series of tasks

(a) Creating macro

1. On the Tools menu, point to Macro, and then click Record New Macro.
2. In the Macro name box, type a name for the macro.
3. In the Store macro in box, click the template or document in which you want to store the macro.
4. In the Description box, type a description for the macro.
5. If you don't want to assign the macro to a toolbar, a menu or shortcut keys, click OK to begin recording the macro.

(b) Playing macro

1. On the Tools menu, point to Macro, and then click Macros.
2. select the macro from list and click on Run.

(c) Deleting macro

- 1 On the Tools menu, point to Macro, and then click Macros.
- 2 select the macro from list and click on Delete and click on Close.

Working with Templates:-

Every Microsoft Word document is based on a template. A template determines the basic structure for a document and contains document settings such as AutoText entries, fonts, key assignments, macros, menus, page layout, special formatting, and styles.

(a) Creating template

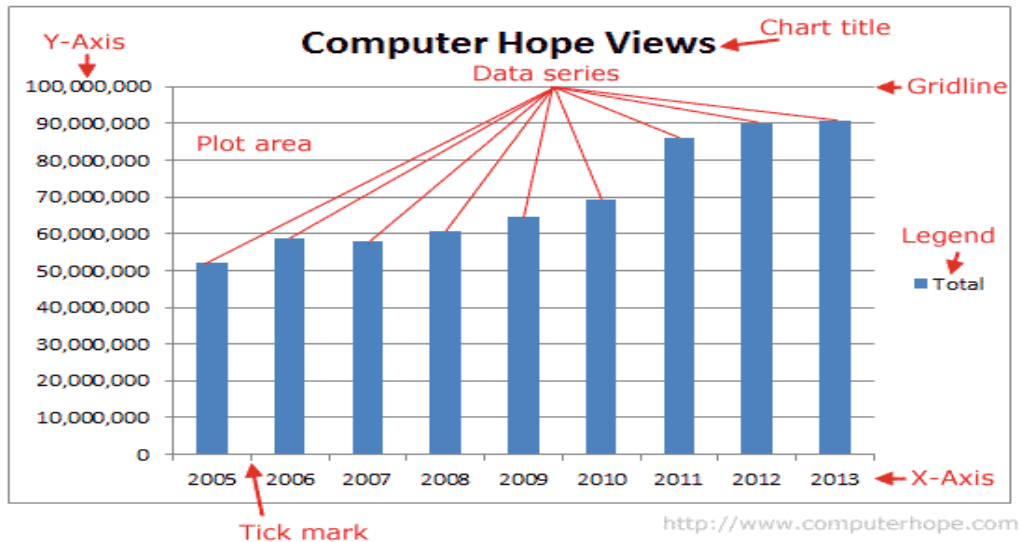
1. Do one of the following:
 - a.To base a template on an existing document
 1. On the File menu, click Open.
 2. Open the document you want.
 - b.To base a new template on an existing template
 3. On the File menu, click New.
 4. In the New Document task pane, under New from template, click General Templates.
 5. Click a template that is similar to the one you want to create, click Template under Create New, and then click OK.
 4. On the File menu, click Save As.
 5. In the Save as type box, click Document Template. This file type will already be selected if you are saving a file that you created as a template.
 6. The default folder is the Templates folder in the Save in box. To save the template so that it will appear on a tab other than General, switch to the corresponding subfolder within the Templates folder.
 7. In the File name box, type a name for the new template, and then click Save.
 8. In the new template, add the text and graphics you want to appear in all new documents that you base on the template, and delete any items you don't want to appear.
 9. Make the changes you want to the margin settings, page size and orientation, styles, and other formats.
 10. On the Standard toolbar, click Save icon, and then click Close on the File menu.

Charts:- A chart is a graphic representation of data. Charts allow users to see what the results of data to better understand and predict current and future data.

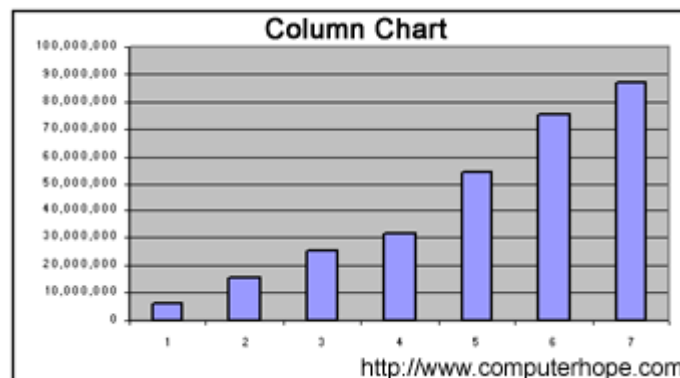
Types of charts:-There are a wide variety of charts available to display data, below are the most popular types of charts supported in most programs.

Bar chart:- Alternatively referred to as a bar graph. A bar chart is a graphic representation of data. Bar charts show horizontal or vertical bars going across the chart horizontally, with the values displayed on the bottom of the chart. Below is a sample picture of a bar chart of unique views Computer Hope received between the years of 2005 and 2013. In this chart all important parts that make up the chart are also labeled.

Bar Chart Overview

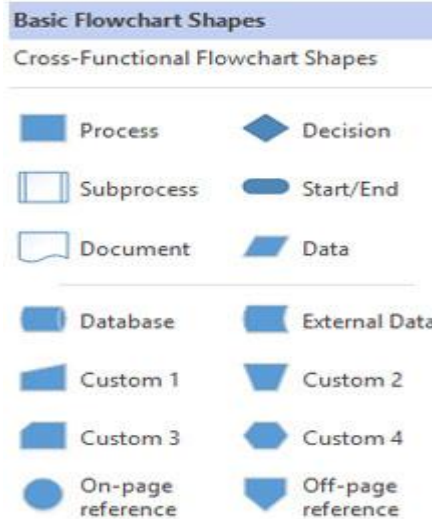
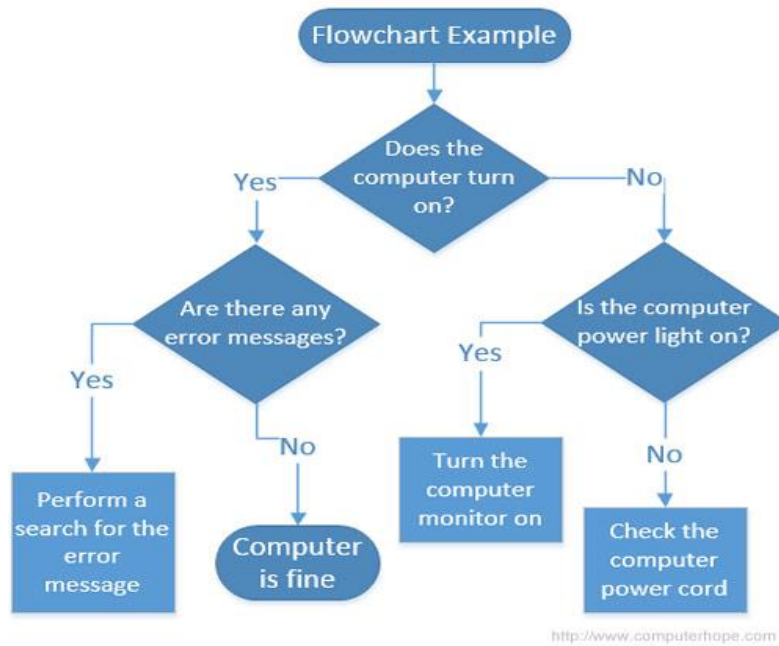


Column chart:- A column chart is a graphic representation of data. Column charts display vertical bars going across the chart horizontally, with the values axis being displayed on the left side of the chart. In the picture below, is an example picture of a column chart of unique visitors Computer Hope has received between the years of 2000 and 2006. As can be seen in this example, you can immediately see a gentle increase of users without reading any data.

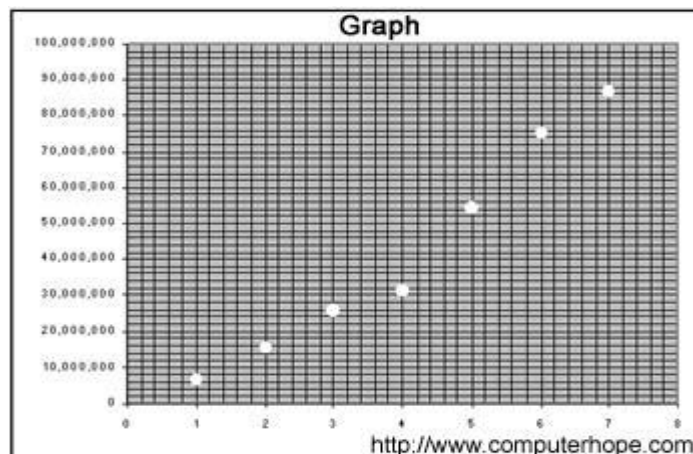


3.Flow chart:- A flowchart is a graphical representation of decisions and their results mapped out in individual shapes that were first developed by Herman Goldstine and John von Neumann in the 1940's. Flowcharts can provide a step-by-step diagram for mapping out complex situations, such as programming code or troubleshooting problems with a computer. The picture to the right shows an image from Microsoft Visio, a popular program used to design and create flowcharts and diagrams.

Below is an example of a basic flowchart created in Visio that gives a good representation of their layout. As can be seen, you have several steps that may be followed systematically to help determine the cause of computer problem. Of course, this is just an example and not the full set of steps required to troubleshoot computer issues.

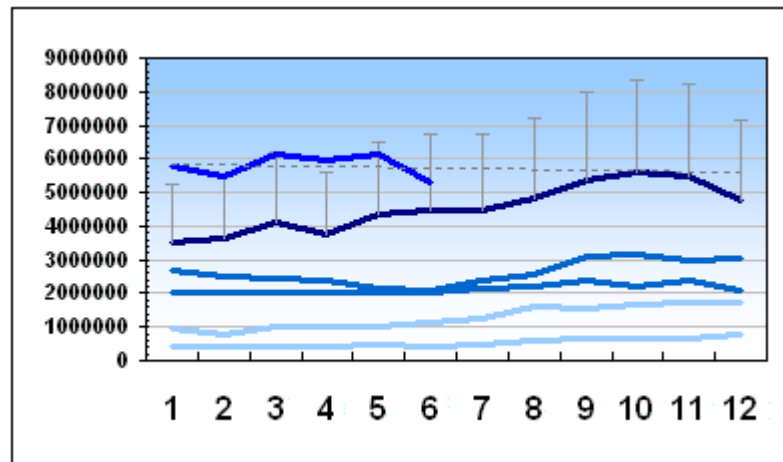


4.Graph:- Not to be confused with a chart, a graph is a visual representation of values over grids (horizontal and vertical lines) that give the user an easy to view representation of all the values. Below is a picture and an example of a basic graph.



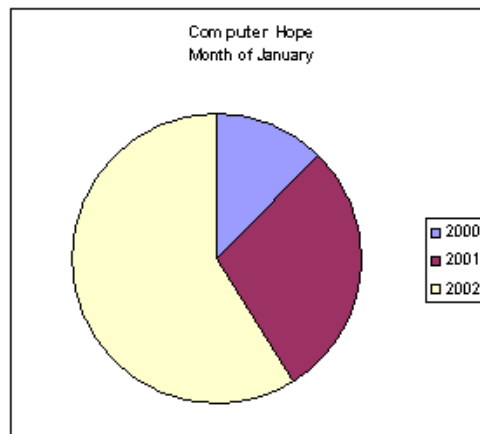
5.Line chart:- alternatively referred to as a line graph, a line chart is a graphic representation of data that is plotted

using a series of lines. Line charts display lines going across the chart horizontally, with the values axis being displayed on the left side of the chart. In the picture below, is an example of a line chart showing unique visitors to Computer Hope.



As can be seen in this example, you can easily see the increases and decreases each year over different years.

6. Pie chart:- Circular chart that is sliced into sections (similar to slicing a pie you would eat), each section represents a percentage. The picture shows a pie chart of Computer Hope visitors from the years 2000 to 2002. With pie charts, users can see that the visits to Computer Hope increased significantly in 2002 when compared to 2000.



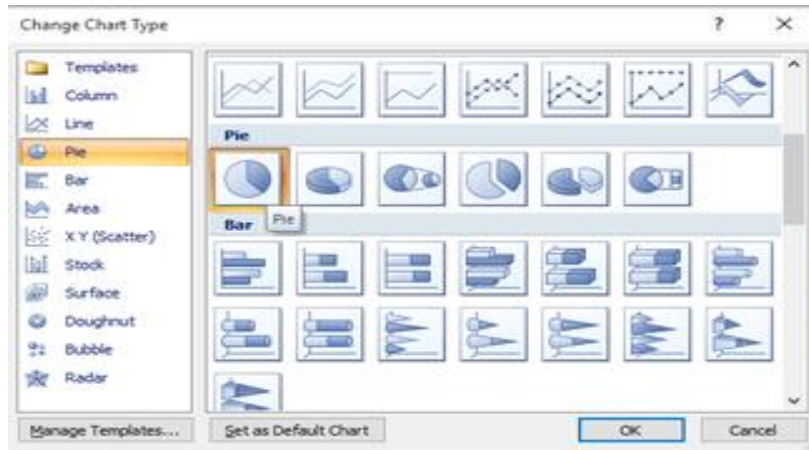
7. Point chart:- A point chart is a graphic chart comprised of various points (or dots) that commonly represent a large quantity of data and can be used to locate trends or averages.

Creating Charts in Microsoft Word :- In Microsoft Word, you can insert many kinds of data charts and graphs, such as column charts, line graphs, pie charts, bar charts, area graphs, scatter graphs, stock charts, surface charts, doughnut charts, bubble graphs, and radar graphs.

1. Open your Word document and click on the Insert > Illustrations > Charts:

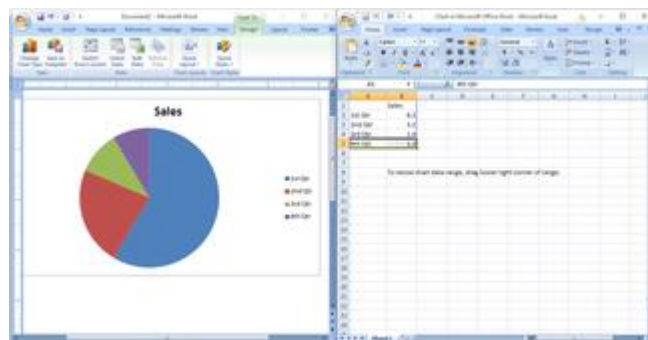


2. Word will open a menu titled Insert Chart. Select the type of chart you'd like to create and then choose the desired template:



Click on OK to insert the selected chart into the document. By default, the chart will insert at your current cursor position.

3. Word will also create a data sheet (Excel table) for the chart. Any modifications made to the data sheet will be automatically carried over to the new chart:



4. Customizing Your Microsoft Word Chart:- Open your Word document, select the desired chart and then go to Chart Tools > Design tab. Here, you will be able to edit the chart to your liking:



You'll find additional customization options under the Layout and Format tabs.

Converting a word document into various Formats:- There are three primary ways to convert word files to files compatible with Microsoft Word, such as .doc, .docx, .xls, .ppt, .pdf or rich text(.rtf) formats:

1. Manually open and save the document as a new file type,
2. Use an online conversion service, or
3. Download one of many available conversion programs. Free conversion programs are available online.

1. Open the file with Word

There are two ways to open the file with Word. First, you can locate the .rtf file in its folder, right-click on it, and then select Open With from the menu that pops up. Here, you can choose to open the file with Word. You may have to select Browse if Word does not come up as an option. In this case, you have to locate the folder with the Word launch icon, which is usually under Microsoft Word or Microsoft Office. The other method is to launch Word, then click Open under the File menu. Find the folder where the .rtf file is saved, then double-click to open it in Word.

Save it as a Word file

Once your files is open in Word, click on the File menu again and select Save As. Depending on your version of

Word, you may have to select a destination folder before a save window appears. When the save window comes up, look under the line where the file name appears, and click the Save as Type drop menu. From here, you can select Word Document to save it in either a .docx format or .doc, .docx,.xls,.ppt, .pdf ,.rtf format for Word Document.

2. Use an online service

If manual conversion is beyond your comfort level with Word, try one of several online conversion services. The methods vary by website, but they are generally easy to follow. Use a search engine to find a service that works for you.

3. Download conversion software

There are many free or inexpensive converter software programs that can be downloaded from websites, and they typically work the same way as the online services, except you can access them offline.

References

1. Shelly, G. B., Cashman, T. J., & Vermaat, M. E. (2011). *Microsoft Office 2010: Introductory*. Cengage Learning.
2. Beskeen, D. W., Duffy, J. L., & Friedrichsen, L. J. (2014). *Microsoft Office 2013: A skills approach*. McGraw-Hill Education.
3. Norton, P. (2006). *Introduction to computers (6th ed.)*. McGraw-Hill.
4. Sinha, P. K., & Sinha, P. (2007). *Computer fundamentals (6th ed.)*. BPB Publications.
5. Shneiderman, B., & Plaisant, C. (2010). *Designing the user interface: Strategies for effective human-computer interaction (5th ed.)*. Pearson.
6. Myers, B. A. (1988). A taxonomy of user interface tools. *ACM Transactions on Computer-Human Interaction*, 1(1), 64–103.
7. Carroll, J. M. (1997). Human-computer interaction: Psychology as a science of design. *Annual Review of Psychology*, 48, 61–83.
8. Microsoft Corporation. (n.d.). *Microsoft Word advanced features and documentation*. Retrieved from <https://www.microsoft.com>
9. IEEE Computer Society. (n.d.). *Human-computer interaction and document systems*. Retrieved from <https://www.computer.org>
10. ACM Digital Library. (n.d.). *Research on office automation and document processing systems*. Retrieved from <https://dl.acm.org>