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CHAPTER ONE

HISTORY OF COMPUTERS

1.1 History of Computers

Course objective

1. It enables students have an understanding on the theoretical concepts of IT and application
2. Understanding the different part of physical part Computer.
3. It enables the Student to understand the concept of input
4. Enables student to have the full Understanding computer system

Introduction

The history of computers Starts out about 2000 year ago, at the birth of the abacus ,modern rack holding two horizontal wires with beads strung on them .when these beads are moved around according to programming rules memorized by the user ,all regular arithmetic problem can be done . Blasé Pascal was usually for building the first digital computer in 1642 .it added numbers entered with dials and made to help his father, fax collector.

In1812, Charles Babbage realized that many long calculations, especially those needed to make mathematical tables were really a series of predictable action that were constantly repeated. From this he suspected that it should be possible to do this automatically.Hebegan to design an automatic mechanical calculating machine, which he called a Difference Engine. By1812 he had a working model to demonstrate.

The start of World War II produced a large need for Computer Capacity, especially for military. This leads to the development of modern computers.

The digital computers is largely a collection of electronic switches .these switches are used to represent, as well as to control,the routing of data elements called binary digits (bits).Because of on/off nature of the binary information and signal routing used by the computer, an efficient electronic switch was required .The first electronic computers used Vacuum tubes as switches ,and although the tubes worked, they had many problems.

The tube was inefficient as a switch. It consumed a great deal of electrical power and gave off enormous heat a significant problem in the

earlier systems .primarily because of the heat they generated, tubes were notoriously.

The invention of the transistor ,or semiconductor was one of the most important developments leading to the personal computer revolution .The transistor was invented in 1948 by Bell Laboratories engineers John Bardeen.Walter Brattain and William Shochley. The Transistor which essentially is a sold state electronic switch, replaced the much less suitable vacuum tube. Because the transistor consumed significantly less power, a computer system built with transistors was much smaller, faster and more efficient.

In 1969 Engineers at texas Instruments invented the integrated Circuit (IC), semiconductor circuit that contains more than one transistor on the same base and connected the transistor with out wires. The first IC contained only six transistors. By comparisons. the Intel Pentium Pro Processor in many of to day's high end systems has more than 5.5 million transistor ,and the integral cache build into some of these chips contains an additional 16 million .

The first Microprocessor the Intel 4004, a 4bit processor was introduced in 1971, the chip operated on 4 bits of data at a time. The successor of the 4004 chip was the 8008 8-bit microprocessor, introduced in 1972.

History of Computer

The start of the World War II produces a substantial need in the growth of computers capacity, particularly for military purpose. The modern history of computers development, i.e. the time after 1940, is often discussed with reference to different generation.

Depending on the type of technological achievement like:

- Basic electronic component
- Secondary storage device
- Operating system
- Access time of the computer and
- Computer language used

There are five generations of computer which are discussed below:

Generations of Computer

First Generation Computers (1940-1956)

- Used Vacuum tubes or thermionic valve as a circuitry.
- Have small internal memory based on magnetic drums or relays.
- Input device was based on punch card or paper tape.
- Output is displayed on printouts.

- Use Machine (or low level) language.
- Access time measured in milliseconds (thousands of a second).
- Consists' about 1,000 circuits per cubic foot.
- Require extreme air conditioning system.

Examples: Harvard Mark I (electromechanical), Whirlwind, ENIAC, EDSAC UNIVAC & IBM 650, UNIVAC I, UNIVAC II, UNIVAC 1101, IBM models 604 etc.

Second Generation Computers (1956-1963)

- used transistors (discrete electronic components) as a main circuitry
- Use magnetic core or tape as storage device.
- Input device was on punch card.
- Output was displayed on printout.
- Use assembly language
- Consists of about 100,000 circuits per foot.
- Access time measured in microseconds

Examples: -UNIVAC 1107, UNIVAC III, NCR 300 series, IBM 7030 Stretch Honeywell 800, 400 series, General Electric GE 635, LARC, Burroughs B5000 etc.

Third Generation computers (1964 - early 1970.s)

- Use Integrated circuits in place of transistors.
- A number of transistors are integrated on a small size silicon chip.
- Use IC based (magnetic) storage device.
- 10 million circuits per square foot
- New input/ output devices, like the keyboard and visual displaying unit, were developed.
- Access time in 100 nanoseconds (100 times that of second generation computer.)
- Cheaper and made commercial production easier.

Examples: Burroughs 6700, Control Data 3300, Honeywell 200, IBM System/360, System 3, System 7, NCR Century Series, RCA Spectra 70 series, UNIVAC 9000 series, General Electric GE 600 series, GE 235 etc.

Fourth generation computers (1970.s to present)

- Are extension of the fourth generation computers
- Introduce very large scale integration circuit or VLSI technology.
- Widely known for the use of microprocessors.
- Circuit density approached 100,000 components per chip and above
- billions of circuits per cubic foot
- Access time approached nanoseconds
- Programming task were simplified
- Virtual operating systems were introduced for multiple use
- Are versatile in nature and are also able to form a network.

Examples: IBM System 3090, IBM RISC 6000, IBM RT, ILLIAC IV Cray 2 XMP, HP 9000, Pentium I, Pentium II. etc.

Fifth Generation (future generation) computers

One major behavior of computers which exist in the present day is that they perform what they instructed to do. This raise the question of why? This means:

- Why they do not learn from their mistakes?
- Why they do not posses the skill of experts?

Therefore, to answer the above questions, future generation computers are expected to have:

- Logical decision making capability
- Reasoning capability.
- Use super large scale integration circuit(SLSI)
- parallel processing will be used
- high speed logic and memory chips
- Voice/data integration, knowledge-based platforms.
- they are called as artificial intelligent (or expert systems)
- Generally expected to understand and processes human natural language accordingly.

Review Questions

1. Identify the different parts of Computer Generations

2. Which types of computers generations uses vacuum tube

3.. Which types of computers generations uses relative uses less power .-----

1.2. Computers and Data Processing

I. Computers

Computer is electronic machine that performs tasks, such as calculations or electronic communication, under the control of an internally stored set of instructions called as program. Programs usually reside within the computer primary memory and are retrieved and processed by the computer electronically. The program results are stored or routed to output devices, such as video display monitors or printers. Computers perform a wide variety of activities reliably, accurately, and quickly.

II. Communications Network

- An integral part of IT is the ability to communicate to send and receive data and information over a communication network.
- A communications network is an interconnection of stations (or devices) at different locations through a medium that enables people to send and receive data and information and to share resources.
- Telephone wires and cables are common communication media.
- *Data communication is the transmission of data and information over a communications medium.*

III. Know-how

Other critical part of IT is the ability to draw on the power of IT to solve problems and to take advantages of the opportunities it creates offered by IT. Therefore IT require or implies know-how, knowing how to do something well.

- Know-how includes
- Familiarity with the tools of IT
- The skills needed to use these tools
- Understanding when to use IT to solve a problem etc.

Data processing

A given data to be information it should have to be processed and have to get a meaning. Therefore what is data processing? Data processing is the manipulation and transformation of data in to more meaningful form (or information). It is the process of converting data in to information.

Data (input) → processing → Output (Information)

Processing may include:-Calculating, Sorting, Summarizing, Merging etc.

E.g. Think of the data that is created when you buy a product from a retailer. This includes:

- Time and date of transaction (e.g. 10:05 Tuesday 23 December 2003)
- Transaction value (e.g. £55.00)
- Facts about what was bought (e.g. hairdryer, cosmetics pack, shaving foam) and how much was bought (quantities)
- How payment was made (e.g. credit card, credit card number and code)

At its simplest, this data needs processing at the point of sale in order for the Customer to receive a valid receipt. So the data about the transaction is processed to Create "information" - in this case a receipt. You can imagine that the same data would also be useful to the manager of the retail store. For example, a report showing totals sales in the day, or

which are the best-selling products. So the data concerning all shop transactions in the day needs to be captured, and then processed into a management report.

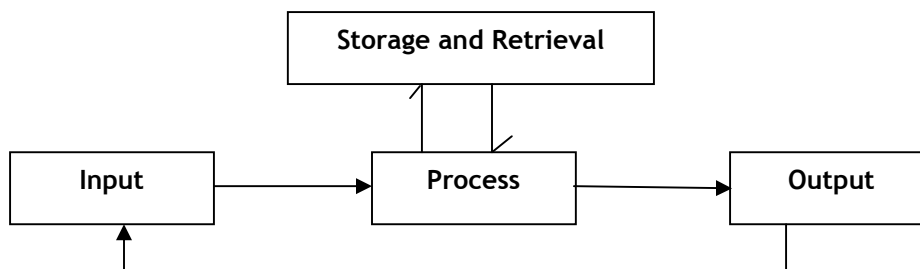
Therefore in general: Information is data that has been processed in such a way as to be meaningful to the person who receives it.

Data processing life cycle

Data processing life cycle shows the steps involved while processing data in to information. Information processing (manual or computerized) requires

1. Input data
2. Processing
3. Output and
4. Storage and retrieval

The figure below shows the information processing cycle.



1. Input

Input is the *data* given to the system in order to be processed

Activities include:-

- *Collecting & recording data:* in hard copy or soft copy form.
- *Classifying & coding input data:* - the task of identify one kind of data & distinguishing it one from the other kind by means of code number or letter (alphanumeric system) to speeds up processing.

2. Process

Processing includes different *operations* which are used to convert the input data to information.

The operations include:-

- Calculating operations:- arithmetic or logical operations
- Summarizing:- reducing the volume of data
- Sorting: - putting in a definite order (either in ascending or descending)
- Merging: - combining a data.

3. Storing and retrieving

Storing: - saving data for future use.

Retrieving: - searching created by Secured - 6 -or & finding data which resides in the storage device.

4. Output

- Output is the final result of data processing.
- Output is the information that we get after the data is processed.
- Output can be in different format, this include:- Hard copy- printed form
Soft copy-(magnetic form), Audio format, Visual format.

Manual Vs Automated Information Processing

Information processing can be either manual or computerized (automated).

- Manual information processing is processing of information using paper, pencil, and brain.
- Automated information processing is processing of information with the help of computers this means that when the above cycles are done with the help of Computers. This is much more flexible than the manual one and a lot faster.

What is a computer?

Computer is electronic machine that performs tasks, such as calculations or electronic communication, under the control of an internally stored set of instructions called as program. Programs usually reside within the computer primary memory and are retrieved and processed by the computer electronically. The program results are stored or routed to output devices, such as video display monitors or printers. Computers perform a wide variety of activities reliably, accurately, and quickly.

Characteristics of Computers

Computers are meant for processing information. They are capable of taking inputs in different formats, processing the input data and providing outputs in different formats. In addition to this there are also additional characteristics that make them so powerful and essential, this include:-

Storage capacity

Computers help to save space and economy by storing very large amount of data. Data stored on paper that filled the shelves of a registrar office can be stored in a single computer with larger storage capacity. This saves space, money to buy paper, ink, and shelves. This also helps to have backup (copy) of the data and put it somewhere else for security purpose. Now day computers can store data in multiples of tens of Giga bytes. You can also put multiples of hard disks in a computer to increase its storage capacity.

Speed

These days, computers process tasks in very short period of time. They can accomplish tasks in Nanoseconds or less. So they can perform very repetitive activities in slice of time. *Computers can process millions of instruction with in a single second.* The speed of the computer can be measured either in Mega byte or Giga byte.

Accuracy

Once well programmed, computers accomplish tasks accurately. The set of instruction that drives the system determines the accuracy of their activities. Faulty instructions for data processing may lead to faulty result. This can be described by the term known as garbage in garbage out (GIGO).

Reliability

Reliability is the measure of performance of computers against some predetermined standard for operation with out any failure. Now a day's computers are used in sensitive areas that need very high reliability. For example hospitals are using computers in patient diagnosis, monitoring patient operations. They are also monitoring activities in industries that may cause failure or success of the company. Computers are also used in nuclear plants that need very high care and its failure may cause the destruction of a continent or the whole world. In general computers are becoming reliable devices even in life and death situations.

Flexibility

Computers are quite versatile in nature. It can perform multiple tasks simultaneously with equal ease. For example, you can listen music while you are writing some text. Computers can be used for transaction processing, computers can be used for designing, they can be used for communication, etc. In general, computers can perform many tasks as per the program (or set of instruction) which reside in the system.

Diligence/ Consistency

Computer, being a machine, dose not suffer from the human traits of tiredness and lack of concentration. It is able to carry repetitive and voluminous tasks. If one million calculations have to be performed, then the computer will perform the last one-millionth calculation with the same accuracy and speed as the first calculation.

Resource sharing

Initially computers used to be isolated machines. With tremendous growth of technologies, computers to day have the capability to connect to each other. This is to mean that computers are able to connect to each other by establishing a network so as to share data, information as well as resources like printers. By sharing data and information computer enables one to create large knowledge base.

Limitations of Computers

Even if computer is powerful device which have the ability to perform tremendous activities, it also has some drawbacks, this includes:-

- Computers can't decide how to be programmed. It is always persons or humans that are responsible for programming the computers.
- Computer is not intelligent device therefore it can only perform what it is instructed to do.
- Computers do not provide their own inputs unless people provide it with the inputs.
- Computer can not foresee, i.e. it can make plans based on information but it can't predict for its success.
- Interpretation of data and implementation of decisions is always left for humans.

Classification of computers

Computers also differ based on their data processing capabilities. There are different types of computers which are classified based on different categories of characteristics and are described below:

A. Classification based on purpose

According to the purpose or application it provides, a computer can be classified in to two: General purpose and special purpose computers

General purpose

These computers have the ability to perform a wide range of tasks. The computers have the ability to store numerous programs. These machines can be used for various applications, ranging from scientific as well as business applications. E.g. Computers that you use home and schools are general purpose computers.

Special purpose

This includes computers which are design to handle a specific problem or to perform a single task. They lacked versatility. However, being designed for specific tasks; they can be providing the result very quickly and effectively. These computers are used for airline reservation, satellite tracking, and air traffic control.

B. Classification based on method of operation

Based on the way they process data, computers are classified in to three:

Analog computers:

Are devices which operate by measuring? They deal with continues variable. They do not compute directly with numbers, rather, they operate by measuring physical magnitude such as pressure temperature, voltage, current and etc. It is continuous fluctuation of voltage over time.

E.g. Thermometer, voltmeter, speedometer

Generally, they are computers designed for specific purpose.

Digital Computers:

Unlike the analog computers, digital computers operate by counting rather than measuring. Deal with discrete variables. They operate directly upon numbers (or digits) that represent numbers, letters, or other special symbols. Digital computer is a computing device in which data is represented by discrete numerical quantities which represented by discrete voltage states (0s and 1s). They have very high accuracy and speed than analog ones.

E.g. Personal Computers

Hybrid Computers

The best features of analog and digital computers can be combined into a single device to form a hybrid computer. It processes the information by collecting input data with analog method, converts it into digital quantities, processes the digital values and provide the output in analog form.

C. Classification based on functionality

Depending on the functionality (size, speed, cost and performance), computer can be divide in to four categories as described below:

Microcomputers

Microcomputers (often called personal computers or PCs for short) are the smallest but most important and most frequently used type of computer particularly for end users. They are relatively small or compact computers having the capability of executing millions of instruction with in a second. Basically they can be grouped into three: Laptop, Palmtop and Desktop computers.

Desktop: Desktop computer is the most widely used type of personal computer (microcomputers). Desktop computers have detachable parts. However, since it.s size is larger than the other types of personal computers, it is not easily portable.



Laptop: laptop computers are smaller versions of microcomputers about the size of a briefcase designed for portability. People can easily carry these personal computers with them in their car, on airplane, or when walking from one location to another. Unlike desktop PCs that have mostly detachable components, laptops include all their components (except their printer) on a single unit.

Palmtop: Palmtop computer is the smallest version of microcomputer which has the same size of a pocket calculator. It is the most portable computer and is growing in popularity among the latest entries in the microcomputer market. Palmtops are typically used for a limited number of functions, such as maintaining personal calendar, name and address files, or electronic worksheets.

Minicomputer

Minicomputer is midrange computer which is able to process and store more data than most microcomputers but is smaller and less powerful than mainframe computer system. It is designed to meet the computing needs for several people simultaneously in a small to medium sized business environment.

- Since it is about the size of a two drawer file cabinet, its size prevents it from being easily portable as compared to microcomputers.
- Minicomputers cost less to buy and maintain than mainframe computers.
- Is a multi-user system (carries out a processing task for multiple user working on terminals).
- It is capable of supporting 4 to 400 simultaneous users
- Since it is multi-user system it is widely used in interactive application in industries, scientific laboratories, research organizations, universities and colleges etc.
- It is also used for real time control and engineering design work.

Some widely used minicomputer are PDP 11, IBM (8000 series), and VAX 7500.

Mainframes

A mainframe is an ultra-high performance computer made for high volume, processor-intensive computing task. It consists of a high-end computer processor, with related peripheral devices, capable of supporting large volume of data processing, high performance online transaction processing system, and extensive data storage and retrieval.

- It is physically larger than micros and minis and usually has processors with faster instruction processing speeds.
- A mainframe computer is generally placed in a special computer room where environmental factors, such as temperature, humidity, dust and air conditions are closely monitored. And also because of the computer's cost and the value of the information stored there, the rooms have security systems allowing only authorized personnel to enter.
- It is capable of supporting around 1000 multiple users working at time. Therefore, it is designed to handle the information processing need of organization with many employees and customers or with complex computational problems.
- They are also used as the center of computer networking. These computers are used by organizations that have enormous and complex data processing assignments.
- Widely used in business or government organization to provide a centralized control, storage, processing and management. Some example of mainframe computers are IBM.s ES000, VAX 8000, and CDC 6600.

Supercomputer

The term supercomputer has been coined to describe a category of extremely powerful computer designed for high-speed processing. A supercomputer is generally characterized as being the fastest, most powerful, which can resolve a complex mathematical equation in a few hours, which would take a scientist a life time with paper and pencil.

- It is the most expansive computer designed for an intensive tasking.
- As many as sixty miles of wiring are closely packed inside supercomputers, and tremendous amounts of heat are generated. Because of this, supercomputers demand special cooling requirement and the room itself should be air conditioned.

- In addition, highly trained data processing professionals are required to operate supercomputers.
- Typically, super computer used to solve multi-variant mathematical problems of existent physical process, such as aerodynamics, metrology, and plasma physics.
- These computers can take inputs from over 10,000 individual computers and users at the same time.
- Super computers are largely used by research organizations, military defense systems, national weather forecasting agencies, large corporations, aircraft manufacturer, etc.

CRAY-3, Cyber 205, PARAM are some well known super computers.

Uses of Computers

For the last few decades, computer technology has revolutionized the businesses and other aspects of human life all over the world. People use computers in many ways. Some application areas of computers are listed below.

Science: scientists have been using computers to develop theories, to analysis, and test the date. The fast speed and the accuracy of the computer allow different scientific analyses to be carried out. E.g. detail study of how earth quakes affect buildings or population affect weather pattern, satellite based application.

Education: computers have also revolutionized the whole process of education. Currently, the classroom, libraries, and museums are effectively utilizing computers to make the education much more interesting.

Medicine and health care: now doctors are using computers right from diagnosing the illness to monitoring a patient's status during complex surgery.

Engineering /architectures: the architects and engineering are extremely using computers in designing and drawings. By using the techniques like virtual reality, architects can explore houses that have been designed

Entertainment: computers are used to control the images and sounds. The special effects, which mesmerize the audience, would not have been possible with out the computer. In addition, computerized animation and color full graphics have modernized the film industry.

Communication: due to computers, now a days communication have become fast, very easy and instant. E.g. E-Mail or Electronic, Mail is one of the communication media in which computer is used. Through e-mail the message and report are passed from one person to one or more person by the aid of computer and the telephone line. The advantage of this service is that while transferring the message it save time, avoids wastage of paper, and so on.

Business application: There are various concern for which computer are used such as in business applications (like at the sale counter) that require immediate response from computer. There are various concerns from which computers are used such as in business forecasting, to prepare pay bills and personal record, in banking operation and data storage, in the various types of Life

Insurance Business, and as an aid to management. *Publishing*: Computers have created a field known as DTP or Desk top publishing. In DTP, with the help of computer and a laser printer one can perform the publishing job all by oneself.

Review Questions

1. What is communication?

2. Write at least four uses of computers

3. Write the Classifications of Computers and their

uses

1.3. Data Representation in Computers

Objectives

- ❖ To understand how really data represented, flow, stored and processed inside the computer.
- ❖ To know the different coding systems & unit of data representation.

We enter data into a computer or review (see) output data from a computer using the letter of alphabet, various special symbols, and the numerals in the decimal number system. But since computer is an electronic device, which understands electrical flow (signal) there is no letter, symbol or number inside the computer. Computer works with binary numbers. As a semiconductor is conducting or isn't conducting; a switch is closed or opened. So data are represented in the form of a code that can have a corresponding electrical signal.

Number System

A number system is a set of symbols used for counting

There are various number systems

Ex. Decimal, Binary, octal-decimal, hexadecimal etc.

a) The Decimal Number System

The Decimal number system is based on the ten different digits (or symbols) 0,1,2,3,4,5,6,7,8,9.

We say it is a *base ten number system*

Though it is widely used, it is inconvenient for computer to represent data. So we need another number system.

b) The Binary number system

Binary number system is based on the two different digits; 0 and 1;

It is important to note that every decimal number system has its equivalent binary number; Conversion from binary to its equivalent decimal and from decimal to its equivalent binary is possible; Operation on binary number system is also possible

Binary	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001
Decimal	0	1	2	3	4	5	6	7	8	9

The most elementary form to organize data within a computer (an electronic device) is in the form of a code which utilizes the “ON” and “OFF” states of electric switches or there is “current” and “no current” condition of the electronic components;

We see that the nature of the electronic devices has similarity with the binary number system in that both represent only two elementary states;

It is therefore convenient to use binary number system to represent data in a computer;

An “ON” corresponds to a 1; An “OFF” corresponds to a 0;

In the computer “ON” is represented by the existence of a current and “OFF” is represented by non existence of current

On a magnetic disk, the same information is stored by changing the polarity of magnetized particles on the disk’s surface.

c) Octal number System (base 8) (Oct)

- It uses 8 symbols 0-7 to represent numbers;
- Like binary number system it is complete number system.

Example: 77 in octal equals 63 in decimal and 111111 in binary.

When we compare the octal with the decimal, 0-7 in octal is the same as 0-7 in decimal but 10 in octal is not the same as 10 in decimal because 10 in octal holds the position of 8 in decimal, off course 10 in octal is the same as 8 in decimal.

d) Hexadecimal number system (16) (hex)

➤ It uses 16 symbols to represent numbers. But for the numbers greater than 15 they represented in terms of the 16 symbols. for example the decimal number 16 represented as 10, 20 as 14, 30 as 1E and so on. These symbols are 0,1,...9,A,B,C,D,E,F

➤ When we compare the hexadecimal with decimal, 0-9 in hexadecimal is the same as 0-9 in decimal but 10 in hexadecimal is not the same as 10 in decimal, off course 10 in hexadecimal is equal to 16 in decimal because it holds the position of 16 in decimal.

Example			
DECIMAL	OCTAL	BINARY	HEXADECIMAL
0	0	0	0
3	3	11	3
8	10	1000	8
10	12	1010	A
16	20	10000	10

Units of Data Representation

When data is stored, processed or communicated within the computer system, it is packed in units;

Arranged from the smallest to the largest, the units are called *bit*, *byte* and *word*; these units are based on the binary number system;

BIT

- ❖ Bits are the smallest units and can convey only two possible states 0 or 1;
- ❖ Bit stands for binary digits;
- ❖ A bit is a single element in the computer, on a disk that stands for either “ON” indicating 1 or “OFF” indicating 0;

In the computer “ON” is represented by the existence of current and “OFF” is represented by the non-existence of current

On a magnetic disk, the same information is stored by changing the polarity or magnetized particles on the disk’s surface;

BYTE

Bits can be organized into large units to make them represent more and meaningful information; This large unit is called a byte and is the basic “unit of data representation” in a computer system. The commonly used byte contains 8 bits;

Since each bit has two states and there are 8 bits in a byte, the total amount of data that can be represented is 2^8 or 256 possible combinations;

Each byte can represent a character (a character is either a letter, a number or a special symbol such as +, -, ?, *, \$, etc

A byte is then used as a unit of measurement in the computer memory, processing unit, external storage and during communication;

If the computer memory is 524288 byte, this is expressed in short by saying 512KB, where KB stands for kilobyte.

1 Kilobyte (1KB) is 2^{10} or 1024 bytes

1 Megabyte (MB) is 2^{20} bytes or 2^{10} kilobytes

1 Gigabyte (GB) is 2^{30} bytes or 2^{20} kilobytes or 2^{10} megabytes

Word

Word refers the number of bits that a computer process at a time or a transmission media transmits at a time. Although bytes can store or transmit information, the process can even be faster if more than one byte is processed at a once;

A combination of bytes, then form a “word”. A word can contain one, two, three or four bytes based on the capacity of the computer. Word length is usually given in bits

We say that a computer is an 8-bits, a 16 bit, a 32 bit or a 64 bit computer to indicate that the amount of data it can process at a time.

The large the word length a computer has the more powerful and faster it is.

Coding Methods

It is possible to represent any of the character in our language in a way as a series of electrical switches in arranged manner;

These switch arrangements can therefore be coded as a series of equivalent arrangements of bits.

There are different coding systems, that convert one or more character sets into computer codes.

Some are: EBCDIC, BCD, ASCII-7 & ASCII-8.

In all cases, binary coding schemes separate the characters, known as character set, in to zones.

Zone groups characters together so as to make the coding scheme to decipher and the data easier to process. With in each zone, the individual characters are identified by digit code.

EBCDIC:

Pronounced as “Eb-see-dick” and stands for Extended Binary Coded Decimal Interchange Code.

Used usually for IBM Main frame model and in similar machines produced by other manufacturer. It is an 8-bit coding scheme: (00000000 – 11111111)

It accommodates to code 2^8 or 256 different characters. It is a standard coding scheme for the large computers.

Coding Example EBCDIC

Character	zone (4 Bit)	digit (4 Bit)
-----------	--------------	---------------

0-9	15	0-9
a-i	8	1-9
j-r	9	1-9
s-z	10	2-9
A-I	12	1-9
J-R	13	1-9
S-Z	14	2-9

Character	Zone	Digit
a	1000	0001
b	1000	0010
A	1100	0001
B	1100	0010
0	1111	0000
9	1111	1001

BCD (Binary Coded Decimal)

The 4 bit BCD, which represent any digit of decimal number by four bits of binary numbers. If you want to represent 219 using 4 bit BCD you have to say 0010 0001 1001

- ◆ 4 bits BCD numbers are useful whenever decimal information is transferred into or out of a digital system. Examples of BCD systems are electronic ousters, digital voltmeter, and digital clocks; their circuits can work with BCD numbers.
- ◆ BCD's are easy for conversion but slower for processing than binary. And they have limited numbers because with BCD we can represent only numbers 0000 for 0 and 1001 for 9 and, 1010, 1011, 1100, 1101, 1110, 1111 can't be used because 1010 represent 10 in decimal as 10 in decimal is 0001 0000 in BCD.

ASCII-7

ASCII stands for American Standard Code for Information Interchange.

Used widely before the introduction of ASCII-8 (the Extended ASCII)

Uses 7 bits to represent a character;

With the seven bits, 2^7 (or 128) different characters can be coded (0000000-1111111)

It has 3 zone and 4 digit bits positions.

Coding examples:

Character	zone (3 bit)	digit(4 bit)
0-9	3	0-9
A-O	4	1-15
P-Z	5	0-10

Character	Zone	digits
\$	010	0100
%	010	0101
A	100	0001
a	110	0001
b	110	0010

The ASCII System

Also referred as ASCII-8 or Extended ASCII. It is the most widely used type of coding scheme for Micro Computer system. ASCII uses 8-bits to represent alphanumeric characters (letters, digits and special symbols). With the 8-bits, ASCII can represent 2^8 or 256 different characters (00000000-11111111). Coding Examples

Character	zone (4 BIT)	digit (4 BIT)
0-9	3	0-9
A-O	4	1-15
P-Z	5	0-10
a-o	6	1-15
p-z	7	0-10

Character	zone (4 BIT)	digit (4 BIT)
a	0110	0001
b	0110	0010
A	0100	0001
B	0100	0010
?	0011	1111
+	0010	1011
1	0011	0001

Unicode

A Unicode is a 16 bit code that can represent more than 65,000 different characters. Theoretically, Unicode can represent characters in every language used today, as well as characters from languages that are no longer used. Such code will be very useful in international business and communication, where a document might need to contain sections of text in Japanese, English and Chinese

With Unicode, a software developer can modify a computer program to display on screen prompts, menu, and error messages in different language for use in specific countries or regions. Both Microsoft and Apple have announced plans to add Unicode support to their operating systems. It is a hot research issue.

Conversion from one Base to Another

The values that numbers have with a given number systems are largely determined by their positional notation. Positional notation means that the position of one symbol relative to other symbols in a given number system determines the value of that symbol. For example, the symbols 1 & 7 can represent either 17 or 71 depending upon their relative position to one another.

The decimal number 135 may be expanded as:

$$(135)_{10} = 1*10^2 + 3*10^1 + 5*10^0$$

- The subscript 10 is used to indicate 135 is in base 10 number system.
- The number 10 in binary is not the same as 10 in decimal because the value of 1 in the binary is not the same as the value of the 1 in the decimal.

The binary number 1101 may be expanded as $(1101)_2 = 1*2^3 + 1*2^2 + 0*2^1 + 1*2^0$

$$= (1*8) + (1*4) + (0*2) + (1*1)$$

$$= 8 + 4 + 0 + 1$$

$$= 13_{10}$$

*A number $X_1 X_2 X_3 \dots X_n$ in base M can be expanded as

$$(X_0 X_1 X_2 X_3 \dots X_n)_M = X_0 * m^{n-1} + X_1 * m^{n-2} + X_2 * m^{n-3} + \dots + X_{n-1} * m^1 + X_n * m^0 \text{ in base } 10$$

Conversion from decimal (base 10) to other base (base M)

To convert a decimal number X to a number in base m, divide X by m, store the remainder, again divide the quotient by M, store the remainder, and continue until the quotient is 0. And concatenate (collect) the remainders starting from the last up to the first. Ex.1 Convert 56_{10} to base two (binary) $X=56$ $M=2$

$$56_{10} = 111000_2$$

EX.2 Convert 78_{10} to base eight (Octal)

$$78_{10} = 116_8$$

EX. 3. Convert 30_{10} to base sixteen (hexadecimal)

$$30_{10} = 1E_{16}$$

Convert 16_{10} to base sixteen (hexadecimal)

$$16_{10} = 10_{16}$$

Conversion from base M to base 10 (decimal)

To convert a number X consists of digits $X_1 X_2 X_3 \dots X_n$ in base m to decimal; simply expand the number with base M. That is

$$(X_1 X_2 X_3 \dots X_n)_m = X_1 * m^{n-1} + X_2 * m^{n-2} + X_3 * m^{n-3} + \dots + X_i * m^{n-i} + \dots + X_{n-1} * m^1 + X_n * m^0$$

$$= Y_{10}$$

Example

1. Convert $(1001001)_2$ to decimal = 73
2. Convert $(234)_8$ to decimal = 156
3. Convert $(101)_8$ to decimal = 65
4. Convert $(A1B)_{16}$ to decimal = 2587
5. Convert $(101)_{16}$ to decimal = 257

Conversion from binary (base2) to Octal (base 8) or hexadecimal (base16) and vice versa

To convert a number in binary to octal group three binary digits together starting from the last digit (right) and if there are no enough digits add zeros to the front end (left) and find the corresponding Octal of each group.

Example. Convert 1001001 to octal

$$\begin{aligned} 1001001 &= 001,001,001 \\ &= 111_8 \end{aligned}$$

Convert 101101001 to octal

$$\begin{aligned} 101101001 &= 101,101,001 \\ &= 551_8 \end{aligned}$$

To convert binary to hexadecimal group four binary digits together starting from right and if there are no enough digits add zeros at the left.

EX. Convert 111100100 to hexadecimal

$$\begin{aligned} 111100100 &= 0001 \ 1110 \ 0100 \\ &= 1 \quad 14 \quad 4 \\ &= 1 \quad E \quad 4 \\ &= 1E4_{16} \end{aligned}$$

Convert 111001111 to Hexadecimal

$$\begin{aligned} 111001111 &= 0001 \ 1100 \ 1111 \\ &= 1 \quad 12 \quad 15 \\ &= 1 \quad B \quad F \\ &= (1BF)_{16} \end{aligned}$$

To convert from Octal to binary, convert each octal digit to its equivalent 3 bit binary starting from right.

EX. Convert $(675)_{\text{eight}}$ to binary

$$\begin{aligned} 675_{\text{eight}} &= 110 \ 111 \ 101 \\ &= 110111101_{\text{two}} \end{aligned}$$

Convert 231_{eight} to binary

$$\begin{aligned} 231_{\text{eight}} &= 010 \ 011 \ 001 \\ &= 10011001_{\text{two}} \end{aligned}$$

To convert from Hexadecimal to binary convert each hex. Digit to its equivalent 4-bit binary starting from right.

Ex. Convert 234_{16} to binary

$$\begin{aligned} 234_{16} &= 0010 \ 0011 \ 0100 \\ &= 1000110100_2 \end{aligned}$$

Convert 2AC to binary
 $2AC_{16} = 0010\ 1010\ 1100$
 $= 1010101100_2$

Conversion from Octal to hexadecimal and vice versa

To convert from Octal to hexadecimal, first we have to convert to binary and the binary to hexadecimal. To convert from hexadecimal to Octal, first we have to convert to binary and then the binary to Octal.

EX.1. Convert 235_8 to hexadecimal
 $235_8 = 010\ 011\ 101$
 $= 0000\ 1001\ 1101$
 $= 0\ 9\ 13$
 $= 9D_{16}$

Convert 1A to Octal
 $1A = 0001\ 1010$
 $= 000\ 011\ 010$
 $= 0\ 3\ 2$
 $= 32_8$

Summary of conversion from one base to another base

From base	To base	Method
2	10	Expand binary number in powers of 2
10	2	Factor the decimal number by 2
2	8	Group 3 binary digits together
8	2	Each Octal digit is converted to 3 binary digits
2	16	Group 4 binary digits together
16	2	Each hexadecimal digit is converted to 4 binary digits
8	10	Go from 8.....2.....10
10	8	Go from 10 2.....8
16	10	Go from 16 2.....10
10	16	Go from 10 2.....16
8	16	Go from 8 2.....16
16	8	Go from 16 2.....8

Converting decimal number with fractions to Binary.

- First change the integer part to its equivalent binary.
- Multiply the fractional part by 2 and take out the integer value, and again multiply the fractional part of the result by 2 and take out the integer part, continue this until the product is 0.
- Collect the integer values from top to bottom & concatenate with the integer part.

Ex. A) Convert 12.25_{10} to binary 1100.01
 B) Convert 3.1875 to binary 11.0011

?? What if the decimal fraction has a fraction part that can never be converged to 0? For example, what will be the binary equivalent of the number 0.6? Does it mean that there are cases where computers cannot provide exact results? [Hint: guarding digits]

Converting Binary with fraction to decimal.

To convert a binary number $Y_1Y_2Y_3Y_4Y_n.d_1d_2d_3\dots d_m$ to decimal first convert the integer part to decimal by using

$y_1y_2y_3y_4\dots y_n = y_1*2^{n-1} + y_2*2^{n-2} + \dots + y_j*2^{n-j} + \dots + y_{n-1}*2^1 + y_n*2^0 = Q$ and convert the fractional part to decimal by using

$d_1d_2d_3\dots d_m = d_1*2^{-1} + d_2*2^{-2} + d_3*2^{-3} + \dots + d_j*2^{-j} + \dots + d_m*2^{-m} = R$

then decimal equivalence of $y_1y_2y_3y_4\dots y_n.d_1d_2\dots d_m$ will be $Q+R$ where Q is the integer part and R is the fractional part.

Ex1 : Convert 11001.0101 to decimal

$$\begin{aligned} 11001 &= 1x2^4 + 1x2^3 + 0x2^2 + 0x2^1 + 1x2^0 = 16+8+1 = 25 = Q \\ 0101 &= 0x2^{-1} + 1x2^{-2} + 0x2^{-3} + 1x2^{-4} \\ &= 0 + \frac{1}{4} + 0 + \frac{1}{16} = 0.3125 = R \end{aligned}$$

=> 11001.0101 = 25.3125.

Ex 2: Convert 1000.1 to decimal

$$\begin{aligned} 1000 &= 1+2_3 + 0+0+0 = 8 \\ 1 &= 1x2^{-1} = \frac{1}{2} = 0.5 \\ 1000.1 &= 8.5_{10} \end{aligned}$$

Conversion from Octal or hexadecimal with fraction to binary.

- ◆ Convert each Octal/hexadecimal digit to its equivalent 3/4-bit binary digit.
- ◆ Collect the binary sequences by separating the integer part binaries from the fractional part binaries with point (.)

Conversion from Octal with fraction to hexadecimal

- ◆ To convert from Octal to hexadecimal, first convert the Octal to binary and then the binary to hexadecimal

Conversion from Hexadecimal with fraction to octal

- ◆ To convert from hexadecimal to Octal, first convert the hexadecimal to binary and then the binary to Octal.

Conversion from octal/hexadecimal with fraction to decimal.

- ◆ To convert from Octal/hexadecimal to decimal, first convert to binary and –then the binary to decimal.

Binary Arithmetic

Computer understands only the language of binary numbers. Therefore, the machine performs what is called binary arithmetic (binary computation).

Binary addition

Binary addition operates by the same rule as decimal addition, except that it is simpler. A carry to the next higher order (or more significant) position occurs when the sum is decimal 2, that is, binary 10. Therefore, the binary addition rules may be written as follows:

$$0+0=0$$

$$0+1=1$$

$$1+0=1$$

$$1+1=0 \text{ plus a carry of 1 into the next position}$$

$$1+1+1=1 \text{ plus a carry of 1 into the next position.}$$

The last case occurs when the two binary digits in a certain position are 1s and there is a carry from the previous position.

Example1:

$$6+7=13$$

$$110+111=1101$$

Example2

$$19+31+10=60$$

$$10011+11111+1010=111100$$

Binary Subtraction

It operates by the same rule as decimal subtraction. The rule is as follows;

$$0-0=0$$

$$1-0=1$$

$$1-1=0$$

$$10-1=1$$

Example:

11100	28	101101	45	11001.011
- 11010	-26	- 111	-7	- 111.110
00010	=2	100110	=38	10001.101

Binary Multiplication:

- It is a very simple process that operates by the following obvious rulers:

(a) Multiplying any number by 1 rules the multiplicand unchanged

$$0 \times 1 = 0$$

$$1 \times 1 = 1$$

(b) Multiplying any number by 0 produces 0

$$0 \times 0 = 0$$

$$1 \times 0 = 0$$

Binary division

That is, the process for dividing one binary number (the dividend) by another (the divisor) is based on the rules for binary subtraction and multiplication and Similar to decimal division

$$\begin{array}{r} \text{Ex } 1111101 \quad | \quad 11001 \\ \underline{11001} \quad 101 \quad \quad \\ 11001 \quad \quad \quad \\ \hline \end{array}$$
$$\begin{array}{r} 11001 \\ 00000 \\ \hline 1111101 \div 11001 = 101 \end{array}$$

Representation of Negative numbers

There are different ways of representing negative numbers in a computer.

a) Sign- magnitude representation.

In signed binary representation, the left-most bit is used to indicate the sign of the number. Traditionally, 0 is used to denote a positive number and 1 is used to denote a negative number. But the magnitude part will be the same for the negative and positive values. For example 11111111 represents -127 while, 01111111 represents + 127. We can now represent positive and negative numbers, but we have reduced the maximum magnitude of these numbers to 127.

In a 5- bit representation we use the first bit for sign and the remaining 4- bits for the magnitude. So using this 5 bit representation the range of number that can be represented is from -15 (11111) to 15(01111)

Ex1 represent -12 using 5-bit sign magnitude representation

- first we convert 12 to binary i. e 1100

Now -12 = 11100

Ex2 Represent -24 using 8-bits

24=00011000

-24 = 1001100

In general for n-bit sign -magnitude representation the range of values that can be represented are $-(2^{n-1}-1)$ to $(2^{n-1}-1)$.

i.e. $2^{n-1} + 1$ to $2^{n-1} - 1$

Note: In sign magnitude representation zero can be represented as 0 or -0. This representation has two problems one is it reduces the maximum size of magnitude, and the second one is speed efficiency to perform arithmetic and other operations.

For sign magnitude representation, correct addition and subtraction are relatively complex, involving the comparison of signs and relative magnitude of the two numbers.

The solution to this problem is called the two's complement representation.

CHAPTER TWO

COMPUTER HARD WARE PHYSICAL PART

2.1. Input / Output Devices

A. Input devices

Input device are electro mechanical devices that use to feed information to the computer. These devices enable a computer user to enter data, commands, and program instruction into the computer system. Examples of common input devices include: Keyboard, Pointing devices, Mice, trackballs, joysticks, and touch pads, Light pens, microphones, Scanning devices, Digital cameras, Optical data reader.

Keyboard

Is the most common input device which used to enter data and instruction. It consists a set of typewriter-like keys that enable one to enter data into a computer. Consists four types of keys:

- Typing keys: include Letters and numbers
- Function key: found just above the typing key (F1 to F10/F12)
- Special purpose keys: arrow keys, caps lock, delete, insert, home etc.
- Numeric keypad: (0to 9, +,- *, /)
-

Pointing Devices

Theses use to the screen pointer on the screen. The principal pointing tools used with microcomputers are the mouse, the trackball, the joystick, and the touch pad, all of which have variations.

a. *Mouse*

Mouse is a hand-operated device that controls the movement of the cursor or pointer on a display screen. It is a small object that can be rolled along a rough flat surface so that the movement of the device is translated on to a screen pointer.

Types of mouse

- *Mechanical*: has a rubber or metal ball on its underside that can roll in all directions and mechanical sensors to detect the direction to which the ball is rolling, and move the screen pointer accordingly.
- *Opto-mechanical*: same as mechanical mouse, but uses optical sensors to detect motion of the ball.
- *Optical*- uses a laser to detect the mouse.s movement.

b. *Joystick*

A joystick is a pointing device that consists of a vertical handle, like a gearshift lever, mounted on a base with one or two buttons. Joysticks are principally used in video games, in some

computer-aided design systems, and in computerized robot systems. Special joysticks do exist for people who are unable to use a mouse or trackball.

c. Touch pad

Touch pads let you control the cursor/pointer with your finger. Touch pads are flat, rectangular devices that use a very weak electrical field to sense your touch. As you move your fingertip, the cursor follows the movement. Touch pads most found on many portable computer keyboards and on a system with a built- in screen sensor.

d. Scanners

Are input devices that can read text or illustrations printed on paper and translate the information into a form that a computer can use. It uses to translate a visual data in to digital data.

e. Optical data reader

This includes a different variation of input devices read and input data using light. One example is Bar code scanners, which used read computer readable code (bar code).

f. microphone

These use to capture and enter voice or sounds in to computer system for processing. Converts a person's (speech) input into digital form. Often used in multimedia systems.

B. Output Devices

Are devices which used to convert a machine readable code in to human readable by processing (converting) in to graphical, alphanumeric, or audiovisual form. In general they are a kind of peripheral device that enables a computer to communicate (send out) information to the user. Common types of output devices are: Monitor (visual displaying unit), Printer, and speaker

a. monitor

A monitor or visual displaying unit is the common output for text and graphics. Allow to have a visual output, which means output produced by a computer system appears visually on the display screen. There are two common types of monitors, these are

- LCD (liquid crystal display)



CRT (cathode ray tube) monitors



b. Printer

Printers are devices used for producing permanent output on paper. Such output is sometimes referred to as hard copy. Printers can be classified according to their printing speed, the quality of output produced, & the printing method. Accordingly, they are classified as:

- Impact
- Non-impact

i. Impact printers:

Use a pin or a hammer that strikes a paper and an inked ribbon to form a character.

Work like a typewriter. There are three types of impact printers:

dot-matrix printer
line printer and
character printers

Dot matrix printer: printer contains a print head of small pins that strike an inked ribbon, forming characters or images. In this printer, the characters and images are formed by wire rods pushed against a ribbon and paper. A careful examination of the characters shows that each is actually a collection of small dots. These printers are low cost, and simple. Speed is rated in term of line printed per minute.

Character printers: Print one character at a time. They can print 30 to 200 characters per second.

Line printers: can print a whole line of characters at once rather than a single character at a time.

Print a full line (up to 144 characters) at one time on a continuous form paper that can be up to 14 inches wide. Most widely used on large computers.

ii. Non-impact printers:

Non-impact printers are faster printers than impact printers. Non-impact printers form characters and images without direct physical contact between the printing machine and the paper. They use spray or toner powder than a ribbon. There are three types of non impact

printers: Ink-jet printer, thermal printer and laser printer

Ink jet printers: use a spray on to a paper to form character and graphics. Ink-jets can print in color; they are cheaper printers; but they are slower and print in a somewhat lower resolution than laser printers.

Thermal printer: use heat on a chemically treated paper to form character. The best example for this is a fax machine.

Laser printers: A laser printer creates images with dots. However, these images are created on a drum treated with magnetically charged ink-like toner (powder), and then transferred from drum to paper. Work like a photocopy machine. Laser printers produce resolutions at near-typeset quality; they are fast; they can print in many fonts; color printing is available in more expensive models.

c. Plotters

A plotter is a specialized output device designed to produce high-quality graphics in a variety of colors. Plotters are used for creating large hardcopy items, such as maps, architectural drawings, and 3-D illustrations items typically too large for regular printers. Plotters can produce high-quality multicolor documents and also documents that are larger in size than most printers can handle.

d. speaker

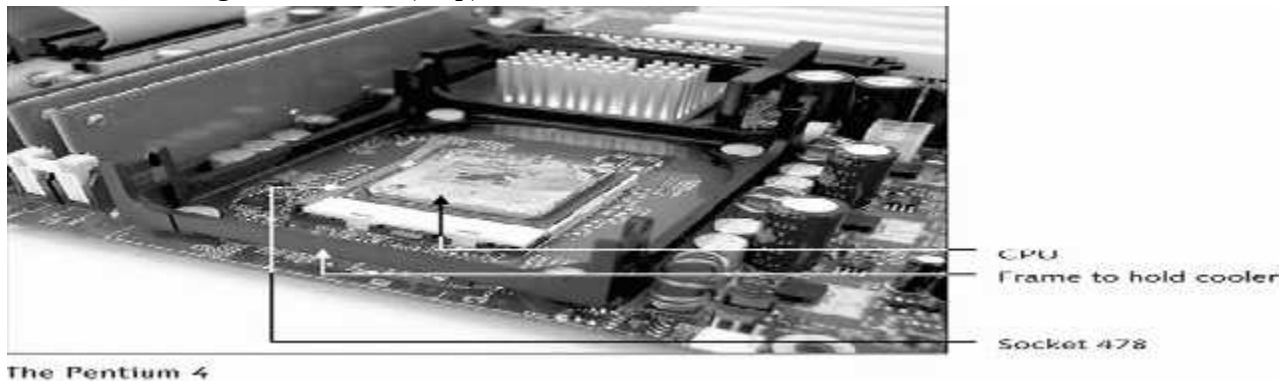
This are devises specially used by the computer for providing audio output.

2.2. Processing Unit

I. Central Processing Unit (CPU)

The CPU may be a single chip or a series of chips that performs Arithmetic and Logical operations and controls the operations of the other elements of the system. The CPU follows the instructions of the software to manipulate data into information. CPU also called as microprocessor, executes program instructions and performs the computer's processing activity.

- It is the part of a computer hardware that executes program instructions.
- Is the result of VLSI technology?
- The CPU is the collection of electronic circuits made up of millions of transistors placed onto integrated circuits (chip).



In general the CPU has two major functions

- Performing arithmetic and logical operation and
- Controlling every activity of the computer like:
 - Controlling internal and external devices
 - Controlling memory usage for storing data and instruction.
 - Controlling sequence of operation.

The CPU has three major components

- i. The Control Unit
- ii. The Arithmetic/Logic Unit (ALU)
- iii. Register

i. Arithmetic/Logic Unit (ALU)

Is the component of the CPU which contains the electronic circuitry that executes arithmetic and logical operations, that underline all computing capabilities and controls the speed of those operations.

- Arithmetic unit:- perform actual computing and calculations based on Fundamental mathematical operations: addition, subtraction, multiplication, and division
- Logical unit: - based on the instruction provided to it, perform logical comparison between data items. The comparison determines whether one information is greater than, less than or equal to the other. That is, $A = B$, $A > B$, $A < B$, $A \geq B$, $A \leq B$

ii. Control unit

The control unit is like the human brain and it controls all of the activities of computer. It directs the entire computer system to carry out every activity. That is, regulates the operations of the entire computer system, reads instruction from a memory and translates it into an activity; and regulates the amount of CPU time that each operation may consume.

- All computer activities are carried out according to instructions that the control unit receives.
- Fetches and store data and instruction from memory to register and visversal.
- It receives an instruction, decodes/ interprets and passes it to the ALU for execution.
- The control unit does not actually execute the instructions (just as the brain does not do the walking or the talking); rather it instructs or directs other processing elements to do so.
- The control unit tells the rest of the computer system how to carry out a program's instructions.
- It directs the movement of electronic signals between:
 - Main memory and the arithmetic/logic unit
 - Main memory and the input and output devices

iii. Registers

Registers are special high-speed circuitry areas that temporarily hold data, keep track instructions, and hold the location and results of operations under the control of CU.

- Are thought of as the CPU's working memory.
- Registers are contained in the processor and hold data to be processed immediately.
- Used to temporarily store data and instruction that relate to the process being executed
- Data and program instructions are loaded from main memory into the registers just before processing

2.3. Storage Unit

Memory unit

Computer systems need to store data and instruction internally or external to the system. Memory is a location that holds data and instruction.

There are two categories of memories:

- Primary memory/storage
- Secondary memory/storage

A. Primary memory (Main /Internal Memory)

Main memory is part of the computer that holds data and instruction for processing. It is an internal storage area which is physically located close to the CPU, to decrease access time. The CPU interacts closely with memory referring to it both for instructions, data and information.

Memory provides the CPU with a working storage area for program instructions and data. In general it can be used:

- To hold data and instruction temporarily receiving from input devices and sending them to output devices during processing
- To store data necessary while execution
- To provide additional space for programs in execution.
- To hold the computers operating system program
- To hold instructions of application software. E.g. Word processing, spreadsheet, etc.

Memory size (storage capacity)

Computer only can understand two circuit states “on or off”, resulting the concepts of representing data in the form of two voltage states. ‘On or high voltage’ is a state represented by “1” and ‘off or low voltage’ is a state represented by “0”. Everything that the computer does is based on the combination of “1’s” and “0’s”. The 1’s and 0’s are known as *bit*’s, which are the smallest memory unit.

The size of memory is measured by the number of storage locations it contains. Each storage location has a predetermined capacity. A byte is the amount of memory required to store one digit, letter or character. A byte is equal to eight bits. The bellow table shows the summery of units of memory:

Main Memory is divided into two:

- Read Only Memory (ROM)
- Random Access Memory (RAM).

a) Read-Only Memory (ROM)

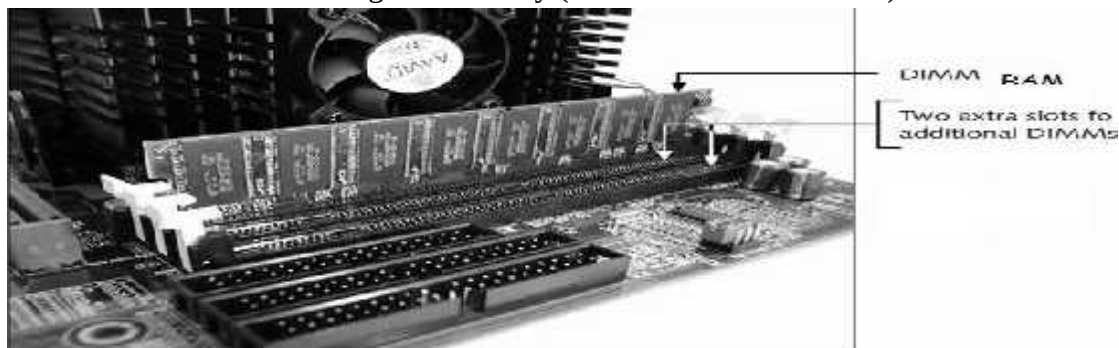
ROM is a kind of read only memory which is used to store initial start-up instruction and routines in BIOS (basic input/output system), which can only read by the CPU, each time switched on. The contents of ROM are not lost even in case of sudden power failure, thus making it non-volatile in nature. One important reason that a computer needs ROM is that it must know what to do when the power is first turned on. ROM is random access in nature which means the CPU can randomly access any location within the ROM. Improvement in technology for constructing flexible ROM comes in various types, namely, PROM (programmable read only memory), EPROM (electrically programmable read only memory), EEPROM (electrically erasable programmable read only memory).

b) Random-Access Memory (RAM)

A kind of memory that can be instantly changed is called read-write memory or random-access memory (RAM). RAM can be defined as a block of sequential memory location, each of which has a unique address determining the location and those locations containing the data element.

A memory address is a number that indicates a location on the memory chips, just as a post office box number indicates a slot into which mail is placed. Memory addresses start at zero and go up to one less than the number of bytes of memory in the computer. RAM is referred to as random-access memory because of its ability to access each byte of data directly.

Actually, read-only memory (ROM) is "random access" as well, so the names for the two types of memory can be misleading. It is best simply to remember that the data in ROM is permanent while the data in RAM changes constantly (i.e. it is volatile in nature).



DRAM on most motherboards today is stored on DIMMs

The electronic circuits used to construct RAM can be classified as *dynamic RAM* (DRAM), *synchronized dynamic RAM* (SDRAM), or *static RAM* (SRAM). DRAM, SDRAM, and SRAM all involve different ways of using transistors and capacitors to store data.

Dynamic RAM (DRAM):- gets its name from the fact that it must be refreshed frequently. (The term refreshing means recharging the RAM chips with electricity). Its chips must be recharged many times every second or they will lose their contents. Most PCs use DRAM as internal memory.

Static RAM: - does not need to be refreshed frequently and can hold its content for long time compared to dynamic RAM. SRAM is also considerably faster than DRAM. Consequently, SRAM is more expensive than DRAM and is not used frequently in PCS.

SDRAM (Synchronized DRAM):- A computer can access data in SRAM more quickly than it can access data in DRAM or SDRAM. However, the SRAM circuitry needs more power and generates more heat than DRAM or SDRAM. *The major difference between SDRAM and DRAM arises on the way in which refresh circuitry is created. DRAM contains separate, independent circuitry to refresh memory.* The refresh circuitry in SDRAM is synchronized to use the same hardware clock as the CPU.

Note: Computers processing speed can be increased by the following factors:-

a. Cache memory

- Cache memory is special form of memory that holds frequently accessed data or program instructions to improve the computer system's performance.
- A special form of high-speed memory that eliminates the need to move data to and from main memory repeatedly.
- A cache consists of ultra fast static random-access memory (SRAM) chips, which rapidly move data to CPU.
- Cache memory acts as a temporary holding/processing cell.
- It is a bridge between a slow device and a fast device.

As data requests pass between the CPU and main memory, they travel through cache memory and are copied there. Subsequent requests for the same data are recognized and captured by the cache memory cell. The cache cell then fulfills the data request to the CPU.

b. Coprocessors

When certain task is performed again and again, special purpose chips can be designed to handle it quickly and efficiently. These chips, called coprocessor chips are mounted on the processor board and function simultaneously with the primary processor chip

- By taking a frequently processing work away from the main processor, they free the central processing unit to focus on general processing needs so as to increase system performance.
- Operations performed by the coprocessor may be [floating point](#) arithmetic, [graphics](#), [signal processing](#), string processing, or [encryption](#)...

For example, Math coprocessor chips are used frequently by scientist and engineers who need to do large amount of intensive calculations.

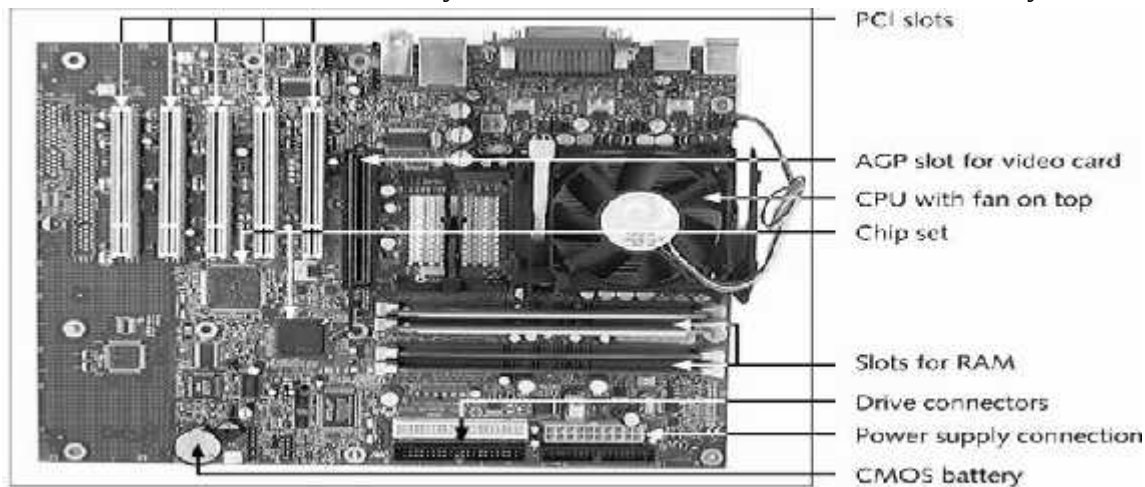
c. Increased chip density and integration

Chip density is the number of circuits on a single chip. Reducing the distance traveled, even a little, makes a tremendous difference in the computer's speed. This fundamental principle underlies the continual emphasis on miniaturization of circuits and having greater chip density.

Other Major System Unit Components

1. The Motherboard:

The motherboard, also called the system board, is the main circuit board in the system unit.



All hardware components are either located on the motherboard or directly or indirectly connected to it because they must all communicate with the CPU

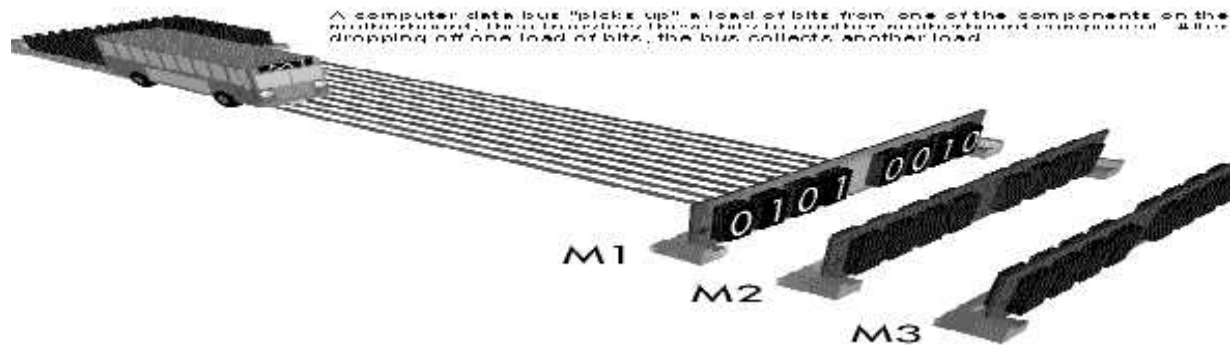
The motherboard acts as a container for the different components in the system unit:

- Microprocessor
- Any coprocessor chips
- RAM chips
- ROM chips
- Other memory types
- Expansion slots where additional circuit boards (called expansion boards) may be plugged in.

2. Computer Bus

The system bus is a metallic conductor through which information travels within a PC. It links the computer's main components, CPU, memory, control logic and I/O devices. In other words, it is simply a pathway through which data travels from one place to another inside the system unit. A bus that connects CPU, memory, and I/O components is known as system bus. System bus has three main variations:

- a. Data bus
- b. Address bus
- c. Control bus



- a. The data bus: is used to transfer data from memory to CPU or vice versa. In other words, it is responsible for transferring data between the processor and the slower main memory. The greater the number of wires, the greater the number of bits you can send and receive at the same time. The size of a data bus is typically can be 8, 16, 32, or 64 bits.
- b. The Address bus: is a set of wires carrying the addressing information used to describe the memory location to which the data is being sent or from which the data is being retrieved. Used to supply the address of a particular location for the CPU, while reading or writing operation is done by the CPU. For the CPU to read or write data, it must be able to specify the precise location of the data in system memory. Such locations are identified through the use of an address bus.
- c. The Control bus: carries signal that tell the computer to read or write data to/or from a given memory location, input device or output device. In other words, it synchronizes and co-ordinates the operation of a CPU with other devices in the computer. Controls the access to data and address bus and also used to transfer commands and timing signals.

B. Secondary memory (External/Auxiliary memory)

Secondary memories are a kind of memory which are external to the main circuit board and connected through a cable. They have high capacity than primary memory. Unlike RAM, is a part of the computer that retains data permanently after the power is turned off. Unlike ROM, it is possible to write to the secondary storage anytime. Secondary storage's can be categorized as:

- Magnetic storage and
- Optical storage

I. Magnetic storage devices

These are storage devices which are made up of iron oxide particle mixed with a binding agent. They use a magnetic technology to read and write data from and to the surface of storage area. The most common types of secondary storage are:

- Magnetic tap
- Magnetic disc

Magnetic tape

These are a kind of storage device which resemble with a video tape (VHS). Magnetic tape is approximately one half inch wide is made of magnetized plastic film. Data are stored on a magnetic tape by running the tape over the electromagnetic read/write head known as tape drive or streamer, which magnetizes small spots on the tape. It stores data sequentially. And also the data accessing mechanism is sequential. So to get to the data you are looking for, a computer must read every record (data) preceding it, for this reason it has slows access time. It is mostly used as a backup (to keep data) in different organization.

Magnetic disk

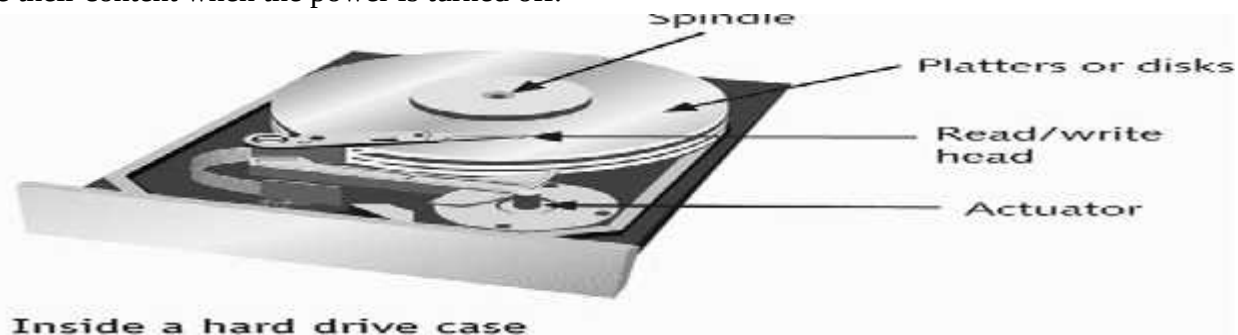
These devices store data as charges on a magnetically sensitive medium such as a disk coated with a fine layer of metallic particles. Magnetic disks allow to store and access information randomly and overcome the slow access time commonly found in tape files. The most common magnetic disk includes floppy, flash and hard disks.

Floppy Disk: is storage medium which is made up of flexible plastic covered with magnetic material. It uses a floppy drive, which use to write or read data from surface of floppy. It used to store programs and data for a longer period outside the computer system. Have low access time and low storage capacity.



The Hard Disk: it is mass storage media found mostly inside the system unit. It uses a spinning magnetic platter(s), to store bits. Hard disks can store enormous amounts of data, but it HAS lower access time than RAM.

But accessing data from hard disk is faster than accessing data from floppy disk. They also don't lose their content when the power is turned off.



II. optical disk/storage

Optical storage devices use the principle of light (laser technology) to store information. The data is actually recorded by burning on a tiny hole which is called pit to store 0's /1's.

The two common types are:

- CD and
- DVD

Compact disk (CD)

CD is a form of data storage device that uses optical material rather than magnetic material. The term compact disk is used because it use exactly the same format as the audio compact disc.

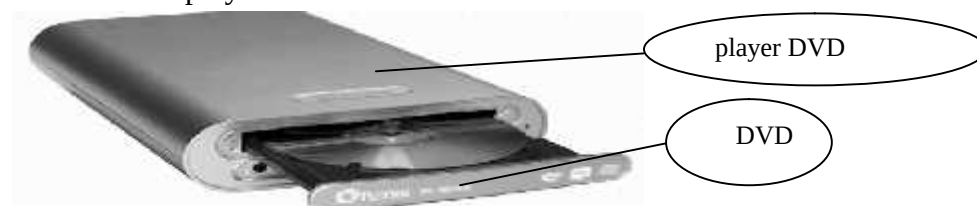
Have three variation, these are:-

- CD-R (CD Recordable, record/write once but read many times).
- CD-RW (CD rewritable, read/write many times).
- CD-ROM (CD read only memory).

Digital Video Disk (DVD):

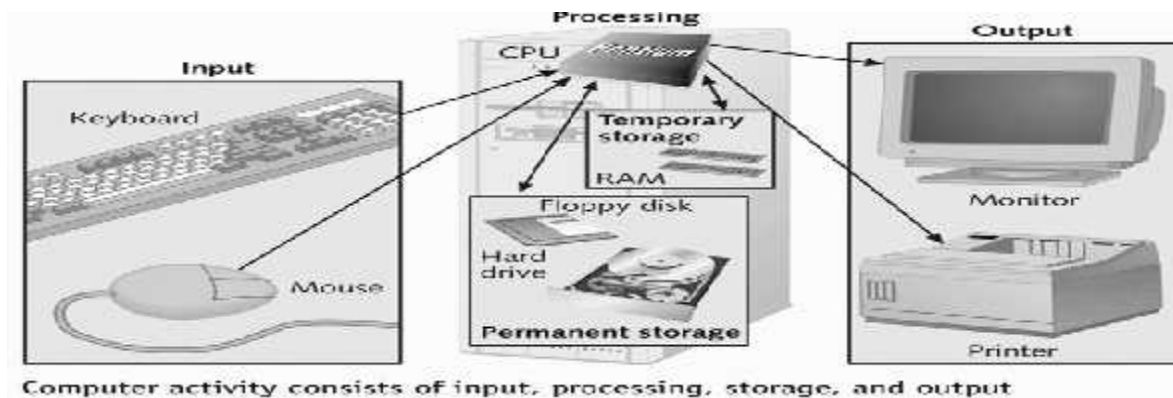
A DVD (stands for Digital Versatile Disc) disc looks just like a CD-ROM, but it can store more than 4 Gigabytes (GB) of information—as much as seven CDs. There are even rumored to be future DVD discs that can hold up to 17 Gigabytes. Thus, DVDs are often used to store *full-length movies* and other multimedia content that requires large amounts of storage space. It requires appropriate DVD drive to read/write this type of media. Below here are some variations of DVDs,

- DVD-ROM: stands for a DVD Read-Only Memory. This means you can only read information from a DVD; you can't add new information.
- DVD+R: (DVD Recordable) disc. The information you write or burn to a DVD+R is permanent and can't be changed or erased.
- DVD+RW (Rewritable) discs, can be re-written to up to 1,000 times. You can also modify and erase information on a DVD+RW disc. It uses DVD+RW drives which can also write to DVD+R discs.
- DVD-RAM: are rewritable DVD format that can be re-written too many times. DVD-RAM discs are beginning to look like an orphan format, since they won't work in most DVD players.



III. Input/ Output Devices

Input/ Output (I/O) devices are the part of the hardware through which the users communicate with the machine.



Review Questions

1. What is Processors?

2. Identify the different types of Processor and their uses their.

3. Define the meanings of bus

4. List out the different types of memory unit and their properties

CHAPTER THREE

OPERATING SYSTEM (OS)

3.1 History of operating systems

In the 1940s, the earliest electronic digital systems had no operating systems. Electronic systems of this time were so primitive compared to those of today that instructions were often entered into the system one bit at a time on rows of mechanical switches or by jumper wires on plug boards. These were special-purpose systems that, for example, generated ballistics tables for the military or controlled the printing of payroll checks from data on punched paper cards. After programmable general purpose computers were invented, machine languages (consisting of strings of the binary digits 0 and 1 on punched paper tape) were introduced that speed up the programming process (Stern, 1981).



OS/360 was used on most IBM mainframe computers beginning in 1966, including the computers that helped NASA put a man on the moon.

In the early 1950s, a computer could execute only one program at a time. Each user had sole use of the computer for a limited period of time and would arrive at a scheduled time with program and data on punched paper cards and/or punched tape. The program would be loaded into the machine, and the machine would be set to work until the program completed or crashed. Programs could generally be debugged via a front panel using toggle switches and panel lights. It is said that [Alan Turing](#) was a master of this on the early [Manchester Mark 1](#) machine, and he

was already deriving the primitive conception of an operating system from the principles of the [Universal Turing machine](#). Later machines came with libraries of [software](#), which would be linked to a user's program to assist in operations such as input and output and generating [computer code](#) from human-readable [symbolic code](#). This was the genesis of the modern-day operating system. However, machines still ran a single job at a time. At Cambridge University in England the job queue was at one time a washing line from which tapes were hung with different colored clothes-pegs to indicate job-priority



An operating system (OS) is a set of [programs](#) that manages [computer hardware](#) resources, and provides common services for [application software](#). The operating system is the most important type of [system software](#) in a computer system. Without an operating system, a user cannot run an application program on their computer, unless the application program is self booting.

Time-sharing operating systems schedule tasks for efficient use of the system and may also include accounting for cost allocation of processor time, mass storage, printing, and other resources.

For hardware functions such as input and output and [memory allocation](#), the operating system acts as an intermediary between application programs and the computer hardware,^{[1][2]} although the application code is usually executed directly by the hardware and will frequently call the OS or be interrupted by it. Operating systems are found on almost any device that contains a computer—from [cellular phones](#) and [video game consoles](#) to [supercomputers](#) and [web servers](#). Examples of popular modern operating systems include [Linux](#), [Android](#), [OS](#), [Mac OS X](#), and [Microsoft Windows](#).

3.2 Types

Real-time

A [real-time operating system](#) is a multitasking operating system that aims at executing real-time applications. Real-time operating systems often use specialized scheduling algorithms so that they can achieve a deterministic nature of behavior. The main objective of real-time operating systems is their quick and predictable response to events. They have an event-driven or time-sharing design and often aspects of both. An event-driven system switches between tasks based

on their priorities or external events while time-sharing operating systems switch tasks based on clock interrupts.

Multi-user vs. Single-user

A multi-user operating system allows multiple users to access a computer system concurrently. Time-sharing system can be classified as multi-user systems as they enable a multiple user access to a computer through the sharing of time. Single-user operating systems, as opposed to a multi-user operating system, are usable by a single user at a time. Being able to have multiple accounts on a Windows operating system does not make it a multi-user system. Rather, only the network administrator is the real user. But for a Unix-like operating system, it is possible for two users to login at a time and this capability of the OS makes it a multi-user operating system.

Multi-tasking vs. Single-tasking

When only a single program is allowed to run at a time, the system is grouped under a single-tasking system. However, when the operating system allows the execution of multiple tasks at one time, it is classified as a multi-tasking operating system. Multi-tasking can be of two types: pre-emptive or co-operative. In pre-emptive multitasking, the operating system slices the CPU time and dedicates one slot to each of the programs. Unix-like operating systems such as Solaris and Linux support pre-emptive multitasking. Cooperative multitasking is achieved by relying on each process to give time to the other processes in a defined manner. MS Windows prior to Windows 2000 used to support cooperative multitasking.

Distributed

A distributed operating system manages a group of independent computers and makes them appear to be a single computer. The development of networked computers that could be linked and communicate with each other, gave rise to distributed computing. Distributed computations are carried out on more than one machine. When computers in a group work in cooperation, they make a distributed system.

Embedded

[Embedded](#) operating systems are designed to be used in embedded computer systems. They are designed to operate on small machines like PDAs with less autonomy. They are able to operate with a limited number of resources. They are very compact and extremely efficient by design. Windows CE and Minix 3 are some examples of embedded operating systems.

Microsoft Windows

Microsoft Windows is a family of [proprietary](#) operating systems designed by [Microsoft Corporation](#) and primarily targeted to Intel architecture based computers, with an estimated 88.9 percent total usage share on Web connected computers.^{[12][13][14][7]} Currently, the most widely used version of the Windows family is [Windows XP](#),^[15] released on October 25, 2001. The newest version is [Windows 7](#) for workstations and [Windows Server 2008 R2](#) for servers.

Microsoft Windows originated in 1985 as an application running on top of [MS-DOS](#), which was the standard operating system shipped on most Intel architecture personal computers at the time. In 1995, [Windows 95](#) was released, combining MS-DOS 7.0 with Windows on the same medium, removing the need of getting a separate MS-DOS license. Keeping much legacy, it could run real-mode MS-DOS^{[16][17]} and 16 bits Windows 3.x^[18] drivers. [Windows Me](#), released in 2000, was the latest version of Windows of the Windows 95 family. Later versions have all been based on the [Windows NT kernel](#). Current versions of Windows run on [IA-32](#) and [x86-64 microprocessors](#), although Windows 8 will support ARM architecture. In the past, Windows NT supported a few non-Intel architectures.

Server editions of Windows are widely used. In recent years, Microsoft has expended significant capital in an effort to promote the use of Windows as a server operating environment. However, Windows' usage on servers is not as widespread as on personal computers, as Windows competes against Linux and BSD for server market share.

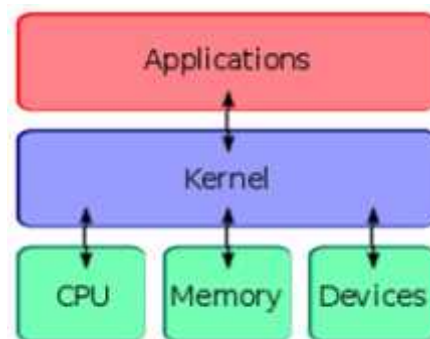
Other

Older operating systems which are still used in niche markets include [OS/2](#) from IBM and Microsoft; [Mac OS](#), the non-Unix precursor to Apple's Mac OS X; [BeOS](#); [XTS-300](#). Some, most notably [Haiku](#), [RISC OS](#), [MorphOS](#) and [FreeMint](#) continue to be developed as minority platforms for enthusiast communities and specialist applications. [OpenVMS](#) formerly from [DEC](#), is still under active development by [Hewlett-Packard](#). Yet other operating systems are used almost exclusively in academia, for operating systems education or to do research on operating system concepts. A typical example of a system that fulfills both roles is [MINIX](#), while for example [Singularity](#) is used purely for research.

Components

The components of an operating system all exist in order to make the different parts of a computer work together. All software—from financial databases to film editors—needs to go through the operating system in order to use any of the hardware, whether it be as simple as a mouse or keyboard or complex as an Internet connection.

Kernel



A kernel connects the application software to the hardware of a computer.

Main article: [Kernel \(computing\)](#)

With the aid of the [firmware](#) and [device drivers](#), the kernel provides the most basic level of control over all of the computer's hardware devices. It manages memory access for programs in

the [RAM](#), it determines which programs get access to which hardware resources, it sets up or resets the CPU's operating states for optimal operation at all times, and it organizes the data for long-term [non-volatile storage](#) with [file systems](#) on such media as disks, tapes, flash memory, etc.

Program execution

The operating system provides an interface between an application program and the computer hardware, so that an application program can interact with the hardware only by obeying rules and procedures programmed into the operating system. The operating system is also a set of services which simplify development and execution of application programs. Executing an application program involves the creation of a process by the operating system [kernel](#) which assigns memory space and other resources, establishes a priority for the process in multi-tasking systems, loads program binary code into memory, and initiates execution of the application program which then interacts with the user and with hardware devices.

Interrupts

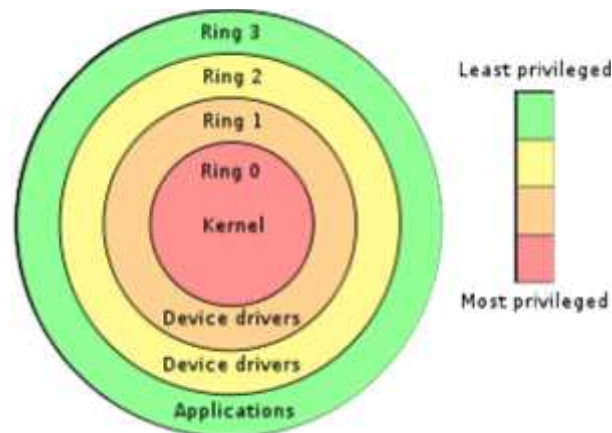
[Interrupts](#) are central to operating systems, as they provide an efficient way for the operating system to interact with and react to its environment. The alternative — having the operating system "watch" the various sources of input for events (polling) that require action — can be found in older systems with very small [stacks](#) (50 or 60 bytes) but are unusual in modern systems with large stacks. [Interrupt](#)-based programming is directly supported by most modern CPUs. Interrupts provide a computer with a way of automatically saving local register contexts, and running specific code in response to events. Even very basic computers support hardware interrupts, and allow the programmer to specify code which may be run when that event takes place.

When an interrupt is received, the computer's hardware automatically suspends whatever program is currently running, saves its status, and runs computer code previously associated with the interrupt; this is analogous to placing a bookmark in a book in response to a phone call. In modern operating systems, interrupts are handled by the operating system's [kernel](#). Interrupts may come from either the computer's hardware or from the running program.

When a hardware device triggers an interrupt, the operating system's kernel decides how to deal with this event, generally by running some processing code. The amount of code being run depends on the priority of the interrupt (for example: a person usually responds to a smoke detector alarm before answering the phone). The processing of hardware interrupts is a task that is usually delegated to software called [device driver](#), which may be either part of the operating system's kernel, part of another program, or both. Device drivers may then relay information to a running program by various means.

A program may also trigger an interrupt to the operating system. If a program wishes to access hardware for example, it may interrupt the operating system's kernel, which causes control to be passed back to the kernel. The kernel will then process the request. If a program wishes additional resources (or wishes to shed resources) such as memory, it will trigger an interrupt to get the kernel's attention.

Modes



Privilege rings for the [x86](#) available in [protected mode](#). Operating systems determine which processes run in each mode.

Modern CPUs support multiple modes of operation. [CPUs](#) with this capability use at least two modes: [protected mode](#) and [supervisor mode](#). The supervisor mode is used by the operating system's kernel for low level tasks that need unrestricted access to hardware, such as controlling how memory is written and erased, and communication with devices like graphics cards. Protected mode, in contrast, is used for almost everything else. Applications operate within protected mode, and can only use hardware by communicating with the kernel, which controls everything in supervisor mode. [CPUs](#) might have other modes similar to protected mode as well, such as the virtual modes in order to emulate older processor types, such as 16-bit processors on a 32-bit one, or 32-bit processors on a 64-bit one.

When a computer first starts up, it is automatically running in [supervisor mode](#). The first few programs to run on the computer, being the [BIOS](#) or [EFI](#), [boot loader](#), and the operating system have unlimited access to hardware - and this is required because, by definition, initializing a protected environment can only be done outside of one. However, when the operating system passes control to another program, it can place the CPU into [protected mode](#).

In [protected mode](#), programs may have access to a more limited set of the CPU's instructions. A user program may leave [protected mode](#) only by triggering an interrupt, causing control to be passed back to the [kernel](#). In this way the operating system can maintain exclusive control over things like access to hardware and memory.

The term "protected mode resource" generally refers to one or more CPU registers, which contain information that the running program isn't allowed to alter. Attempts to alter these resources generally causes a switch to supervisor mode, where the operating system can deal with the illegal operation the program was attempting (for example, by killing the program).

Memory management

Among other things, a multiprogramming operating system [kernel](#) must be responsible for managing all system memory which is currently in use by programs. This ensures that a program does not interfere with memory already used by another program. Since programs time share, each program must have independent access to memory.

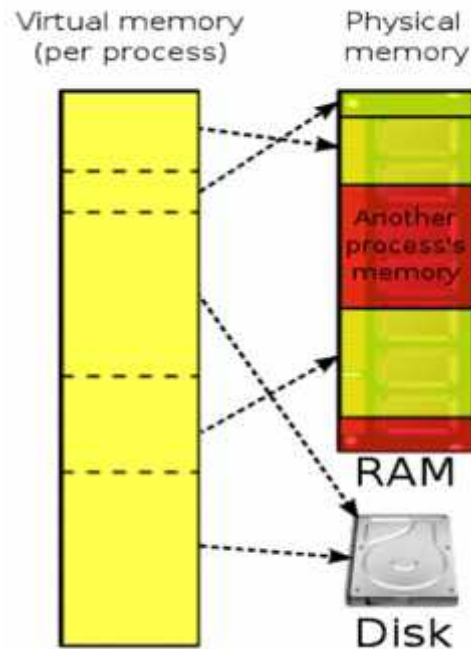
Cooperative memory management, used by many early operating systems, assumes that all programs make voluntary use of the [kernel](#)'s memory manager, and do not exceed their allocated memory. This system of memory management is almost never seen any more, since programs often contain bugs which can cause them to exceed their allocated memory. If a program fails, it may cause memory used by one or more other programs to be affected or overwritten. Malicious programs or viruses may purposefully alter another program's memory, or may affect the operation of the operating system itself. With cooperative memory management, it takes only one misbehaved program to crash the system.

[Memory protection](#) enables the [kernel](#) to limit a process' access to the computer's memory. Various methods of memory protection exist, including [memory segmentation](#) and [paging](#). All methods require some level of hardware support (such as the [80286](#) MMU), which doesn't exist in all computers.

In both segmentation and paging, certain [protected mode](#) registers specify to the CPU what memory address it should allow a running program to access. Attempts to access other addresses will trigger an interrupt which will cause the CPU to re-enter [supervisor mode](#), placing the [kernel](#) in charge. This is called a [segmentation violation](#) or Seg-V for short, and since it is both difficult to assign a meaningful result to such an operation, and because it is usually a sign of a misbehaving program, the [kernel](#) will generally resort to terminating the offending program, and will report the error.

Windows 3.1-Me had some level of memory protection, but programs could easily circumvent the need to use it. A [general protection fault](#) would be produced, indicating a segmentation violation had occurred; however, the system would often crash anyway.

Virtual memory



Many operating systems can "trick" programs into using memory scattered around the hard disk and RAM as if it is one continuous chunk of memory, called virtual memory.

The use of virtual memory addressing (such as paging or segmentation) means that the kernel can choose what memory each program may use at any given time, allowing the operating system to use the same memory locations for multiple tasks.

If a program tries to access memory that isn't in its current range of accessible memory, but nonetheless has been allocated to it, the kernel will be interrupted in the same way as it would if the program were to exceed its allocated memory. (See section on memory management.) Under UNIX this kind of interrupt is referred to as a [page fault](#).

When the kernel detects a page fault it will generally adjust the virtual memory range of the program which triggered it, granting it access to the memory requested. This gives the kernel discretionary power over where a particular application's memory is stored, or even whether or not it has actually been allocated yet.

In modern operating systems, memory which is accessed less frequently can be temporarily stored on disk or other media to make that space available for use by other programs. This is called [swapping](#), as an area of memory can be used by multiple programs, and what that memory area contains can be swapped or exchanged on demand.

Multitasking

Main articles: [Computer multitasking](#) and [Process management \(computing\)](#)

Further information: [Context switch](#), *Preemptive multitasking*, and *Cooperative multitasking*

[Multitasking](#) refers to the running of multiple independent computer programs on the same computer; giving the appearance that it is performing the tasks at the same time. Since most computers can do at most one or two things at one time, this is generally done via time-sharing, which means that each program uses a share of the computer's time to execute.

An operating system [kernel](#) contains a piece of software called a [scheduler](#) which determines how much time each program will spend executing, and in which order execution control should be passed to programs. Control is passed to a process by the kernel, which allows the program access to the [CPU](#) and memory. Later, control is returned to the kernel through some mechanism, so that another program may be allowed to use the CPU. This so-called passing of control between the kernel and applications is called a [context switch](#).

An early model which governed the allocation of time to programs was called [cooperative multitasking](#). In this model, when control is passed to a program by the kernel, it may execute for as long as it wants before explicitly returning control to the kernel. This means that a malicious or malfunctioning program may not only prevent any other programs from using the CPU, but it can hang the entire system if it enters an [infinite loop](#).

Modern operating systems extend the concepts of application preemption to device drivers and kernel code, so that the operating system has preemptive control over internal run-times as well. The philosophy governing [preemptive multitasking](#) is that of ensuring that all programs are given regular time on the CPU. This implies that all programs must be limited in how much time they are allowed to spend on the CPU without being interrupted. To accomplish this, modern operating system kernels make use of a timed interrupt. A [protected mode](#) timer is set by the kernel which triggers a return to supervisor mode after the specified time has elapsed. (See above sections on Interrupts and Dual Mode Operation.)

On many single user operating systems cooperative multitasking is perfectly adequate, as home computers generally run a small number of well tested programs. [Windows NT](#) was the first version of [Microsoft Windows](#) which enforced preemptive multitasking, but it didn't reach the home user market until [Windows XP](#) (since [Windows NT](#) was targeted at professionals).

Disk access and file systems

File systems allow users and programs to organize and sort files on a computer, often through the use of directories (or "folders")

Access to data stored on disks is a central feature of all operating systems. Computers store data on [disks](#) using [files](#), which are structured in specific ways in order to allow for faster access, higher reliability, and to make better use out of the drive's available space. The specific way in which files are stored on a disk is called a [file system](#), and enables files to have names and attributes. It also allows them to be stored in a hierarchy of directories or folders arranged in a [directory tree](#).

Early operating systems generally supported a single type of disk drive and only one kind of file system. Early file systems were limited in their capacity, speed, and in the kinds of file names and directory structures they could use. These limitations often reflected limitations in the

operating systems they were designed for, making it very difficult for an operating system to support more than one file system.

While many simpler operating systems support a limited range of options for accessing storage systems, operating systems like [UNIX](#) and [GNU/Linux](#) support a technology known as a [virtual file system](#) or VFS. An operating system such as UNIX supports a wide array of storage devices, regardless of their design or [file systems](#), allowing them to be accessed through a common [application programming interface](#) (API). This makes it unnecessary for programs to have any knowledge about the device they are accessing. A VFS allows the operating system to provide programs with access to an unlimited number of devices with an infinite variety of file systems installed on them, through the use of specific [device drivers](#) and file system drivers.

A connected [storage device](#), such as a [hard drive](#), is accessed through a [device driver](#). The device driver understands the specific language of the drive and is able to translate that language into a standard language used by the operating system to access all disk drives. On UNIX, this is the language of [block devices](#).

When the kernel has an appropriate device driver in place, it can then access the contents of the disk drive in raw format, which may contain one or more file systems. A file system driver is used to translate the commands used to access each specific file system into a standard set of commands that the operating system can use to talk to all file systems. Programs can then deal with these file systems on the basis of filenames, and directories/folders, contained within a hierarchical structure. They can create, delete, open, and close files, as well as gather various information about them, including access permissions, size, free space, and creation and modification dates.

Various differences between file systems make supporting all file systems difficult. Allowed characters in file names, [case sensitivity](#), and the presence of various kinds of [file attributes](#) makes the implementation of a single interface for every file system a daunting task. Operating systems tend to recommend using (and so support natively) file systems specifically designed for them; for example, [NTFS](#) in Windows and [ext3](#) and [ReiserFS](#) in GNU/Linux. However, in practice, third party drives are usually available to give support for the most widely used file systems in most general-purpose operating systems (for example, NTFS is available in GNU/Linux through [NTFS-3g](#), and ext2/3 and ReiserFS are available in Windows through FS-driver and rfstool).

Support for file systems is highly varied among modern operating systems, although there are several common file systems which almost all operating systems include support and drivers for. Operating systems vary on file system support and on the disk formats they may be installed on. Under Windows, each file system is usually limited in application to certain media; for example, CDs must use [ISO 9660](#) or [UDF](#), and as of [Windows Vista](#), [NTFS](#) is the only file system which the operating system can be installed on. It is possible to install GNU/Linux onto many types of file systems. Unlike other operating systems, GNU/Linux and UNIX allow any file system to be used regardless of the media it is stored in, whether it is a hard drive, a disc (CD,DVD...), a USB flash drive, or even contained within a file located on another file system.

Device drivers

A [device driver](#) is a specific type of computer software developed to allow interaction with hardware devices. Typically this constitutes an interface for communicating with the device, through the specific computer bus or communications subsystem that the hardware is connected to, providing commands to and/or receiving data from the device, and on the other end, the requisite interfaces to the operating system and software applications. It is a specialized hardware-dependent computer program which is also operating system specific that enables another program, typically an operating system or applications software package or computer program running under the operating system kernel, to interact transparently with a hardware device, and usually provides the requisite interrupt handling necessary for any necessary asynchronous time-dependent hardware interfacing needs.

The key design goal of device drivers is [abstraction](#). Every model of hardware (even within the same class of device) is different. Newer models also are released by manufacturers that provide more reliable or better performance and these newer models are often controlled differently. Computers and their operating systems cannot be expected to know how to control every device, both now and in the future. To solve this problem, operating systems essentially dictate how every type of device should be controlled. The function of the device driver is then to translate these operating system mandated function calls into device specific calls. In theory a new device, which is controlled in a new manner, should function correctly if a suitable driver is available. This new driver will ensure that the device appears to operate as usual from the operating system's point of view.

Under versions of Windows before Vista and versions of Linux before 2.6, all driver execution was co-operative, meaning that if a driver entered an infinite loop it would freeze the system. More recent revisions of these operating systems incorporate kernel preemption, where the kernel interrupts the driver to give it tasks, and then separates itself from the process until it receives a response from the device driver, or gives it more tasks to do.

Networking

Currently most operating systems support a variety of networking protocols, hardware, and applications for using them. This means that computers running dissimilar operating systems can participate in a common [network](#) for sharing resources such as [computing](#), files, printers, and scanners using either wired or wireless connections. Networks can essentially allow a computer's operating system to access the resources of a remote computer to support the same functions as it could if those resources were connected directly to the local computer. This includes everything from simple communication, to using networked file systems or even sharing another computer's graphics or sound hardware. Some network services allow the resources of a computer to be accessed transparently, such as [SSH](#) which allows networked users direct access to a computer's command line interface.

Client/server networking allows a program on a computer, called a client, to connect via a network to another computer, called a server. Servers offer (or host) various services to other

network computers and users. These services are usually provided through ports or numbered access points beyond the server's [network address](#). Each port number is usually associated with a maximum of one running program, which is responsible for handling requests to that port. A daemon, being a user program, can in turn access the local hardware resources of that computer by passing requests to the operating system kernel.

Many operating systems support one or more vendor-specific or open networking protocols as well, for example, [SNA](#) on [IBM](#) systems, [DECnet](#) on systems from [Digital Equipment Corporation](#), and Microsoft-specific protocols ([SMB](#)) on Windows. Specific protocols for specific tasks may also be supported such as [NFS](#) for file access. Protocols like [ESound](#), or esd can be easily extended over the network to provide sound from local applications, on a remote system's sound hardware.

Security

A computer being secure depends on a number of technologies working properly. A modern operating system provides access to a number of resources, which are available to software running on the system, and to external devices like networks via the kernel.

The operating system must be capable of distinguishing between requests which should be allowed to be processed, and others which should not be processed. While some systems may simply distinguish between "privileged" and "non-privileged", systems commonly have a form of requester *identity*, such as a user name. To establish identity there may be a process of *authentication*. Often a username must be quoted, and each username may have a password. Other methods of authentication, such as magnetic cards or biometric data, might be used instead. In some cases, especially connections from the network, resources may be accessed with no authentication at all (such as reading files over a network share). Also covered by the concept of requester identity is *authorization*; the particular services and resources accessible by the requester once logged into a system are tied to either the requester's user account or to the variously configured groups of users to which the requester belongs.

In addition to the allow/disallow model of security, a system with a high level of security will also offer auditing options. These would allow tracking of requests for access to resources (such as, "who has been reading this file?"). Internal security, or security from an already running program is only possible if all possibly harmful requests must be carried out through interrupts to the operating system kernel. If programs can directly access hardware and resources, they cannot be secured.

External security involves a request from outside the computer, such as a login at a connected console or some kind of network connection. External requests are often passed through device drivers to the operating system's kernel, where they can be passed onto applications, or carried out directly. Security of operating systems has long been a concern because of highly sensitive data held on computers, both of a commercial and military nature. The United States [Government Department of Defense](#) (DoD) created the [Trusted Computer System Evaluation Criteria](#) (TCSEC) which is a standard that sets basic requirements for assessing the effectiveness of security. This became of vital importance to operating system makers, because the TCSEC

was used to evaluate, classify and select computer systems being considered for the processing, storage and retrieval of sensitive or [classified information](#).

Network services include offerings such as file sharing, print services, email, web sites, and [file transfer protocols](#) (FTP), most of which can have compromised security. At the front line of security are hardware devices known as [firewalls](#) or intrusion detection/prevention systems. At the operating system level, there are a number of software firewalls available, as well as intrusion detection/prevention systems. Most modern operating systems include a software firewall, which is enabled by default. A software firewall can be configured to allow or deny network traffic to or from a service or application running on the operating system. Therefore, one can install and be running an insecure service, such as Telnet or FTP, and not have to be threatened by a security breach because the firewall would deny all traffic trying to connect to the service on that port.

An alternative strategy, and the only [sandbox](#) strategy available in systems that do not meet the [Popek and Goldberg virtualization requirements](#), is the operating system not running user programs as native code, but instead either [emulates](#) a processor or provides a host for a [p-code](#) based system such as Java.

Internal security is especially relevant for multi-user systems; it allows each user of the system to have private files that the other users cannot tamper with or read. Internal security is also vital if auditing is to be of any use, since a program can potentially bypass the operating system, inclusive of bypassing auditing.

User interface

A screenshot of the [Bourne Again Shell](#) command line. Each command is typed out after the 'prompt', and then its output appears below, working its way down the screen. The current command prompt is at the bottom.

Main article: [User interface](#)

Every computer that is to be operated by an individual requires a [user interface](#). The user interface is not actually a part of the operating system—it generally runs in a separate program usually referred to as a [shell](#), but is essential if human interaction is to be supported. The user interface requests services from the operating system that will acquire data from [input hardware devices](#), such as a [keyboard](#), [mouse](#) or [credit card reader](#), and requests operating system services to display [prompts](#), [status messages](#) and such on [output hardware devices](#), such as a [video monitor](#) or [printer](#). The two most common forms of a user interface have historically been the [command-line interface](#), where computer commands are typed out line-by-line, and the [graphical user interface](#), where a visual environment (most commonly with windows, buttons, icons and a [mouse pointer](#)) is present.

Graphical user interfaces

A screenshot of the KDE graphical user interface. Programs take the form of images on the screen, and the files, folders (directories), and applications take the form of icons and symbols. A mouse is used to navigate the computer.

Most of the modern computer systems support [graphical user interfaces](#) (GUI), and often include them. In some computer systems, such as the original implementation of [Mac OS](#), the GUI is integrated into the [kernel](#).

While technically a graphical user interface is not an operating system service, incorporating support for one into the operating system kernel can allow the GUI to be more responsive by reducing the number of [context switches](#) required for the GUI to perform its output functions. Other operating systems are [modular](#), separating the graphics subsystem from the kernel and the Operating System. In the 1980s UNIX, VMS and many others had operating systems that were built this way. GNU/Linux and Mac OS X are also built this way. Modern releases of Microsoft Windows such as [Windows Vista](#) implement a graphics subsystem that is mostly in user-space; however the graphics drawing routines of versions between [Windows NT 4.0](#) and [Windows Server 2003](#) exist mostly in kernel space. [Windows 9x](#) had very little distinction between the interface and the kernel.

Many computer operating systems allow the user to install or create any user interface they desire. The [X Window System](#) in conjunction with [GNOME](#) or [KDE](#) is a commonly found setup on most Unix and [Unix-like](#) (BSD, GNU/Linux, Solaris) systems. A number of [Windows shell replacements](#) have been released for Microsoft Windows, which offer alternatives to the included [Windows shell](#), but the shell itself cannot be separated from Windows.

Numerous Unix-based GUIs have existed over time, most derived from X11. Competition among the various vendors of Unix (HP, IBM, Sun) led to much fragmentation, though an effort to standardize in the 1990s to [COSE](#) and [CDE](#) failed for various reasons, and were eventually eclipsed by the widespread adoption of GNOME and KDE. Prior to [free software](#)-based toolkits and desktop environments, Motif was the prevalent toolkit/desktop combination (and was the basis upon which CDE was developed).

Graphical user interfaces evolve over time. For example, Windows has modified its user interface almost every time a new major version of Windows is released, and the Mac OS GUI changed dramatically with the introduction of Mac OS X in 1999.

Real-time operating systems

A real-time operating system (RTOS) is a multitasking operating system intended for applications with fixed deadlines ([real-time computing](#)). Such applications include some small [embedded systems](#), automobile engine controllers, industrial robots, spacecraft, industrial control, and some large-scale computing systems.

An early example of a large-scale real-time operating system was [Transaction Processing Facility](#) developed by [American Airlines](#) and [IBM](#) for the [Sabre Airline Reservations System](#).

Embedded systems that have fixed deadlines use a [real-time operating system](#) such as [VxWorks](#), [PikeOS](#), [eCos](#), [QNX](#), [MontaVista Linux](#) and [RTLinux](#). [Windows CE](#) is a [real-time operating system](#) that shares similar APIs to desktop Windows but shares none of desktop Windows' codebase. [Symbian OS](#) also has an RTOS kernel (EKA2) starting with version 8.0b.

Some embedded systems use operating systems such as [Palm OS](#), [BSD](#), and [GNU/Linux](#), although such operating systems do not support real-time computing.

CHAPTER FOUR

MICROSOFT WORD

4.1. Unit Objectives

This unit focuses on the hand of experience on the well known word processing application program Microsoft Word. After completing this unit you will be able to:

- o create, edit, format and print documents;
- o insert tables, footnotes, and endnotes;
- o insert graphics and edit them;
- o proof a document for spelling and grammar error, display statistics, lookup for synonyms and antonyms;
- o create mail merge.

4.2. Introduction

Dear learner! Cleared and organized writing is one of the most important skills for success of today's world. Microsoft Word can help you develop those skills as well as help you with your own writing needs.

It is a full-featured word processing program designed to help you in using the computer for any word related tasks like creating high-quality documents such as: announcement, letters, resumes, advertisements, newsletters, brochures, reports, and revise them easily. It can do more than this like editing, formatting and printing documents. Word processors can also offer facilities for check spelling, find synonyms, incorporate graphics created with another program, correctly align mathematical formulas, create and print form letters, perform calculations, display documents in multiple on-screen windows and enable users to record macros that simplify difficult or repetitive operations.

Starting Microsoft Word

Follow these steps to start Word. The general method of starting Word is:

- o Click the start button.
- o Click on program and.
- o Click on the Microsoft Word icon in the cascading menus.

Exploring Word Document Window

The Word document window contains several elements similar to the document windows and in its other applications, as well as some elements unique to Word.

Most of the tools and commands you need are easy to find on the standard and formatting toolbars and on the Word menus. The following is an introduction to various features of the Microsoft Word screen with a blank document Print Layout view.

Document view: With Word, you can display your documents in one of the four views:

Normal, Outline, Page Layout, or Outline Layout

- o Normal view is the most often used and shows such formatting as line spacing, font, font size and italics. Multiple column text is displayed in one continuous column.
- o Outline view displays the document in outline form. Headings can be displayed without the text. A heading can be moved and the accompanying text moved with it.
- o The Page Layout view shows the document as it will look when it is printed.
- o The Outline Layout View optimizes the document for outline viewing.

4.3. Editing a Document

You can use the Clipboard to copy and paste data easily between Windows applications. The Clipboard is a temporary storage area for cut or copied items. When you cut or copy texts or objects in one of the programs, Windows places that item on the Clipboard. You can then paste that item to the same document, a different document, or different programs. You can continue to paste the same item over and over again until you cut or copy another item.

Steps to be needed are:

1. In your Word document, select the information you want to copy.
2. Press Ctrl +C or click the Copy button on the Standard toolbar.
3. Switch to the other application and position the insertion point where you want to copy the information. If you are copying from Word to Excel, for example, switch to Excel and position the active cell pointer where you want the copied data to appear.
4. Press Ctrl +V or click the Paste button on the Standard toolbar to place the copied text in the new location.

NOTE: If you want to delete the original text and paste it somewhere else, use the keyboard shortcut Ctrl +X or the Cut button on the Standard toolbar in the previous Step 1. Remember if you "cut" or delete the original text, it removes it from the original location.

Copy leaves the original text intact and allows you to paste it in a new location. You can also use the right mouse button to access the shortcut menu with the Cut, Copy, and Paste commands.

Copying: Text

In Word, you can copy information within one document, between documents, or even between Word and another application.

Steps you are required to pass through:

1. Select the information you want to copy.
2. Press Ctrl +C or click the Copy button on the Standard toolbar.
3. Move the insertion point to the location where you want to copy the information.
4. Press Ctrl +V or click the Paste button on the Standard toolbar.

Go To: Using

If you need to go to another location in the document and you know the name for that location, using the Go To command is the quickest way to get there. You can choose to go to a specific page, section, line, bookmark, comment, footnote, endnote, field, table, graphic, equation, object and heading.

Steps needed to make it practical:

1. Press Ctrl +G or choose Edit, Go To.
2. In the Go To What list, select Page, Section, Line, Bookmark, Comment, Footnote, Endnote, Field, Table, Graphic, Equation, Object, or Heading depending on the item you want to go to.
3. In the Enter Item text box, type the number or name of the item you want to go to; or select from the list box, if available, the name of the item you want to go to, then press Enter or click the Go To button.
4. The insertion point will move to the location you specified and the Find and replace dialog box will remain open for you to choose another item to go to. If you are finished moving with the Go To command, choose Close on the dialog box; otherwise, repeat Steps 2 and 3 to go to another location.

4.4. Saving a Document

While you are creating a document, it is important to be able to save your information to use later or for reference. There are many options when saving a file.

Some steps to be needed are:

1. Press Ctrl +S or Choose File, Save. The Save As dialog box is displayed.
2. Type a file name in the File Name text box.
3. Change the location to store the file in the Save In list and select the folder you want to use to store the file, if different from the default location. Press Enter or click the Save button.

In many instances you will need to select information; change the character or paragraph format, copy or move information, or delete information. As with most Windows applications, Word works on the "select, then do" principle. If you are a touch typist, you don not have to move your fingers off the keyboard to select text.

Steps

1. Move the insertion point to the beginning of the text you want to select.
2. Use one of the key combinations in the following tables to select the text.

Select Text Using the Arrow Keys

Key	Action
Shift+[arrow down] or [arrow up]	Select one line at a time
Shift+> or <-	Select one character at a time
Shift +Ctrl+> or <-	Select one word at a time
Shift +Ctrl+[arrow down] or [arrow up]	Select one paragraph at a time

Select Text Using the Home and End Keys

Key	Action
Shift +Home	Select from the insertion point to the beginning of the current line
Shift +End	Select from the insertion point to the end of the current line
Shift +Ctrl +Home	Select from the insertion point to the beginning of the document
Shift +Ctrl +End	Select from the insertion point to the end of the document
Ctrl +A	Select the entire document, regardless of where the insertion point is

TIP: If you want to select a large range that is not entirely visible on-screen, you can combine the F8 (Extend Selection) key with the Ctrl +G (Go To) command. Press F8, press Ctrl +G, select the item you want to move to, press Enter, press Esc to close the Find and Replace dialog box, and press Esc again to turn off the Extend Selection mode.

Selecting text with the mouse is easy and convenient. You can select any amount of text, from a single character to an entire document. If you have good control when using the mouse and don't know the navigation keyboard shortcuts, it may be easier for you to select text using the mouse instead of the keyboard.

Steps advised for use are:

1. To select a small portion of text, click and hold the mouse button at the beginning of the text you want to select, drag the pointer in any direction to select the text as you move the mouse.
2. To select blocks of text, use any of the mouse actions in the following table.

Selecting Text Using the Mouse

To Select	Mouse Action
A word	Double-click the word
A sentence	Press Ctrl and click anywhere in the sentence
A line	Click the selection bar (blank margin to left of text)
Multiple lines	Click the selection bar and drag up or down

Double-click the selection bar

A paragraph

A document Triple-click the selection bar

Rectangular (not Click the top left of the column to be block or column selected, then hold Alt while you within a table) drag to select the text

4.5. Formatting a Document

To enhance the appearance and improve readability of your documents, you can format the text in paragraphs either before or after you enter the text. You can change the fonts, or apply attributes such as boldface, italic, underline, borders, patterns, and colors. You can also insert special characters or symbols.

Once you determine formatting that you want to use, you can create and apply styles to existing text. Many of the formats you will use most often are accessible on the Formatting toolbar. Additional formatting options are available on the Format menu.

Alignment: Aligning Text Horizontally

Word automatically aligns text on the left margin. You can choose to change the alignment to center, right, full justified, or back to left. For example, you may want to center text for report titles or letterhead information, justify text for newsletters or formal business letters, right-align text in a column of a list or in the header, and footer right-align the page number.

Steps required are:

1. Select the paragraph or paragraphs you want to change.
2. Press Ctrl +L (Left), Ctrl +E (Center), Ctrl +R (Right), or Ctrl +J (Justify) to change the alignment of the paragraph accordingly.

If you prefer to use the mouse, select the paragraph, then click the Align Left, Center, Align Right, or Justify buttons on the Standard toolbar.

Alignment: Aligning Text Vertically

By default, Word aligns text to the top margin in your document. You may need to align it differently, maybe in the center of the page for a report cover, or justify the paragraphs on the page between the top and bottom margins to make the layout of the pages more consistent. Aligning text vertically applies to sections. If you have not created section breaks, it applies to the whole document.

Steps

1. Move the insertion point inside the section where you want to align the text.
2. Choose File, Page Setup to display the Page Setup dialog box.
3. Click the Layout tab, then in the Vertical Alignment list, select Center, Justify, or Top to change the alignment.

4. In the Apply To list, select Whole Document, or Selected Text, then choose OK.

Auto Format: Using

AutoFormat analyzes the active document and applies a style to each paragraph that is currently formatted with the Normal or Body Text style. Word uses formatting rules to find elements such as bulleted and numbered lists, headings, body text, addresses, and letter closings. AutoFormat also removes extra paragraph marks, replaces straight quotation marks with smart quotes (typesetting quotation marks), changes asterisks (*) or hyphens (-) or other characters used in list items with a bullet character, and replaces spaces inserted with the space bar or Tab key to indents if needed.

This is one of the most productive tools in Word. You can type a business letter and not pay attention to the letter's formatting; then with the click of the mouse, change the letter into the formal business letter you need. After you have used the AutoFormat command, you can review your document and add any manual formatting to polish the look even further. You do want to make sure that Word did not misinterpret areas of the document and format it incorrectly.

Steps needed to make it practical include:

1. Type your letter without applying any formatting.
2. Choose Format, AutoFormat to display the AutoFormat dialog box.
3. In the Please Select a Document Type list, select Letter, General, or E-mail to define the type of document formatting you wants to apply.
4. Choose the Options button to turn off or on the different formatting options, choose OK to return to the AutoFormat dialog box, choose OK again to reformat the document, and assign specific styles to the different elements.
5. You can polish the letter's appearance by manually applying styles or formatting to any elements in the document.

Bullets

You may type a list of information and then decide you want to make it a bulleted list, or change a numbered list to a bulleted list. With the Formatting toolbar you can easily start a new bulleted list or add bullets to an existing list.

Steps to be used:

1. Select the list of information you want to apply bullets to, or position the insertion point where you want the new bulleted list to appear.
2. Click the Bullets button on the Formatting toolbar.

Case: Changing

You can use a shortcut to change the case of letters. You can use UPPERCASE, lowercase, or Title Case for your text. This is useful when you want to draw attention to the text, but you aren't sure what look you like best. You can cycle through the options to see what you want to use.

Steps

1. Select the text whose case you want to change.
2. Press Shift+F3 to change the case. Each time you press F3 you will toggle through three options: UPPERCASE, lowercase, and Title Case.

Columns

To insert columns:

1. Click Format
2. choose columns
3. indicate the number of columns, also select other settings

Adding a vertical line between columns can add interest to your page and make the readability of the page easier. For instance, when you create a newsletter with columns, including the vertical line between the columns makes it easier to follow and read. Lines are the length of the longest column in the section.

Steps

1. Position the insertion point in the section containing columns where you want to add a vertical line.
2. Choose Format, Columns to display the Columns dialog box.
3. Click the Line Between check box to activate the choice, and then choose OK.

Columns: Balancing Column Lengths

Word automatically balances the last line of text at the bottom of each column. In instances where the columns run out of text on a page, you may be left with two full-length columns and a third column that is only partially filled. You can balance column lengths so the bottom of all the columns is within one line of each other.

Steps

1. Position the insertion point at the end of the text in the last column of the section you want to balance.
2. Choose Insert, Break to display the Break dialog box.
3. Select the Continuous option in the Section Breaks part of the dialog box, and then choose OK.

Columns: Creating Columns of Equal Width

You can use columns to format your text on a page. The standard Word layout is newspaper style, where all columns are the same width, and text flows from the bottom of one column to the top of the next.

Steps

1. Switch to Page Layout View (click the Page Layout View button at bottom left of the document window).
- 2 Select the text (or to format the entire document with columns, select the document).
3. On the Standard toolbar, click the Columns button.
4. Drag the pointer to select the number of columns you need.

Columns: Creating Columns of Unequal Width

Although you can easily create columns using the Columns button, you can choose from more options when you use the Columns dialog box. You can define the dimensions for your own columns, or choose preset columns that include one wide and one narrow column (the wide column is twice as wide as the narrow column).

Steps

1. Select the text you want to format into columns (or to format the entire document with columns, select the document).
2. Choose Format, Columns to display the Columns dialog box.
3. In the Presets section of the dialog box, select the Left or Right option to create two unequal columns.
4. Increase the number in the Number of Columns box if you want more than two columns.
5. If needed, fine-tune the dimensions in the Width and Spacing sections for each column, then choose OK.

Columns: Removing

You can easily remove columns if you want to change the look in your document. (For more information on inserting columns, see "Columns: Creating Columns of Equal Width" and "Columns: Creating Columns of Unequal Width" before you complete this task.)

Steps

1. Select the text for the columns you want to remove.
2. Click the Columns button on the Standard toolbar and select one column.

Copying Formats: Using Format Painter

After you have applied character formatting to your text, you may decide that the formats you have used would look great in another area of the document. Instead of applying multiple

changes to each section of text, you can use the Format Painter tool on the Standard toolbar to copy the existing formats to other locations.

Steps

1. Select the text whose format you want to copy.
2. Click the Format Painter button on the Standard toolbar--click the button once to copy to one location or double-click the button to copy to multiple locations.
3. Select the text you want to change and release the mouse button. Repeat this process for all the locations you want to change. If you are changing more than one location, press Esc to turn off Format Painter when you are done.

Drop Cap: Adding

Visual interest can be added to paragraphs by using the drop cap at the beginning of the paragraph. A drop cap is a large capital letter of the first word that is set into a paragraph. The top of the drop cap aligns with the top of the first line of the paragraph and successive lines are indented to allow for space for the dropped text. Drop caps usually mark the beginning of key sections or major topics in a document.

Steps

1. Select the first letter, word, or section of the paragraph you want to format with a drop cap.
2. Choose Format, Drop Cap to display the Drop Cap dialog box.
3. Select Dropped or In Margin in the Position section of the dialog box.
4. In the Options section, select the Font from the drop-down list and increase or decrease the Lines to Drop if you don't want to use the default of three lines.
5. If you want to change the distance of the text from the drop cap, use the increment buttons on the Distance from Text option, then choose OK.

Fonts: Adding Colors and Highlight

Just as different fonts and attributes can enhance your documents, colors can help clarify meaning and help make important information stand out by differentiating parts of the document. If you have a color printer, you can print these colors.

Steps:

1. Select the text to which you want to add highlight color or font color (or both).
2. To apply highlight color (background), click the drop-down arrow on the Highlight button on the Standard toolbar, then select the color for the highlight from the choices on the palette.
3. To change font color, click the drop-down arrow on the Font Color button on the Standard toolbar, then select the color for the font from the choices on the palette.

Fonts: Types and Sizes

Fonts represent the various typefaces used in printed materials. The height of fonts is measured in points, and there are 72 points per inch. Therefore, an 18-point font will print 1/4 inch tall. You can also change many character attributes of fonts, such as applying bold, italic, underline, or strikethrough to the text.

Steps

1. Select the text you want to format.
2. Click the drop-down arrow next to the Font button on the Formatting toolbar. A list of available fonts appears. Click the font you want to use.
3. Click the drop-down arrow next to the Font Size button on the Formatting toolbar. A list of available font sizes for the selected font appears. Click the font size you want to use.

Formatting: Character Shortcut Keys

If you are a touch typist, you may find that formatting characters using keyboard shortcuts is easier and quicker than using the mouse, menus, and toolbars. If you use the shortcut key without selecting text first, the text you type next will have the formatting associated with the shortcut key. You can then press the shortcut key again when you want to turn the formatting off.

Steps

1. Select the text to format.
2. Use the appropriate keyboard shortcuts, described in the following table.

Format	Shortcut
Bold	Ctrl +B
Italic	Ctrl +I
Single underline	Ctrl +U
Word underline	Ctrl+ Shift +W
Double underline	Ctrl +Shift +D
SMALL CAPS	Ctrl +Shift +K
Superscript	Ctrl +Shift+=(equal sign)
Subscript	Ctrl+=(equal sign)
Copy formatting (like Format Painter)	Ctrl +Shift +C
Paste formatting	Ctrl +Shift +V
Remove formatting	Ctrl +space bar
Change case	Shift+F3
Next larger point size	Ctrl +Shift+>
Next smaller point size	Ctrl +Shift+<

Formatting: Paragraph Shortcut Keys

If you are a touch typist, you may find that formatting paragraphs using keyboard shortcuts is easier and quicker than using the mouse, menus and toolbars.

Steps:

1. Select the paragraph to format, or position your insertion point where you want the formatting to begin.
2. Use the appropriate keyboard shortcuts, described in the following table.

Format	Shortcut
Left align	Ctrl +L
Right align	Ctrl +R
Center	Ctrl +E
Full justify	Ctrl J
Increase indent	Ctrl +M
Decrease indent	Ctrl +Shift +M
Hanging indent	Ctrl T
Decrease hanging indent	Ctrl +Shift T
Return to normal formatting	Ctrl +Q

4.6. Page Setup

Changing the default page layout formatting enables you to choose whether your headers and footers are the same throughout the document, or change from odd page to even page. You can elect to print the header/footer on all pages except the first page; and you can specify how you want text positioned on the page. The defaults start all sections on a new page and align all text with the top of the page.

Steps

1. Choose File, Page Setup to display the Page Setup dialog box and then select the Layout tab.
2. In the Section Start drop-down list, select where you want new sections to start.
3. In the Headers and Footers section, click one of the options: Different Odd and Even or Different First Page, depending on the needs you have for the headers and footers in the document.
4. Select the Vertical Alignment drop-down arrow to choose between Top, Center, or Justified.
5. In the Apply To box, indicate to what portion of the document you want these changes to apply and then choose OK.

Page Setup: Changing Margins

The default margin settings are one-inch top and bottom margins, and 1 1/4-inch right and left margins. The default gutter margin is zero, and the header and footer default from the edge is one-half inch. You can change these defaults on a document-by-document basis, or you can permanently change the default.

Steps

1. In a new or existing file, choose File, Page Setup and then select the Margins tab.
2. Either select or type in the margins you prefer for all sides, including the From Edge settings for the Header and Footer.
3. If you will be binding the document and want the inside margin to remain constant, click Mirror Margins to toggle that feature on and off.
4. In the Apply To box, indicate to what portion of the document you want these changes to apply.
5. If you want these changes to be in effect with all new documents using the same template, click Default, then click yes. When you are finished, choose OK.

Page Setup: Changing Paper Size

With Word, you can work with many different sizes of paper and you can print in either portrait (vertical) or landscape (horizontal) orientation. The default is standard 8 1/2x11-inch paper in a portrait orientation.

Steps

1. Choose File, Page Setup to display the Page Setup dialog box, and then select the Paper Size tab.
2. Select the paper size that matches your needs from the Paper Size box.
3. If your paper measurements are not included in the Paper Size box, type in the appropriate measurements in the Width and Height text boxes. (You can scroll through and select what's there or you can overwrite with your unique requirements.)
4. Choose the orientation you prefer. In the Apply To box, indicate to what portion of the document you want these changes to apply.
5. If you want these changes to be in effect with all new documents using the same template, also click Default and then Yes. When you are finished, choose OK.

Page Setup: Changing Paper Source

The Paper Source tab tells your printer where to go to get the first page of a document and then where to go to get all subsequent pages. The default is Default Tray (Auto Select) for all pages. If you use preprinted company letterhead paper for letters, you need to tell Word where to pull the letterhead from, and where to pull the rest of the paper from.

Steps

1. Choose File, Page Setup to display the Page Setup dialog box, and then select the Paper Source tab.
2. In the First Page list box, select the location or source for the paper of the first page of each document for your printer.
3. In the Other Pages list box, select the location or source for the paper of all subsequent pages for your printer.
4. In the Apply To box, indicate to what portion of the document you want these changes to apply.
5. If you want these changes to be in effect with all new documents using the same template, click Default, then click yes. When you have finished, choose OK.

4.7. Graphics

Graphics is a small word used here to describe a large block of topics that encompasses clip art, custom color, drawings, graphs, movies, photos, pictures, and sound. A few capabilities of the graphic components in Word are omitted due to space constraints.

Clip Art: Adding, Changing, Deleting

The steps are essentially the same whether you need to add, change, or delete a clip art category. Each is done in the same dialog box.

Steps:

1. Choose Insert, Picture, and Clip Art. After the dialog box appears, click the Clip Art tab at the top of the dialog box. To rename a category, click the Edit Categories button.
2. In the Edit Category list box, select the category you want to revise, click the Rename Category button, and enter the new name. Go to Step 5.
3. To add a category, click the New Category button and type in its name. Go to Step 5.
4. To remove a category, select it and click the Delete Category button. In the Warning box, click Yes or No. Go to Step 5.
5. Click the Close button in the Edit Category list and again in the Microsoft Clip Gallery dialog box.

Clip Art: Changing Colors

Clip art images are actually grouped shapes, rectangles, squares and freehand shapes. If you find an image in the Clip Art Gallery that is perfect except for some or all of its colors, you can recolor it after it is inserted.

Steps

1. Choose View, Toolbars, and select both Picture and Drawing to display both toolbars. Click the image to recolor.

2. On the Drawing toolbar, click the Draw button drop-down arrow and choose Ungroup. Click outside the image to deselect it.
3. In the Picture toolbar, click the Set Transparent Color button. The pointer becomes the Transparent Color pointer, a four-pointed arrow overlaid with the white draw arrow pointer.
4. Click the color area you want to change. Only that portion of the image is selected. You can Shift +click to select several areas at once. Use the Fill Color or Line Color drop-down arrow to apply the color you want. Continue selecting areas of the image and re coloring as you like.
5. When all color changes are completed, use the Draw pointer to drag a rectangle around the entire image. Click the Drawing toolbar Draw button drop-down arrow and select Group or Regroup.

Drawing: AutoShapes

There are six categories of AutoShapes: lines, basic shapes, block arrows, flowcharts, stars and banners and callouts. Each category has a variety of choices in a drop-down menu. If you "can't draw a straight line," AutoShapes are for you. If you can draw, you will still find clever shapes that save time. In either case, there are also useful shapes to build attractive flow charts.

Steps:

1. Choose View, Toolbars, Drawing to open the Drawing toolbar and click the drop-down arrow in the AutoShapes button to see the six categories of shapes available: Lines, Basic Shapes, Block Arrows, Flow Chart, Stars and Banners, and Callouts.
2. Click the category you want to use. A drop-down menu of choices appears. Click the one you want and move your pointer to the document. The pointer becomes a dark cross.
3. Hold down the left mouse button and drag diagonally to create the shape. Release the mouse button when the shape is the size you want.
4. When you release the mouse button, the shape is automatically selected, indicated by eight white handles and yellow diamond handles. You can resize using the white handles. Use the yellow diamond handles to adjust the shape. Color the shape using the Fill Color and Line Color buttons.
5. To reposition the AutoShape, place the pointer inside the shape, hold down the left mouse button, and drag the shape into position.

Drawing: Creating Shapes

There are tools for drawing rectangles, ovals, lines, and arrows. After a shape is drawn, you can fill it with color, texture, pattern, or gradient as well as use color and line styles for the border around a shape. You can resize any shape you have drawn, so accuracy is not an issue.

Steps

1. Choose View, Toolbars, Drawing to open the Drawing toolbar. Click the Rectangle or Oval tool button for the shape you want to draw. The pointer becomes a dark cross.
2. with the pointer in your document, hold down the left mouse button as you drag diagonally. Release the mouse button to complete the shape.

3. When the shape is drawn, it is automatically selected and shows eight handles. The handles are hollow boxes. Move the pointer over the shape and it becomes the move pointer, a black, four-headed arrow with the white draw pointer affixed.
4. To reposition the shape, place the pointer inside the shape, hold down the left mouse button and drag the shape into position.
5. To resize the shape, place the pointer over one of the handles. The pointer becomes the resize pointer, a two-headed arrow. Hold down the left mouse button and drag the handle to revise the shape.

WordArt: Creating Objects

The process of creating and inserting WordArt has changed in Word. Now there is an entire toolbar dedicated to it.

There are buttons to Insert WordArt, Edit Text and open the WordArt Gallery. The Format Object button opens the Format WordArt dialog box to select options for Colors and Lines, Size, Position, and Wrapping. The WordArt Shape button is for selecting the shape of text flow. There is a Free Rotate button, a button to set WordArt Same Letter Heights, and another button to toggle text orientation between Vertical and Horizontal. You can adjust the alignment using the WordArt Alignment button to Left Align, Center, Right Align, Word Justify, Letter Justify, or Stretch Justify. Adjust WordArt Character Spacing using this button to choose Very Tight, Tight, Normal, Loose, Very Loose, or a custom percentage amount. Last on the toolbar is a button to Kern Character Pairs.

4.8. Endnotes, Footnotes and Footers and Headers

Endnotes provide additional information in a document without cluttering up the page. When inserted, endnotes are marked by a superscript number in the text with the reference information on the last page of the document. Endnotes are most often used in academic papers. Footnotes are also used to reference information, but are placed at the bottom of the page.

Steps:

1. Position the insertion point in the document where you want to insert the endnote mark.
2. Choose Insert, Footnote to display the dialog box. In the Insert section of the dialog box, select Endnote.
3. In the Numbering section of the dialog box, leave AutoNumber selected to use the default numbering style.
4. To use a different number sequence, choose the Options button at the bottom of the dialog box. Select the Number Format you want to use and any other option and then choose OK to return to the Footnote and Endnote dialog box.
5. When you have finished with your selections, choose OK to return to your document and type the endnote information in the Endnote pane provided. Click in your document to return to the document and leave the pane open, or choose Close to close the pane and return to your document.

Footnotes: Inserting

Footnotes provide additional information in a document without cluttering up the page. When inserted, footnotes are marked by a superscript number in the text with the reference information at the bottom of the page. Endnotes are also used to reference information, but are placed at the end of the document.

Steps

1. Position the insertion point in the document where you want to insert the footnote mark.
2. Choose Insert, Footnote to display the dialog box. In the Insert section of the dialog box, select Footnote.
3. In the Numbering section of the dialog box, leave AutoNumber selected to use the default numbering style.
4. To use a different number sequence, choose the Options button at the bottom of the dialog box, select the Number Format you want to use and any other option, then choose OK to return to the Footnote and Endnote dialog box.
5. When you are finished with your selections, choose OK to return to your document and type the footnote information in the Footnote pane provided. Click in your document to return to the document and leave the pane open, or choose Close to close the pane and return to your document.

Headers and Footers: Creating

Headers and footers contain information repeated at the top or bottom of the pages in a document. You can create simple headers or footers that only have a person's or company's name and address, or complex headers and footers that contain a company logo, the name of the author, date and time information, document statistics, or any other relevant information.

You can format headers and footers like any other part of a document, but they are positioned in the top and bottom margins of the page.

Steps:

1. With the document open, choose View, Header and Footer to display the Header pane in your document.
2. Type and format the information for your header.
3. To include the Page Number, Number of Pages, or current Date or Time, click the corresponding button on the Header and Footer toolbar.
4. To create footer, click the Switch between Header and Footer button on the toolbar and type and format your footer just as you did for the header. Click Close to return to your document.

Headers and Footers: Different for Sections

When using headers and footers, you may find the need to have different headers or footers in different parts of your document. To have the option for different sections of the document, you need to insert section breaks accordingly. For this task to work, you must first have inserted section breaks.

Steps

1. After you have applied section breaks, move the insertion point to the section you want to change. Choose View, Header and Footer to display the Header pane for the section you are in.
2. Notice at the top of the Header pane you now see a section number. Click the Same as Previous button on the Header and Footer toolbar to turn this option off.
3. Type and format the new header.
4. Click the Switch between Header and Footer button on the toolbar to type and format the new footer.
5. The new header or footer applies to the current section and all the following sections. To change the header or footer for the following or preceding sections, click the Show Next or Show Previous buttons on the toolbar.

Headers and Footers: First Page

In some cases, you may determine the need for a different first page header, either for the entire document or for sections within the document. For example, if your company prints letters on a preprinted letterhead for the first page, you may want to have no header on the first page and a header on the remaining pages in your letter.

Steps

1. Choose View, Header and Footer. Click the Show Previous or Show Next button to locate the section where you want a different first page header or footer.
2. Click the Page Setup button on the Header and Footer toolbar to display the Page Setup dialog box. Then click the Layout tab.
3. In the Headers and Footers section, select Different First Page to create specific first page headers or footers, and then choose OK.

The header or footer editing pane displays a title that says first page header (or footer) and the section number. If you are not on the first page header, the title just indicates page header (or footer) and the section number.

1. If you want no header or footer, leave the editing area blank; otherwise, create it now. Choose Close to return to your document.

Tables: Splitting

Sometimes you are better off having two tables rather than one complex table. Splitting a table creates a blank line between rows. If you position the insertion point in the first row, you get an extra blank line above the table.

Steps

1. Position the insertion point in a row below where you want the split to occur.

2. Choose Table, Split Table. You now have two individual tables and can edit and format each table separately. You could even move to the blank line between the tables and type information in paragraphs.

Tables: Typing and Moving Within

You use the mouse or the Tab key to move between cells of a table. When you are on the last cell and press Tab, Word adds a new row at the bottom of the table.

Steps

1. To type within a table, place the insertion point in the cell, type text, and press the Tab key to go to the next cell.
2. If you want to return to a previous cell, click in the cell or press Shift + Tab to move backwards.

4.9. Outputting

Word provides many ways for you to produce output. You can print form letters and envelopes with the Mail Merge feature and even select specific records to limit the number of form letters you send.

After you have previewed your data, you can send the data directly to a printer. You can print the current page, a group of pages (page range), or the whole document. You can even compress a document to fit on one page.

In addition, you can fax or e-mail your data directly from your Word documents.

Documents: Previewing

When you will be come ready to print your document, using Print Preview first allows you to see the layout of the pages. You can then make any necessary corrections before you print the document. The Print Preview toolbar contains many convenient buttons for zooming and displaying multiple pages. Not only can you view the document, but you can edit in the Print Preview mode, too.

Steps

1. Open the document you want to preview, and then click the Print Preview button on the Standard toolbar. The document is displayed so you can view one full page or multiple pages at a time. The Print Preview toolbar also helps view the document or make changes. The most common buttons are listed in the table following these steps.
2. Click the Magnifier button on the toolbar to edit in the document. Then click in the part of the document you want to edit.
3. Edit the document, revising and formatting text and even repositioning margins if needed. If the document is a little longer than a page and should fit on one page, click the Shrink to Fit button on the toolbar.
4. Click the Zoom Control button to see more of the page, click the Print button to print, and click the Close button to close Print Preview.

The most common buttons used on the Print Preview toolbar are listed in the following table. Use the pointer and the ScreenTip on the other buttons to see what they do.

Button	Action
Print	Prints the document using the printing options set in the Print dialog box.
Magnifier	Toggles the mouse pointer between a magnifying glass (for viewing the document) and the normal mouse pointer (for editing the document).
One Page	Displays the document one page at a time.
Multiple Pages	Displays the document in multiple pages. If you click this button and drag down and to the right, you can change the preview to display up to 24 pages.

Mail Merge: Creating Data Source

If you do not have a data source that contains your list of names and addresses for your merge document, you can create one using the Mail Merge Helper. You can also use address information from Outlook and Schedule. You need to create the main document first.

Steps

1. With the main document for your mail merge open, choose Tools, Mail Merge to display the Mail Merge Helper dialog box.
2. Choose Get Data under Step 2 on the dialog box; then choose Create Data Source to display the Create Data Source dialog box.
3. Scroll through the list of fields in the Field Names in Header Row list box to see commonly used field names provided by Word.
4. Edit the list of field names using the list following these steps and when finished, choose OK.
5. Word displays the Save As dialog box. In the File Name box, enter a name for the data source document and choose Save.
6. Word displays a decision box; choose Edit Data Source to enter information into the data source file you just created, or choose Edit Main Document to insert merge fields into the main document.

You can change field names in Step 4 through various options including the following:

- if you see any field names you won't use in your main document, select the name from the list and then choose the remove field name button.
- to add a field name that isn't listed, type the name in the field name text box, then choose add field name.
- to change the sequence of field names, select a field name in the field names in header Row list box, then click the up-arrow or down-arrow buttons. The top-to-bottom order of the fields is the order the fields will be in for data entry in the data source.

71 Review Questions

1. Explain all the functions of Ms-word.

-
-
2. Prepare a document using Microsoft Word. Include all the topics covered in this chapter. Your document should be clear and attractive.
-
-

CHAPTER FIVE

MICROSOFT EXCEL

5.1. Chapter Objectives

This unit covers spreadsheet management using Microsoft Excel. At the end of this chapter you are therefore would be able to:

- o Navigate within Excel worksheet;
- o Enter texts, numbers, etc.;
- o To create formulas and functions;
- o Create and manage charts and graphics;
- o Work with data management using Microsoft Excel.

5.2. Introduction

Dear Student! To start the Excel program, you first must start Windows 95. If you have not yet installed Excel, follow the installation instructions provided with the program.

Steps

1. To start Excel, click the Start button in the Windows taskbar.
2. Choose Programs, Microsoft Excel. Undo and Redo

Excel provides a built-in safety net, the Undo command that enables you to reverse your most recent action and return your workbook to its previous state. You must use Undo immediately after the most recent action you want to undo. The Undo command (in the Edit menu) changes to show the most recent action performed; if the Undo command is dimmed, you cannot undo the most recent action. Not all commands can be undone--you cannot undo a save operation, for example.

If you want to reverse the action of the most recent Undo command, use the Redo command. You can select the Undo or Redo commands multiple times to step back through your most recent actions or to redo the last set of actions that have been undone. However, you cannot undo a previous action without also undoing all actions that you performed after it; that is why you should choose Undo immediately following the command or action you want to reverse.

Steps

- To undo your most recent entry or command, choose Edit, Undo; or click the Undo button in the Standard toolbar.
- If you want to redo the entry or command you just undid, choose Edit, Redo; or click the Redo button in the Standard toolbar. Note that the Redo command is unavailable until you choose Undo.
- If you want to undo or repeat multiple actions (not just the most recent action), click the arrow beside either the Undo or Redo button on the Standard toolbar. A drop-down list of the previous actions that can be undone or redone appears. Select the actions you want to undo or redo.

Entering: Data in a Selected Range

To speed data entry, you can pre-select the range in which you want to enter data. Then, the active cell will move automatically to another cell in the range after you press a specified key. This feature is especially convenient for creating data-entry forms and lists.

Steps

1. Select the range in which you want to enter data. The first cell in the selected range is active and appears with a white background. Type the data you want to enter in the first cell.
2. Press Enter to move down one cell, press Shift +Enter to move up one cell, press Tab to move right one cell, or press Shift +Tab to move left one cell.

Entering: Data Series

Excel includes a feature named AutoFill, which enables you to enter sequences of values automatically. You start the sequence, and AutoFill analyzes the sequence and continues it for you in a specified range. You can use AutoFill for dates, months, years, positive and negative numbers, and so on.

Steps

1. To fill a range with a sequence of numbers, enter the numbers in the first two cells of the range. (These two cells can be in the same column or the same row.)
2. Select the two cells, then position the mouse pointer over the handle in the lower-right corner of the selected range; the pointer changes to a cross.

Drag the cross to the end of the range you want to fill with the sequence and release the mouse button; AutoFill completes the sequence of numbers.

Entering: Dates and Times

When you type a date or time, Excel converts your entry to a serial number. Time is recorded as a decimal fraction of a 24-hour day. If Excel recognizes your entry as a valid date or time format, you see the date or time on-screen.

Steps

1. Select the cell in which you want to enter the date or time.

To enter a date or time, enter the date into the cell using any of these formats: 11/6/97, 6-Nov-97, 6-Nov, Nov-97; or, enter the time into the cell using any of these formats: 21:41, 21:41:35, and 9:41 PM, 9:41:35 PM.

Entering: Numbers

Numbers are constant values containing only the following characters: 0 1 2 3 4 5 6 7 8 9 + - (), / \$ %. E e

You can enter integers, such as 24 or 973; decimal fractions, such as 908.37 or 0.72; integer fractions, such as 3 1/4 or 2/3; or scientific notation, such as 5.87137E+3. (See also "Entering: Text" and "Entering: Dates and Times.")

Steps

1. Select the cell in which you want to enter the number.

Type the number into the cell. To type a negative number, precede the number with a minus sign (-). Press Enter.

Entering: Text

Text entries can include a combination of alphabetical characters, numbers, and symbols. You can type up to 255 characters in a cell. By default, when you enter text in a cell, the text automatically aligns on the left side of the cell.

Occasionally, you may need to enter a number as a text entry. For example, you may need to create a text heading--such as (\$000)--that Excel would normally enter as a number. To make Excel accept numbers as text, type an apostrophe (') followed by the number--for example, '39,800.

Steps

1. Select the cell in which you want to enter text. Then, type the text into the cell, and press Enter.
2. Text you enter in a cell may appear to be truncated if the cell is not wide enough and if the cell to the right contains data. To automatically fit the column to its widest text entry, double-click the right boundary of the column letter.

Exiting Excel

Before you exit the Excel program, you should be sure to save all active files (if you want to save recent changes made to them) so you don't lose any data. Excel displays a message box reminding you to save your files if you try to exit the program without saving recent changes. (See "Saving: Workbooks" and "Workbooks: Closing a Workbook" in the section "File Management," before you complete this task.)

Steps

1. Choose File, Exit. If you have saved all changes in active workbook files, Excel closes. If a message box appears reminding you to save changes, click Yes to save changes, click No if you don't want to save changes, or click Cancel to return to Excel.

Go To: Jumping to a Specific Cell

If you need to jump to another location in the worksheet, and you know the cell address or named range for that location, using the Go To command is usually the quickest way to get there. If you choose a named range with Go To, the entire range is selected.

Steps

1. Display the worksheet containing the cell or named range you want to jump to. Then, choose Edit, Go To; or press F5.
2. In the Reference text box, type the cell address or the named range you want to go to, or select from the list box the named location you want to go to; then click OK.

Naming Cells and Ranges

Excel enables you to assign a name to a cell or range because names are usually easier to remember than cell references. It's much easier to recall a name like Qtr1, for example, than the cell address that refers to that range, such as D4:D6. Also, the meaning of the formula =Sales-Expenses is much clearer than the formula =C12-C25. Another advantage to using names is that names automatically adjust when you insert or delete rows or columns--you don't need to redefine the name.

Steps

1. To define a name, select the cell or range you want to name and click the arrow beside the name box in the formula bar.

Type the name for the selected cell or range; then press Enter.

Navigating in a Worksheet

To enter data in a cell, select ranges, and view areas of the worksheet, you first must move the cell pointer to the cell you want to manipulate. The active cell in the worksheet is indicated by a highlighted border. In Excel, you can move the cell pointer with both the mouse and keyboard.

Keys Useful for Worksheet Navigation

Although the mouse has become the tool of choice for many and is required for some tasks, there are still times when keyboard navigation can be quite useful. The following table summarizes the keys or key combinations you can use to navigate the Excel worksheet.

Worksheet Navigation Keys

Key	Action
-----	--------

[arrow down] or Enter	Moves down one row
[arrow up] or Shift +Enter	Moves up one row
-> or Tab	Moves right one column
<- or Shift +Tab	Moves left one column
Page Down	Moves down one screen
Page Up	Moves up one screen
Alt +Page Down	Moves right one screen
Alt +Page Up	Moves left one screen
Home	Moves to the first cell in the current row
Ctrl +Home	Moves to cell A1 of the current worksheet
End, Home	Moves to the bottom right corner of the current worksheet
Ctrl +Page Down	Moves to the next sheet in the workbook
Ctrl +Page Up	Moves to the previous sheet in the workbook

Steps

- To move the cell pointer with the mouse, click the cell you want to make active; if that cell is not visible, use the scroll bars to move to the area of the worksheet you want, and then click the cell.
- To move the cell pointer with the keyboard, use any keys or key combinations described in the table above.

Selecting: Cells and Ranges

In many Excel commands, such as to copy a range of cells or apply a cell format, you first must select the range of cells you want the command to affect. You can select cells with the mouse or keyboard. (If you want to navigate the worksheet using the keyboard, see "Navigating in a Worksheet" before completing this task.)

Steps

- To select a single cell, click that cell or use the keyboard navigation keys to move to that cell.
- To select a range of cells, click the first cell in the range; then hold down the mouse button and drag to the opposite corner of the range. Release the mouse button.
- If you want to select a large range that is not entirely visible on-screen, select the first cell in the range. Then scroll the worksheet until you see the opposite corner. Hold down the Shift key, and then click the opposite corner of the range. All cells between the two corners are selected.

Selecting: Cells Based on Content

In addition to using Go To to jump to a particular cell or named range, you also can use Go To to select cells by content or relationship to formulas. This command is useful if you want to select only cells containing items such as comments, constants, formulas, conditional formats, or objects like charts.

Steps

1. To check the entire worksheet for specific cell content, select a single cell; to check only cells within a range, select a range of cells.
2. Choose Edit, Go To; or press F5.

From the Go To dialog box, choose Special and select the desired option; then click OK.

Inserting and Deleting: Rows

Just as you can insert or delete columns in the worksheet, you also can insert blank rows or delete existing rows. In a list of information, you can insert a row if you want to add a new record of data, for example, or you can delete a row if you no longer want to include a specific record in the list.

Steps

1. If you are inserting a row, select the row header of the row you want to move down when you insert the new row; or, if you are deleting a row, select the row header of the row you want to delete.

To insert a row, choose Insert, Rows; or, to delete the selected row, choose Edit, Delete.

Inserting Worksheets

Each new workbook contains three worksheets by default. You can easily insert new worksheets (as many as 255 totals) at any time. If you are copying or moving existing worksheets, you do not need to insert a blank worksheet before you copy or move a worksheet.

Steps

1. Open the workbook to which you want to add a new worksheet.
2. Choose Insert, Worksheet. The new worksheet is inserted just before the current worksheet.

Drag the sheet tab of the new worksheet to where you want the worksheet to appear.

Moving: Between Worksheets

The sheet tabs at the bottom of each workbook enable you to quickly move among the worksheets in that workbook. If your workbook contains multiple worksheets and some of the sheet tabs are hidden, you can increase the width of the sheet tab area by dragging the tab split

box (the vertical bar just left of the horizontal scroll bar) to the right. If you still cannot see all the sheet tabs, use the tab scroll arrows to the left of the sheet tabs to move through the sheet tabs. With a single click, the tab scroll arrows enable you to move to the first sheet, previous sheet, next sheet, or last sheet in the workbook.

Steps

1. Display the sheet tab for the worksheet to which you want to move.
Click the sheet tab to move to that worksheet.

Moving: Cell Data

In Excel, you can move cell data within a worksheet, between worksheets, between workbooks, or even between Excel and another application. When you move (or cut) cell data, you also move the cell formatting with the data. Be sure you won't overwrite any existing data when you move the data (make room for the data first, if necessary). (See also "Copying: Cell Data.")

Steps

1. Highlight the cell or range you want to move; then click the Cut button on the Standard toolbar (or choose Edit, Cut).
2. Select the cell in the upper-left corner of the range where you want to move the data. If you are moving the data to another application, switch to that application and navigate to where you want to place the data.
3. Click the Paste button on the Standard toolbar (or choose Edit, Paste).

Moving: Worksheets

You can move worksheets to a different location within the same workbook or to another workbook entirely. You do not need to create a blank worksheet to receive the new data--you can move the worksheet directly to the new location. (See also "Copying: Worksheets.")

Steps

1. Open the source and destination workbooks. Then display the source workbook (the workbook containing the worksheet you want to move).
2. Right-click the tab of the worksheet that you want to move; then choose Move or Copy from the shortcut menu.
3. In the To Book list, select the workbook to which you want to move the selected worksheet.

In the Before Sheet list box, select which sheet you want the moved sheet placed in front of; then click OK.

Naming Worksheets

Each worksheet in a workbook is automatically assigned a name. In a new workbook, worksheets are named Sheet1, Sheet2, and so on, as displayed on the sheet tabs. You can also assign your own descriptive name of up to 31 characters to each worksheet. You can use spaces in a worksheet name, but you cannot use any of the following characters:

/ \ : ? * [] < >

Steps

1. Double-click the sheet tab for the worksheet you want to rename.
2. Type the new name for the worksheet and press Enter.

Pasting: Formats, Values, or Transposed Data

With the Edit, Paste Special command, you can copy and paste part of a cell's attributes, such as the format or value, but not both. This command also enables you to transpose data by switching rows of cells to columns, and columns to rows. In addition, you can use this command to combine the attributes of cells by pasting them together.

Steps

1. Select the cell or range of cells you want to paste, and then click the Copy button on the Standard toolbar.
2. Select the cell in the upper-left corner of where you want to paste the data. Be sure to select an area where you won't overwrite existing cell data. Then, choose Edit, Paste Special.
3. In the Paste area, select the characteristics you want transferred: All, Formulas, Values, Formats, Comments, Validation, or All Except Borders.
4. In the Operation area, select how you want the transferred data combined with the cells you are pasting into: None, Add, Subtract, Multiply, or Divide.

Protecting: Workbooks

You can prevent other users from accessing or changing the contents of a workbook by assigning password protection to a file. Excel provides three levels of protection: you can assign a workbook as read-only recommended, as write-protected, and as password-protected. The first setting suggests to users that they open a file in read-only mode. The last two options enable you to enforce protection by restricting file modification or access only to those who have the password.

Steps

1. Open the workbook you want to protect; then choose File, Save As, and click the Options button.

2. In the Save Options dialog box, enter the passwords you want to set--you can set one to open the workbook and another to modify the workbook. Passwords are case sensitive.
3. Reenter the password(s) in the confirmation box (es); then click OK.
4. Select Read-Only Recommended if you want to recommend that others open a workbook as read-only (they must save the workbook with a different name if they want to save their changes--they cannot make any changes to the existing workbook); then click OK.

Click the Save button to save the workbook with your changes.

5.3. Formatting Worksheet

To enhance the appearance and improve readability of your worksheets, you can format the information in worksheet cells either before or after you enter the data. You can change the fonts or apply attributes such as boldface, italic, underline, borders, patterns, and colors. You also can apply numeric and date and time formats. Many of the formats you will use most often are accessible on the Formatting toolbar. Additional formatting options are available on the Format menu.

Alignment: Aligning Text Horizontally

Excel automatically aligns entries within a cell, according to the data you enter. When you enter text in a cell, Excel aligns the data to the left of the cell. When you enter numbers, Excel aligns them to the right. You can override this automatic alignment, however, and specify how you want data aligned: to the left, to the right, centered or justified within a cell, or centered across a range of cells.

In most cases, you will probably want to change the alignment of column headings so that the text is centered in each cell. If your worksheet data includes a title, you may also want to center the title over the worksheet data. (See also "Alignment: Centering Across Multiple Cells.")

Steps

1. Select the cell or range containing data you want to align. Choose Format, Cells; then click the Alignment tab.
2. Select one of the alignment options in the Horizontal drop-down list; then click OK.

You can quickly align data by selecting a cell or range, then clicking one of the following buttons on the Formatting toolbar: Align Left, Center, Align Right, or Merge and Center.

Alignment: Aligning Text Vertically

By default, Excel aligns text and numbers at the bottom edge of a cell. You can change the vertical alignment of cell data so that the data is displayed at the top edge or centered in a cell, or justified between the top and bottom edges. You may want to center text vertically in a cell, for example, if you want to place a border surrounding the cell.

Steps

1. Select the cell or range containing data you want to align. Choose Format, Cells; then click the Alignment tab.
2. Select one of the alignment options in the Vertical drop-down list; then click OK.

Formatting: Dates and Times

Regardless of how you enter or calculate the date and time, you can display the date and time using any of Excel's predefined formats. Excel supplies several predefined date and time formats for you. If you find that you want to use a format that isn't available, however, you can create a custom numeric format to display your date or time as you want it to appear. To do so, see "Formatting: Custom Numeric Formats" for more information.

Steps

1. Select the cell or range containing the date or time you want to format. Choose Format, Cells; then click the Number tab.
2. In the Category list, select either Date or Time.
3. Select the format you want from the Type list; then click OK.

Formatting: Multiple Worksheets

Excel enables you to perform operations to groups of worksheets at the same time. By grouping worksheets, you can save much formatting, data entry, and editing time by applying the same operations to the entire group at once. This is especially useful for applications such as consolidations, or worksheets that should contain common headings or formulas. If you name a range in the active sheet while sheets are grouped, the same name is applied to all the sheets in the group. You can only group worksheets that are contained in the same workbook.

Steps

1. Select the worksheets to which you want to apply identical formatting. Notice that the title bar now contains [Group].
2. Begin formatting one of the selected worksheets. All formatting you apply to the current worksheet also applies to other sheets in the group.
3. To separate the group into individual sheets, hold down the Shift key and click the sheet tab for the current worksheet.

Formatting: Numbers

By default, numbers are right-aligned and appear in the General number format. You can change the existing format to any Excel format you choose, however.

Excel supplies several predefined number formats for you. If you find that you want to use a format that isn't available, however, you can create a custom numeric format to display your

number as you want it to appear in your worksheet. See "Formatting: Custom Numeric Formats" for more information.

Steps

1. Select the cell that contains the number. Choose Format, Cells; then click the Number tab.
2. Select the desired format from the Category list.
3. Choose from any additional options that appear (such as Decimal Places, if applicable); then click OK.

Formatting: Selected Characters in a Cell

You can apply one or more attributes, such as bold, italic, or underline, to individual characters within a cell rather than to the entire cell. If a cell entry contains two words, for example, you can apply formatting to only one of these words.

Steps

1. Select the cell containing the text you want to format. Select the text in the formula bar that you want to change by dragging across it with the mouse.
2. Choose Format, Cells. Select the options you want to change on the Font tab; then click OK.

Formatting: Tables with AutoFormats

Excel's AutoFormat feature lets you create professional- looking tables with the click of a few buttons. No matter what your level of expertise with Excel, you can use AutoFormat to apply a set of predefined formatting choices to reports, tables, and lists without resorting to complex formatting operations.

Steps

1. Select the range you want to format. Choose Format, AutoFormat.
2. In the Table Format list, select the desired format (a preview of your selection appears in the Sample box). Click OK. The range you selected now displays the AutoFormat you chose.

5.4. Formula and Function Management

Formulas enable you to enter calculations in a worksheet. After you enter a formula, you can change the values in the referenced cells; Excel automatically recalculates values based on the cell changes.

Functions are predefined formulas that perform a specific operation, such as determining loan payments or calculating investment returns. Functions accept information, called arguments and

return a result. In most cases, the result is a calculation, but functions also return results that are text, references, logical values, arrays, or information about the worksheet.

For information on specific functions, refer to the "Functions Mini-Reference" located near the end of this book. This reference includes detailed information on many of the commonly used Excel functions from each of the function categories.

Auditing: Locating Errors in a Worksheet

Excel enables you to set up relationships among the various cells in the worksheet. However, if you run into an error in the worksheet, you may need to trace those various relationships to find the error. You can use the Auditing toolbar when you need to trace an error.

Examining the Error Values

Excel can display seven different types of error values. These error values are listed and described in the following table.

Excel Error Values

Error	Description
#DIV/0!	The formula is attempting to divide by zero. Check the cell references for blanks or zeros that may have resulted if you deleted a cell referenced by the formula.
#N/A	The formula refers to a cell with a #N/A entry or a cell that contains no value. This error value warns you that not all the data referenced by a formula is available.
#NAME?	Excel doesn't recognize a name you entered in a formula. Verify that all names used in the formula exist, and define any missing names. If applicable, verify that you used the correct function name.
#NULL!	The formula specifies two areas that don't intersect. Check to see if you entered the cell or range reference incorrectly. Remember to use commas (not spaces) between function arguments.
#NUM!	There is a problem with a number used in the formula. Check for the correct use of function arguments.
#REF!	A cell reference in the formula is incorrect. Check for changes to cell reference caused by deleting cells, rows, or columns referenced by the formula.
#VALUE!	The formula contains the wrong type of argument or operator. Check for the correct syntax of the formula.

Steps

1. To display the Auditing toolbar, choose Tools, Auditing, Show Auditing Toolbar.
2. Click the cell containing the error.
3. Click the Trace Error button on the Auditing toolbar. An arrow or arrows show the source of the error. Correct the error.
4. To remove the arrow(s), click the Remove All Arrows button on the Auditing toolbar.

Auditing: Tracing Formulas

You can display tracer lines to find precedents (cells that are referred to by a formula), dependents (cells that contain formulas that refer to other cells), and errors in any cell. Most of the time when you use the Auditing feature; you probably will want to trace the precedents to a formula to find out what other cells contribute to the formula in that cell.

Steps

1. To display the Auditing toolbar, choose Tools, Auditing, Show Auditing Toolbar.
2. Click the cell whose precedents you want to trace.
3. Click the Trace Precedents button on the Auditing toolbar. An arrow or arrows shows the precedents.
4. To remove the arrow(s), click the Remove Precedent Arrows button on the Auditing toolbar.

Formulas: Absolute, Relative, and Mixed Cell References

When a cell contains a formula with references to other cells, you can use several methods to handle those references. Each method causes a different result and may be utilized differently by Excel, so understanding the differences is important.

Understanding Cell Reference Types

Excel normally uses relative references for cell addresses in a formula, unless you specify otherwise. When you use relative references, the cell references in a formula automatically adjust after you copy the formula to another cell or range. If cell B10 contains the formula =SUM(B3:B9), for example, and you copy this formula from cell B10 to cell C10, the new formula in cell C10 automatically adjusts to read =SUM(C3:C9). In most cases, you want formulas to use relative cell references.

To prevent a cell reference in a formula from changing when you copy that formula to another cell or range, use an absolute reference.

You indicate absolute references by typing a dollar sign (\$) in front of the column letter and the row number. In a sales worksheet, for example, if you have a column of formulas that multiply a value by the commission percentage located in cell D7, you could use \$D\$7 to refer to that percentage in the first cell; then copy the formula down the column.

If you want only the row number or column letter (not both) to remain fixed when you copy a formula, use a mixed reference to refer to the cell address. The reference \$C3 prevents the column from changing, for example, but the row changes relative to a new copied location. If you use C\$3 as the reference, the column adjusts to a new location but the row remains fixed when you copy the formula.

(See "Formulas: Entering Formulas" before you complete this task.)

Steps

1. Place the cell pointer in the cell where you want to enter the formula.
2. To enter an absolute or mixed reference in a formula, type an equal sign (=) to start the formula (to enter a relative reference, just type the reference--no special treatment is needed). Then type or click the cell reference.
3. Press F4 until the desired combination of dollar signs appears, and then type the arithmetic operator, such as a plus sign (+).

Continue to type other values or cell references and operators as needed; then press Enter to complete the formula.

Formulas: Converting Formulas to Values

You can replace a formula in the worksheet with its calculated result if you no longer want or need to use the formula. When you convert the formula to a value, Excel permanently removes the formula (you can later reenter the formula if necessary).

For example, if you want to delete the cells or name to which a formula refers, first convert the formula to a value before deleting the cells or name.

Steps

1. Select the cell containing the formula you want to convert to a value.
2. Click the Copy button on the Standard toolbar.
3. Choose Edit, Paste Special, and then select the Values option. Click OK.
4. Press Enter to remove the marquee surrounding the cell.

Formulas: Creating a Text String

At times, you may need to create a formula that joins the contents of two cells. Excel refers to this action as concatenation.

How Concatenation Works

If a worksheet includes first names in one column and last names in another column, for example, you can enter a formula in a third column that joins the first name with the last name. Suppose that the first names are located in column B and the last names are located in column C; row 3 is the first row in the list. The following line shows an example of the formula for this situation:

=B3&" "&C3

The ampersand (&) in the preceding formula is the concatenation operator that joins text, numbers, and dates into one long text string. Note that if you used the formula =B3&C3 in this example, the first and last names would be joined together without a space. Therefore, you must use two quotation marks with a space between them (" ") to indicate that Excel should insert a space between the two text strings. (See "Formulas: Entering Formulas" before you complete this task.)

Steps

1. Select the cell where you want the formula to appear, and type an equal sign (=) to start the formula.
2. Type or click the first cell reference or name in the formula.
3. Type the concatenation operator (&), then type or click the next cell reference or name.
4. Repeat step 3 as necessary. Remember to type " " between the ampersands if you need to insert a space; press Enter to complete the formula.

Formulas: Displaying Formulas

You may at times prefer to see the formulas in your worksheets (such as =Jan +Feb) rather than the results of the formulas (such as 2,537). Perhaps you want to evaluate the structure of a worksheet to see that the formulas are correct, even if the worksheet contains no known errors. For example, you may notice incorrect cell references in displayed formulas that are causing inaccurate results (but not error values) in the worksheet.

Displaying all worksheet formulas also enables you to easily print all formulas used in the worksheet, for purposes of documentation.

This step is a good safeguard in case you accidentally delete or lose the worksheet, or if the worksheet becomes damaged. (See "Formulas: Entering Formulas" before you complete this task.)

Steps

1. From anywhere in the worksheet, choose Tools, Options; then click the View tab.
2. Select the Formulas check box; then click OK.

To display the results again, choose Tools, Options; then clear the Formulas check box on the View tab.

5.5. Charts and Graphics

Charts enable you to present worksheet data in graphical form. When you create a chart, the worksheet data used to create the chart is linked to it. When the worksheet data changes, the chart is updated to reflect those changes. Excel provides many features for creating and formatting charts. The Chart Wizard leads you step-by-step through the process. You can change chart types add elements to a chart (such as titles or legends), and format chart elements (such as numbers, fonts, and styles).

Excel also enables you to add graphic elements to your worksheet. You can import graphics from other programs, insert clip art objects, or use the Drawing toolbar to create objects such as arrows, rectangles, and WordArt. After you draw an object in the worksheet, you can edit, rotate, flip copy or move, size, or add shadows or 3-D effects to the object.

You can use the data map feature to present geographical data from your worksheets in map form. Data mapping enables you to see the relationships between numbers and geographic features.

Adding: Chart Arrows

You can use arrows to identify chart elements that you want people to notice, such as sales data that is higher or lower than expected, or a specific trend that may be occurring in the chart data. Frequently, you may use a text label to include explanatory text, and you can draw the arrow from the label to the chart element.

Steps

1. Select the chart, and then display the Drawing toolbar by clicking the Drawing button on the Standard toolbar.
2. Click the Arrow button on the Drawing toolbar. The pointer changes to a crosshair.
3. Click in the chart where you want the tail of the arrow to appear, hold down the mouse button while you drag across the chart to where you want the head of the arrow, and then release the mouse button.

Move an existing arrow by selecting it and then dragging it to the location you want. To change the length or position of the arrow, select the arrow and then drag the white square at either end of the arrow. To delete an arrow, select the arrow and then press Delete.

Adding: Chart Data Labels

You can attach labels to data points on your chart, which helps the viewer interpret the data in a chart more easily. Data labels can represent the value for that data point or the category axis label associated with the data point. You can attach data labels to individual data points, a single data series, or all data points in a chart.

Steps

1. Within the chart, select the data point(s) to which you want to add labels: to select an entire data series, click any point in the series; to select an individual point in the series, click the data point twice; to insert labels on all data points for all series, click outside the chart to select the entire chart.
2. Choose Chart, Chart Options; then click the Data Labels tab in the Chart Options dialog box.
3. Select the Data Labels option you want to use, such as Show Value, Show Percent, or Show Label. (Depending on the chart type, some options may not be available.) Click OK.

To remove existing data labels from a chart, display the Data Labels tab of the Chart Options dialog box. Then select the None option and click OK.

Adding: Chart Gridlines

Use gridlines to help viewers compare markers and read values in a chart. If you use the Chart Wizard to create a chart, Excel enables you to add gridlines as you are creating the chart.

You can add gridlines that originate from either the category or value axis, or both. In a 3-D chart, you can also add gridlines for the Z axis (chart depth). You can choose whether to display gridlines for major divisions on an axis or minor divisions (including points between major divisions).

Steps

1. After selecting the chart, choose Chart, Chart Options; then click the Gridlines tab in the Chart Options dialog box.
2. Select the type of gridlines you want to add; then click OK.

To remove gridlines from a chart, display the Gridlines tab of the Chart Options dialog box, and then clear the boxes for the gridlines you want to remove.

TIP: Avoid using too many gridlines in a chart because they may make the chart confusing and difficult to read.

Adding: Chart Legends

A legend explains the markers or symbols used in a chart. If you use the Chart Wizard to create a chart, Excel creates a legend by default, based on labels from the shorter side of the worksheet data series. If your chart does not include a legend, you can easily add one. You also can format a legend with border, pattern, and font selections.

Steps

1. Select the chart.
2. Choose Chart, Chart Options; then click the Legend tab in the Chart Options dialog box.
3. Choose Show Legend. Then select the Placement you want for the legend: Bottom, Corner, Top, Right, or Left. Click OK.

You can move the legend by selecting it and then dragging the legend to the location you want. To resize the legend, select it and then drag one of the black handles surrounding the legend. To delete a legend, select it and press Delete.

TIP: To format the legend, right-click the legend and choose Format Legend from the shortcut menu. Make the selections you want from the Format Legend dialog box and then click OK.

Adding: Chart Titles

You can add titles to help explain the data in your chart. Normally, you include a main chart title as well as titles for the category and value axes. If you use the Chart Wizard to create a chart, Excel enables you to add chart titles as you are creating the chart. You also can choose to add chart titles later or modify existing chart titles.

Steps

1. After selecting the chart, choose Chart, Chart Options; then click the Titles tab in the Chart Options dialog box.
2. Select the text box for the title you want to add (such as Chart Title) and type the title; then click OK.

You can move the title by selecting it and then dragging an edge of the title to the location you want. To delete a title, select it and press Delete.

TIP: To format a chart title, right-click the title and choose Format Title from the shortcut menu. Make the selections you want from the Format Title dialog box and then click OK.

Adding: Chart Trend lines

You can add a trend line to a chart to show the direction of the charted data and to make predictions. Regression analysis, a technique that describes relationships among variables, is used to create the trend line from the chart data. You can choose from among five types of regression lines or calculate a line that displays moving averages.

Steps

1. After selecting the chart, choose Chart, Add Trend line; then select the Type tab in the Add Trend line dialog box.
2. Select the data series for which you want to create a trend line in the Based on Series list.
3. Select from among the six Trend/Regression types: Linear, Logarithmic, Polynomial, Power, Exponential, and Moving Average. For more detailed information on these types, click the question mark in the title bar of the dialog box, and then click the option for which you want more information.
4. Select the Options tab if you want to set any additional options for the trend line, such as the Trend line Name or Forecast options. Click OK.

Adding: Graphic Backgrounds

You can add a graphic background, similar to a watermark, to your worksheets. This feature can dramatically improve the appearance of forms and reports. A background also is a unique way of inserting a company logo in a worksheet without using a prominent graphic.

When Excel adds a graphic background, the graphic is tiled, or repeated across the full width and height of the worksheet. Tiling requires no additional memory for multiple graphics than it does for a single graphic. Excel provides some samples of graphic backgrounds, such as a brick wall or a deco design. You also can use pictures of your own as well as Web page backgrounds.

Steps

1. Open the worksheet in which you want to add a graphic background; then choose Format, Sheet, and Background. The Sheet Background dialog box appears.
2. Select the graphic file you want to use. Check the \MSOffice\Clipart folder for samples provided with Excel. Then click Open.

To delete a graphic background, choose Format, Sheet, Delete Background.

TIP: Most graphic backgrounds look better if you remove gridlines from the display. Choose Tools, Options; then click the View tab. Clear the Gridlines check box and then click OK.

Adding: New Chart Data

You can add new data to existing charts, whether you created the chart automatically or manually. You can add a new data series to a chart, add new data points to existing data series, or change the entire range of data the chart uses.

If you are working in a separate chart sheet or an embedded chart that has been selected in a worksheet, you can use the Chart, Add Data command. You can use the Chart, Source Data command to edit existing data series or add new series. (See "Creating: Chart Wizard Charts" before you complete this task.)

Steps

1. To add new data to an embedded chart in a worksheet, select the data you want to add from that worksheet.
2. Point to an edge of the selected range until the pointer changes to an arrow. Drag the data anywhere onto the chart and release the mouse button.

NOTE: If the chart to which you want to add new data resides on a separate chart sheet (instead of being embedded within a worksheet), the procedure is a bit different. Select the chart sheet; then choose Chart, Add Data. Enter the Range for the new data and click OK. The data is added to the chart.

AutoShapes

AutoShapes are ready-made shapes provided with Excel that you can add to worksheets, chart sheets, or embedded charts in a worksheet. These shapes are arranged in groups such as

flowchart symbols, stars and banners, block arrows, and connectors. (See also "Drawing an Object.")

You can use AutoShapes to create an entire flowchart in a worksheet by adding flowchart symbols and using connector symbols or block arrows to connect the flowchart symbols. You can easily add text to most AutoShapes by selecting the shape and typing the text you want to insert.

Steps

1. Select the worksheet, chart sheet, or embedded chart in a worksheet to which you want to add an AutoShape. Then click the Drawing button on the Standard toolbar to display the Drawing toolbar.
2. Click the AutoShapes button on the Drawing toolbar. A pop-up menu appears.
3. Point to a category of AutoShapes, such as Stars and Banners, and then click the shape you want to use.
4. Click on the area within the worksheet, chart sheet, or embedded chart where you want the AutoShape to appear.

You can move the AutoShape by selecting it and then dragging the shape to the location you want. To resize the shape, select it and then drag one of the handles surrounding the shape. To maintain the original proportions of the shape, hold down the Shift key and then drag one of the corner handles. To delete an AutoShape, select it and press Delete.

TIP: To format the AutoShape by adding colors, changing borders, or adding shadow or 3-D effects, select the shape and use the tools on the Drawing toolbar.

For additional formatting options, right-click the AutoShape and choose Format AutoShape from the shortcut menu. Make the selections you want and then click OK.

Changing Chart Types

You can change an Excel chart type to represent another type of data. You can change to any of the chart types that Excel offers--bar charts, line charts, pie charts, or special custom charts like floating bar charts.

When to Change Chart Types

You should use an appropriate chart type for the data you want to chart. The following list illustrates some common Excel chart types and explains their purpose. For more detailed information on all the chart types and examples of their use, search on "chart types, example" in Excel help.

- Column chart. Illustrates individual values at a specific point in time and is suitable for almost any data type, particularly side-by-side comparisons of numerous data values.
- Bar chart. Same as a column chart, but displays bars horizontally rather than vertically.
- Line chart. Illustrates linear or unbroken changes in a large number of values.

- Pie chart. Shows the relationship of parts to the whole and to each other, so that the reader can assess and compare items readily.
- XY (scatter) chart. Plots two groups of numbers as one series of XY coordinates. Useful as a diagnostic tool when looking for heavy occurrences or absences of data. Commonly used in scientific applications.
- Area chart. Shows how volume changes over time and emphasizes the amount of change. Useful for giving a bigger sense of "mass" of a change or concept.

Steps

1. Right-click in a blank area of the chart and choose Chart Type from the shortcut menu.
2. In the Chart Type dialog box, click the Standard Types or Custom Types tab.
3. Select the chart type you want and then click OK. Resize the chart by dragging one of the chart handles, if necessary.

NOTE: In some cases, data may be more effective when presented in a table or text chart. Don't overload your charts with too many data points. Combine data into logical units such as first quarter, second quarter, and so on to make your charts more effective.

Clip Art

Clip art is a collection of graphics and pictures that is available for use in programs such as Excel. Clip art enables you to illustrate ideas with pictures. You can use clip art in place of columns or bars in a chart to add interest to a presentation, for example. You also can use clip art to create a company logo for a company invoice or expense statement. Many of Excel's built-in templates include a placeholder for you to insert a clip art logo. Be careful not to overdo your use of clip art; generally one effective use of clip art in a worksheet is sufficient. (See also "Creating: Picture Charts" and "Template Wizard: Using Excel's Templates" in the section "Data Analysis.")

Where to Find Clip Art

Many clip art collections are sold in categories like business graphics, medical graphics, entertainment graphics, and so on. To locate clip art, look for ads in the back of computer magazines, particularly desktop publishing magazines. You also may find clip art packages available for purchase at your local software store.

Some programs, such as Excel, include free clip art collections. You use the Microsoft Clip Gallery in Excel to easily access these clip art images. You also can find collections of clip art on the Internet and online services such as CompuServe, America Online, and Prodigy. (See also "Importing Graphics.")

Steps

1. In your worksheet, select the cell where you want the upper-left corner of the clip art to appear.

2. Choose Insert, Picture, and Clip Art. Select the Clip Art tab in the Microsoft Clip Gallery dialog box.
3. Select a category from the list box on the left side of the dialog box. Then click the clip art symbol you want to use and choose Insert.

NOTE: If you cannot access the Microsoft Clip Gallery, you probably did not install this feature with Excel. For more information on how to install the Clip Gallery, search on "clip art" in Excel help. Then choose "Insert an imported picture or clip art" and follow the instructions.

Creating: Automatic Charts

If you want to create a chart using the default chart type (normally a column chart) and place this chart on a separate chart sheet in the workbook, you can use the shortcut procedure listed below to quickly create the chart. Otherwise, if you want to use a different chart type or embed the chart in the worksheet that contains the source data, use the Chart Wizard to create the chart. (See also "Creating: Chart Wizard Charts.")

Steps

1. Select the worksheet data you want to chart.
2. Press the F11 key. The chart appears automatically in a separate chart sheet.²

Creating: Chart Wizard Charts

In Excel, you most often create charts using the Chart Wizard. Although the Chart Wizard steps you through the entire process of creating a chart, you can create the chart more quickly by accepting some or all of the defaults that Excel suggests. You can add a chart directly to the worksheet or you can create a separate chart sheet in the workbook. (See also "Creating: Automatic Charts.")

Steps

1. Select the worksheet data you want to chart and then click the Chart Wizard button on the Standard toolbar.
2. Select the type of chart you want in the Chart Type list; then choose Next.
3. Verify the chart data range and specify whether you want to plot the series in Rows or Columns; then choose Next.
4. Click the appropriate tab and select the chart options you want, such as titles and data labels; then choose Next.

5. Select whether you want the chart to appear as a new sheet in the workbook or as a chart object (an embedded chart) in an existing worksheet. Choose Finish.

TIP: To move a chart, select it and drag an edge of the chart to the location you want. To change the size or proportions of the chart, drag one of the black handles along the borders until the chart is sized and proportioned the way you want.

Creating: Picture Charts

Excel charts can use pictures as markers in place of columns, bars, lines, or as backgrounds. You can use this feature to make picture charts that draw attention and then communicate the information. When showing dollar amounts, for example, you can use money bags of varying sizes for each marker.

Steps

1. In the chart, right-click the data series that you want to replace with a picture and choose Format Data Series. You can also select the plot or chart area if you want the picture to fill the background area of the chart.
2. In the Format Data Series dialog box, click the Patterns tab; then choose Fill Effects and click the Picture tab.
3. Choose Select Picture. In the Look In box, change to the drive and folder where the image is stored. Select the file for the picture you want to insert; then click OK.
4. Choose other options on the Picture tab if you want. Experiment with various options (Stretch, Stack, or Stack and Scale) to see which effect looks best on your chart. For 3-D charts, select the options you want from the Apply To group. Click OK twice to return to the worksheet.

Drawing an Object

Excel enables you to add graphics to your worksheets by drawing objects inside the worksheet itself. The drawing buttons on the Drawing toolbar enable you to create ovals, rectangles, polygons, arrows, and even freehand objects. Excel includes additional drawing tools as well as new tools to assist you with manipulating drawn objects.

By combining drawn objects, you can create all kinds of images. Drawn objects can enhance your worksheet reports, add annotation elements to your charts, and generally spruce up your worksheets.

You can use the AutoShapes tool on the Drawing toolbar to quickly draw more complex shapes such as stars and flowchart symbols. (See also "AutoShapes.")

Steps

1. To display the Drawing toolbar, click the Drawing button on the Standard toolbar; or choose View, Toolbars, and Drawing.

2. From the Drawing toolbar, select a shape button such as the Arrow, Rectangle, or Oval. If you need more than one copy of a particular shape, double-click the selected button. That button stays selected until you click the same button or click another tool.
3. Click and drag in the worksheet to draw the object, and then release the mouse button. If you just click in the work-sheet, the object appears with the default dimensions.
4. Change the selected object's location by dragging the object; change the selected object's size by dragging the sizing handles.
5. Use the Drawing toolbar buttons such as Fill Color, Line Color, and Line Style to format the object's appearance.

To delete an object, select it and then press Delete.

TIP: To create a perfect square or circle, hold down the Shift key while drawing a rectangle or oval. To add a shadow or 3-D appearance to the object, select the object and then click the Shadow or 3-D button on the Drawing toolbar. Choose the effect you want from the palette.

Drawn Objects: Copying and Moving

Excel enables you to easily create exact duplicates of existing objects in your worksheet. You also can move objects to a different position in the worksheet.

Steps

1. To copy an object, press and hold down the Ctrl key. Then click and drag the object you want to copy. As you drag, a copy of the object moves with the pointer. Release the mouse button.
2. To move an object, select the object and then drag it to the position you want.

Drawn Objects: Freehand Drawings

Although you can use ready-made AutoShapes to save time when drawing objects, you sometimes may need to manually create an unusually shaped object. The Lines option on the AutoShapes button enables you to create these freehand drawings: curves, freeform polygons, and scribbles. (See "Drawing an Object" and "AutoShapes" before you complete this task.)

Steps

1. Click the AutoShapes button in the Drawing toolbar and then choose Lines.
2. Choose the freehand object you want to draw: Curve, Freeform, or Scribble.
3. To create a curve or freeform object, click in the worksheet to begin the object, then move to a new point and click where you want the line to end. A curve or line appears between those two points. Click as many points as you want the object to include. When you are finished, double-click the last point.

4. To create a scribble, hold down the mouse button the entire time you are drawing your object in the worksheet. Release the mouse button when you are finished.
5. To create a closed drawing, right-click the freehand drawing, and choose Close Curve from the shortcut menu.

Drawn Objects: Grouping

When drawing objects, you may find that you want to format or edit many existing objects at once. Instead of having to select each object and format it individually, you can group the objects so they all act as if they are part of the same object. When you group objects, their individual handles disappear and the entire group is surrounded by sizing handles.

Steps

1. Click the first object in the group to select it.
2. Hold down the Shift key and click all other objects that you want in the group. All the objects should remain selected.
3. Choose the Draw button on the Drawing toolbar and choose Group from the pop-up menu. You can now move or format the objects as a group.

To ungroup a set of grouped objects, select the group. Then choose the Draw button on the Drawing toolbar and choose Ungroup from the pop-up menu.

Drawn Objects: Rearranging

As you create a drawing, you sometimes add objects on top of one another in stacked layers. If you need to adjust the order of these objects, you can use the Order options available from the Draw button on the Drawing toolbar. You may choose to move the bottom object to the top, for example, to adjust its order in the stack. To get the arrangement you want, you may need to rearrange several objects in a specific order.

Steps

1. Select the object that you want to move behind or in front of other objects.
2. Choose the Draw button on the Drawing toolbar and then choose Order.
3. Choose the option you want. The Bring to Front and Send to Back options move the object all the way to the front or back of the selected objects in one step. The Bring Forward and Send Backward options move the object forward or backward one object at a time.

Drawn Objects: Rotating and Flipping

You can adjust the placement and position of a drawn object by using the Rotate or Flip option on the Draw button of the Drawing toolbar. You can rotate the object left or right, 90 degrees at a time. You can also flip the object horizontally or vertically to reverse the position of the object. This feature is useful when you want a mirror image of an object.

Steps

1. Select the object you want to rotate or flip.
2. Choose the Draw button on the Drawing toolbar and then choose Rotate or Flip.
3. Choose an option from the Rotate or Flip menu, such as Rotate Left, Rotate Right, Flip Horizontally, or Flip Vertically.

TIP: Click the Free Rotate button on the Drawing toolbar if you need more flexibility when rotating or flipping objects. Drag one of the rotation handles surrounding the object to the position you want. Click the Free Rotate button again to disable the feature.

Drawn Objects: Sizing

After you've drawn an object in the worksheet, you may decide to enlarge or reduce the size of an object. You also may want to change the proportions of the object.

Steps

1. After selecting the object, click and drag one of the object's handles in the direction you want to resize. Drag a side handle to resize the object horizontally or vertically. Drag a corner handle to resize both sides simultaneously.
2. Release the mouse button to end resizing.

TIP: Hold down the Shift key while dragging a corner handle to maintain the proportions of the object.

Formatting: Chart Axes

When you create a chart, Excel uses the default settings for the axis style, tick marks, and scaling. Tick marks are the small lines that appear on an axis, similar to measurement lines on a ruler. You can customize the axis, changing the style of the line used for the axis, the tick marks, the positioning of the tick-mark labels, and the scaling of the axis.

Steps

1. Right-click the axis line you want to customize and choose Format Axis from the shortcut menu.
2. In the Format Axis dialog box, click the Patterns tab and then select one of the Axis options.
3. Select the options you want from the Major Tick Mark Type and Minor Tick Mark Type areas.
4. Select an option in the Tick Mark Labels area to specify where to position the tick-mark labels.

5. Check to see if the axis line in the Sample box looks the way you want, and make additional changes on the Patterns tab if necessary; then click OK.

Formatting: Chart Data Series

You can enhance the presentation of your data by adding error bars or data labels to a data series. Use error bars to visually display the margin of error in a data series. Data labels are typically used to explain the data points in a chart. You also can change the gap width between the columns in a column chart and make other formatting changes.

Steps

1. In the worksheet, right-click the data series you want to format and choose Format Data Series from the shortcut menu.
2. In the Format Data Series dialog box, click the tab containing the options you want to change (such as Error Bars, Data Labels, Series Order, or Options).
3. Modify the options as you want; then click OK.

Formatting: Chart Fonts and Styles

You can change fonts and styles in charts just as you change them in worksheets. First, select the elements you want to change, and then make the changes.

Steps

1. Click the text element you want to format. If you want to format only individual characters within a text element, select those characters.
2. Click a button on the Formatting toolbar for the format you want to change. For example, click the Font Size button to change the point size of the font, or click the Italic button to italicize the text.

TIP: To see additional font options that don't appear on the toolbar, right-click the text element you want to format. Choose Format from the shortcut menu and make your selections from the Font tab; then click OK.

Formatting: Chart Numbers

You can format the numbers in a chart just as you format the numbers in a worksheet. For example, you can add dollar signs to the numbers on the value (Y) axis or change the format of numbers used as data labels.

If the numbers in the worksheet you used to create the chart are formatted, the numbers used in the value axis in the chart are formatted the same way. You can override this formatting, however, or add formatting if the numbers in the chart are unformatted.

Steps

1. Right-click the object whose numbers you want to format and then choose Format from the shortcut menu.
2. In the Format dialog box, click the Number tab and then select the number format you want from the Category list.
3. The Format dialog box changes to display options that relate to your category choice. Change any options you want; then click OK.

TIP: To return the formatting to the number formats that appear in the source worksheet, select the Linked to Source option in the Format dialog box.

Formatting: Chart Objects

Excel provides many options and commands that enable you to enhance your chart objects. Chart objects include titles, legends, axes, data series, and so on. You can easily add or change the colors, patterns, and borders of objects in a chart. Excel includes several new patterns, including interesting gradients and textures that you can use in your charts.

Steps

1. Right-click the chart objects and chooses Format from the shortcut menu.
2. In the Format dialog box, click the Patterns tab.
3. In the Border group, select the border options you want. In the Area group, select the color you want.
4. To select a fill effect (pattern), choose Fill Effects. Click one of the tabs and choose the pattern you want; then click OK twice to return to the worksheet.

TIP: If you want to change the color or pattern for the chart background, right-click any edge of the chart and choose Format Chart Area from the shortcut menu. Make your selections and then click OK.

Formatting: Chart Titles and Labels

For some text objects in charts, such as titles, you can change the horizontal and vertical alignment, as well as the orientation (or rotation) of the text. For other objects, such as the labels on the axes, you can change only the orientation. You can rotate axis titles or text boxes that contain explanations.

Steps

1. Right-click the text objects and chooses Format from the shortcut menu.
2. In the Format dialog box, click the Alignment tab; then select the alignment options you want from the Horizontal and Vertical drop-down lists.
3. Drag the pointer in the Orientation box up or down to change the orientation of the text, or specify a value in the Degrees spin box between 90 and -90 degrees; then click OK.

Importing Graphics

The procedure for importing graphics (or pictures) into your worksheets is similar to the way you insert clip art images. You can insert a picture into your worksheet without opening the program you used to create the picture. After you import a graphic, you can move, resize, or format the graphic.

Steps

1. Select the cell in the worksheet where you want the upper-left corner of the graphic to appear. (Because the picture is inserted as an object, you can later move it to a different location.)
2. Choose Insert, Picture, From File. The Insert Picture dialog box appears.
3. Locate the graphic file you want to import; then choose Insert.
4. The graphic appears in the worksheet, and the Picture toolbar appears. Use the buttons on the Picture toolbar to modify or format the graphic if you want.

Databases: Sorting a Database

Excel enables you to organize the data in a database to suit your needs. Although sorting works best on databases, you can actually sort any data in your worksheet. You can sort data either alphabetically or numerically, in ascending or descending order.

Steps

1. Select any cell in the database; then choose Data, Sort.
2. In the Sort By box, select the fields you want to sort on, then select either Ascending or Descending sort order.
3. If you want to sort on additional fields, select the fields in the Then By text boxes, and then select the sort order for each field. Click OK to perform the sort.

TIP: To quickly sort the database on a single field, select any cell in that field. Then click either the Sort Ascending or Sort Descending button on the Standard toolbar.

NOTE: Excel sorts date fields using the serial number created by dates and times entered in cells. Sorting works correctly only on dates and times entered with a date and time format that Excel recognizes. If you enter dates and times that Excel does not recognize, Excel normally stores them as text and sorts them in text order. (See also "Entering: Dates and Times" in the section "Editing Workbooks.")

Forms: Adding Check Boxes

A check box is linked to a cell so that the result of the check box status appears as TRUE or FALSE in the linked cell. Selecting the check box makes the cell TRUE. Deselecting the check box makes the cell FALSE. The check box control is commonly used in a data form and provides an option to the user.

Steps

1. Draw a check box in the active worksheet by clicking the Check Box button on the Forms toolbar and then clicking the cell where you want the check box; then right-click the check box and choose Format Control from the shortcut menu.
2. Click the Control tab, then select the default value of the check box: Unchecked for FALSE result, Checked for TRUE result, or Mixed for #NA results. Choose the 3D Shading check box to add depth to the check box.
3. Select the Cell Link edit box, and click the cell that you want to hold the results of the check box; then click OK.

Forms: Adding Controls

Excel enables you to place on a worksheet the same type of data-entry controls that you can place in a dialog box run by a macro or Visual Basic procedure. Controls are data-entry objects commonly used in forms, such as scrolling lists or check boxes. When you enter a value in a control or make a selection from a control, the entry appears in a worksheet cell.

Steps

1. With a worksheet open, display the Forms toolbar by right-clicking in the toolbar area and choosing Forms.
2. Click the button on the Forms toolbar that represents the control you want to draw. To create a check box control, for example, click the Check Box button. The pointer changes to a crosshair.

3. Move the crosshair to the top-left corner of where you want the control to appear, and drag down and to the right to where you want the control's opposite corner.
4. Release the mouse button. The control appears in the worksheet. If you created a button control, the Assign Macro dialog box appears when you release the mouse button. Select the macro you want to assign to the control; then click OK.
5. To modify a control, hold down Ctrl and then click the control to select it. When a control is selected, handles appear around the object. You can then move, resize, or change the properties of the selected control. Drag an edge of the control to move it. Resize the control by dragging one of the handles.

TIP: To deselect a control, click a cell or object outside the selected control. To delete the control, select it and then press Delete.

TIP: Double-click a selected control to display the Format Object dialog box. To change the format of the control, select the options you want from the available tabs.

Forms: Adding Lists

Both a list box and a combo box restrict users to choosing from a defined list of items. Restricting user selections prevents them from typing a mistake, entering incorrect data, or using old data.

List boxes and combo boxes produce the same result, but the appearance of the list in each type of box differs. A list box shows multiple items in the list, while the list stays the same height. A combo box is only one item high and has a drop-down arrow on the right side. Clicking the drop-down arrow displays the list. Combo boxes are commonly used when not enough room exists for a list box.

Steps:

1. In the worksheet, enter a vertical list of items you want to appear in the list. Enter one item per cell.
2. If you want the list to appear sorted within the control, select the list and choose Data, Sort to sort the list. Choose the desired sort options and then click OK.
3. Click the List Box or Combo Box button on the Forms toolbar and draw the control in the worksheet. Make a list box wide enough to see the entries in the list and tall enough to see multiple items. A combo box only needs to be tall enough for one item.
4. Right-click the list and choose Format Control; then click the Control tab.
5. Select the Input Range edit box; then drag across the range of cells in the worksheet that contain the data for the list. This list will appear in the list box or the combo box.
6. Select the Cell Link box and click the cell that will receive the results of the list. If you are using a combo box, enter in the Drop Down Lines box the number of lines displayed when the list appears; then click OK.

NOTE: The cell you specify in the Cell Link box returns a value that represents the number of the selected list item, not the actual list item itself. However, you can use this number in a formula to return the selected item in the list. If a combo box is linked to cell B5 and the input range for the list is in the range C5:C10, for example, the following formula returns the value from range C5:C10 based on the selection from the combo box:

=INDEX(C5:C10,B5)

Forms: Adding Option Buttons

Option buttons are used most frequently when you need to make a single choice from a group of choices. Option buttons are round buttons that come in groups.

If you draw just option buttons on a worksheet, all these buttons will belong to the same group, which means that you can select only one button at a time. You can have multiple groups of buttons, however, by enclosing each group in a group box drawn with the group tool.

Steps

1. Draw a group box by clicking the Group Box button on the Forms toolbar and dragging where you want the box in the worksheet. While the box is selected, type a title to replace the default box title.
2. Click the Option Button tool on the Forms toolbar and draw an option button inside the group box. Type a title while the option button is selected.
3. Right-click the option button and choose Format Control; then click the Control tab. Select the value for the option button: Unchecked or Checked.
4. Select the Cell Link edit box, click the worksheet cell that you want to contain the results from the group of option buttons, and then click OK.
5. Repeat Steps 2 through 4 for each additional option button that you want to include. When you have finished creating option buttons, click a cell outside the group box.

NOTE: When you create additional option buttons, you don't have to enter a cell reference for the Cell Link. Only one linked cell exists for all option buttons in a group.

Forms: Adding Scroll Bars

Scroll bars enable users to enter a number within a wide range while getting a visual impression of where their entry lies within the range. To enter a number, you can click the top or bottom arrow, click the gray part of the scroll bar, or drag the square button in the scroll bar.

Steps

1. Draw a scroll bar control in the worksheet by clicking the Scroll Bar button on the Forms toolbar and dragging where you want the scroll bar; then right-click the control and choose Format Control from the shortcut menu.
2. Click the Control tab. In the Current Value edit box, enter the amount you want the linked cell to have when the worksheet opens.
3. Enter the lowest value you want the scroll bar to produce in the Minimum Value box. Enter the highest value you want in the Maximum Value box.
4. Set the amount of change for each click of the control in the Incremental Change box. In the Page Change edit box, enter the amount of change you want when the user clicks the gray part of the scroll bar.
5. Select the Cell Link edit box and then click the cell in the worksheet you want to receive the scroll bar result; then click OK.

Forms: Adding Spin Boxes

Spin boxes are controls that show two arrow heads--one pointing up and the other pointing down. Each click of an arrow head increases or decreases the amount in the cell linked to the spin box. Holding down the mouse button on a spin box causes the number to change continuously. (See "Forms: Adding Controls" before you complete this task.)

Steps

1. Draw a spin box in the worksheet by clicking the Spinner button on the Forms toolbar and dragging where you want the spin box; then right-click the spin box and choose Format Control from the shortcut menu.
2. Click the Control tab. In the Current Value edit box, enter the amount you want the linked cell to have when the worksheet opens.
3. Enter the lowest value you want the spin box to produce in the Minimum Value box. Enter the highest value you want in the Maximum Value box. Set the amount of change for each click of the control in the Incremental Change box.
4. Select the Cell Link edit box and then click the cell in the worksheet that you want to receive the spin box result; then click OK.

Forms: Creating a Form

Excel has many features that enable you to create nice-looking and easy-to-use data entry forms. Before you can create a data entry form using the Template Wizard, you need to create a worksheet that will be the basis for your form. Using Excel formatting techniques, you can make worksheets appear more like a paper form. You probably want to start by having the form in the same workbook as the worksheets that do the calculations, which makes it easier to create and maintain links from the controls on the form to the worksheets using the data.

Enhancing the Appearance of a Form

In most cases, you probably want the form you create to resemble a paper form rather than a typical worksheet. To do this, you can change several Window Options that appear on the View tab of the Options dialog box. The following table describes the recommended settings for these options when you are creating a form.

Review Questions

What is the use of Microsoft Excel?

Prepare a payroll according to the Ethiopian taxation rule. Include all the requirements and outputs you think appropriate.

CHAPTER SIX

MICROSOFT ACCESS

6.1. Chapter Objectives

This unit shows you how to work on database management using Microsoft Access. At the end of this course you would be able to:

- o Understand basic concepts about database and database management;
- o Create and manage tables;
- o Generate queries;
- o Create forms;
- o Generate reports.

6.2. Database Management Basics

Database refers to the collection of organized and arranged data.

Steps to design a database

1. Determine the purpose of your database
2. Determine the subjects you need
3. Determine the fields you need
4. Indicate the primary key
5. Create relationship among the tables(subjects)
6. Create other database objects

Access enables you to open one database at a time. If you have a database open in view and you open another database, Access closes the first one and opens a new one (in other words, you do not have to close one database to open another).

Steps

1. Choose File, Open. If you are in the Database window, click the Open Database button on the Database toolbar.
2. Locate the database file in the Open dialog box and choose the Open button.

Like other applications within Microsoft Office, Access also enables you to choose from one of the last few files open on the bottom of the File menu.

NOTE: If you want to bypass your startup options (such as opening a form or disabling toolbars), hold down Shift when you choose the Open button. If you are in a multiuser environment and need to open the database so no one else has access while you are developing or editing, check Exclusive on the Open dialog box.

Database Window: View Objects

The Database Window is the control center and container for all tables, queries, forms, reports, macros, and modules. Unlike other database applications, all objects (tables, reports, forms) are in one file rather than separate files on a hard disk.

Steps

1. To bring up the Database window while another window is displayed, press F11.
2. To see descriptions and dates modified and created in addition to object names, click the Details button on the toolbar.
3. To open an object (table, query, form, report), click the tab of the object type and then double-click the name in the Database window.

While you are in the Database window you can copy, delete, or rename the objects.

Dates and Times: Enter

Entering dates and times is generally like entering any other data with a couple of shortcuts. When the field is formatted (see "Data: Format" in the Table and Database Design part of this book) you might enter data one way (for example, 10-5-97) but it appears in the field as a different format (for example, 10/5/97).

Steps

1. Open the table, form, or query and move to the field in which you want to enter the data.
2. To enter today's date, press Ctrl+; (semicolon). To enter the time, press Ctrl+: (colon). If you want to enter a date in this year you can leave off the year and enter the month and day (for example, 3/17). After you leave the field, the date or time will format according to the format property for the field.
3. If you want new records to default to the current date or time, choose the Design button. Go to the field's Default value in a table or right-click the control in a form, choose Properties and go to Default value. Type in Date (for current date or Now ()) for either current date or time (depending on format). Return to the Datasheet or Form View.

NOTE: Entering the current date and time depends on your system clock being set correctly. If you need to reset your clock, right-click the time on the far right of your taskbar and choose Adjust Date/Time.

There are special considerations while working with dates in queries and filters.

Exit Access

Unlike other programs such as Word or Excel, you do not need to save changes after you edit a record. You save changes automatically by moving to a different record on a datasheet or a form. However, when you are editing or creating a design of an object, you will be prompted to save changes when you close Access.

Steps

1. Click the Close (X) button on the top right of the Access window.
2. If you are in design mode for any object, choose whether you want to save changes to the object.

CAUTION: Do not turn the power off before exiting Access. You could damage your database. If you need to repair a damaged database, there is a repair procedure that might (or might not) work. (See "Database Repair" tasks in the File Management part of this book.)

Database: Create Blank

A blank database is a database file that contains no objects or data. It is an empty shell that you will use to add new tables, queries, forms, and reports. If you want Access to create some of your tables, forms, and other objects, see "Database: Create New with a Wizard."

Steps

1. In a blank Access window or while the Database window from another database is showing, choose the New Database button on the toolbar.
2. Double-click the Blank Database template in the General tab of the New dialog box.
3. Enter a name in the File New Database File Name text box, specify the storage location of the file in the Save In drop-down list box, and then choose the Create button.

NOTE: You can also press Ctrl +N to start a new database from anywhere in Access. After you give the database a name, Access closes the database that you were working on and opens a blank Database window.

Database: Create New with Wizard

You can create a new database that is blank or let the Database Wizard create one for you that contains the objects you specify for it. The task, "Database: Create Blank" describes the former process. This task describes the use of the Database Wizard. Both procedures begin the same way.

When you use a wizard, Access enables you to choose from sample fields and then create the tables, queries, forms, reports, and switchboards for you. A switchboard is form with buttons that help a user navigate through the database. You can even have Access populate your database with sample data to help you learn how different features work in the sample database.

Steps

1. When you start Access the Introductory screen is displayed. Click Database Wizard to open the Wizard.
If you already have Access opened, click the New Database button on the toolbar.
2. Select the database from the Databases tab of the New Database dialog box; then choose OK.

3. Specify a location for the database file in your file system using the Save In drop-down list box; enter a new name for the database in the File Name text box of the File New Database dialog box; then choose the Create button. Access launches the Database Wizard.
4. Choose Next to view the screen that lets you select additional fields and sample data. Click the check boxes next to include optional fields (in italics) or uncheck any other fields. Click the check box next to the Yes, Include Sample Data if you want that feature, then choose Next.
5. On the next four wizard screens, select the styles you want for your forms and reports, give the database a name that will appear on the switchboard, and choose to open the database. On the last step, choose Finish.

NOTE: To see which sample database wizards are available, look on the Database tab of the New dialog box. These wizards are installed during the default setup. However, if you do not have the wizards, return to setup (through your Office or Access CD), choose the Change Option button while Microsoft Access is selected, and check the Wizards box.

6.3. Working with Tables

To create a blank (empty) table for entering your own data, you can:

- use the table wizard to choose the fields for your table from a variety of predefined tables such as business contacts, household inventory, or medical records.
- create a table in design view, where you can add fields, define how each field appears or handles data, and create a primary key.
- enter data directly into a blank datasheet. when you save the new datasheet, microsoft access will analyze your data and automatically assign the appropriate data type and format for each field.

To create a table from existing data, you can:

- import or link data from another access database or data in a variety of file formats from other programs.
- perform a make-table query to create a table based on data in a current table. For example, you can use make-table queries to archive old records, to make backup copies of your tables, to select a group of records to export to another database, or to use as a basis for reports that display data from a specific time.

Create a table by using the Table Wizard

1. Press F11 to switch to the Database window (Database window: The window that appears when you open an Access database or an Access project. It displays shortcuts for creating new database objects and opening existing objects.).
2. Click Tables under Objects, and then click New on the Database window toolbar.
3. Double-click Table Wizard.
4. Follow the directions in the Table Wizard dialog boxes.

Note: If you want to modify or extend the resulting table, you can do so in Design view (Design view: A window that shows the design of these database objects: tables, queries, forms, and reports, macros, and data access pages. In Design view, you can create new database objects and modify the design of existing ones.) When you have finished using the Table Wizard.

Create a table in Design view

1. Press F11 to switch to the Database window (Database window: The window that appears when you open an Access database or an Access project. It displays shortcuts for creating new database objects and opening existing objects.).
2. Click Tables under Objects, and then click New on the Database window toolbar.
3. Double-click Design View.
4. Define each of the fields in your table.

How?

1. Open the table in Design view (Design view: A window that shows the design of these database objects: tables, queries, forms, and reports, macros, and data access pages. In Design view, you can create new database objects and modify the design of existing ones.).
2. To insert the field within the table, click in the row below where you want to add the field, and then click Insert Rows on the toolbar.

To add the field to the end of the table, click in the first blank row.

3. Click in the Field Name column and type a unique name for the field.
4. In the Data Type column, keep the default (Text); or click in the Data Type column, click the arrow, and select the data type (data type: The characteristic of a field that determines what type of data it can hold. Data types include Boolean, Integer, Long, Currency, Single, Double, Date, String, and Variant (default).) You want.
5. In the Description column, type a description of the information this field will contain. This description is displayed on the status bar (status bar: A horizontal bar at the bottom of the screen that displays information about the current condition of the program, such as the status of items in the window, the progress of the current task, or information about the selected item.) When adding data to the field and is included in the Object Definition of the table. The description is optional.
5. Define a primary key (primary key: One or more fields (columns) whose values uniquely identify each record in a table. A primary key cannot allow Null values and must always have a unique index. A primary key is used to relate a table to foreign keys in other tables.) Field before saving your table.

How?

1. Open a table in Design view (Design view: A window that shows the design of these database objects: tables, queries, forms, and reports, macros, and data access pages. In Design view, you can create new database objects and modify the design of existing ones.).

2. Select the field or fields you want to define as the primary key (primary key: One or more fields (columns) whose values uniquely identify each record in a table. A primary key cannot allow Null values and must always have a unique index. A primary key is used to relate a table to foreign keys in other tables.).

To select one field, click the row selector (row selector: A small box or bar that, when clicked, selects an entire row in table or macro Design view, or when you sort and group records in report Design view.) for the desired field.

To select multiple fields, hold down the CTRL key and then click the row selector for each field.

3. Click Primary Key on the toolbar.

Note If you want the order of the fields in a multiple-field primary key to be different from the order of those fields in the table, click Indexes on the toolbar to display the Indexes window (Indexes window: In an Access database, a window in which you can view or edit a table's indexes or create multiple-field indexes.), and then reorder the field names for the index (index: A feature that speeds up searching and sorting in a table based on key values and can enforce uniqueness on the rows in a table. The primary key of a table is automatically indexed. Some fields can't be indexed because of their data type.) named Primary Key.

Note you don't have to define a primary key, but it's usually a good idea. If you don't define a primary key, Microsoft Access asks if you want Access to create one for you when you save the table.

6. When you are ready to save your table, click Save on the toolbar, and then type a unique name for the table.

Create a table by entering data in a datasheet

1. Press F11 to switch to the Database window (Database window: The window that appears when you open an Access database or an Access project. It displays shortcuts for creating new database objects and opening existing objects.).
2. Click Tables under Objects, and then click New on the Database window toolbar.
3. Double-click Datasheet View. A blank datasheet is displayed. The default column names are Field1, Field2, and so on.
4. Rename each column you will use: double-click the column name, type a name for the column, and then press ENTER.
5. You can insert additional columns at any time: click in the column to the right of where you want to insert a new column, and then on the Insert menu, click Column. Rename the column as described in step 4.
6. Enter your data in the datasheet.

Enter each kind of data in its own column (each column is called a field (field: An element of a table that contains a specific item of information, such as a last name. A Title field might contain Mr. or Ms. Databases such as Microsoft SQL Server refer to fields as columns.) in Microsoft Access). For example, if you are entering names, enter the first name in its own column and the last name in a separate column. If you are entering dates, times, or numbers, enter them in a consistent format so that Microsoft Access can create an appropriate data type (data type: The

characteristic of a field that determines what type of data it can hold. Data types include Boolean, Integer, Long, Currency, Single, Double, Date, String, and Variant (default.) and display format (format: Specifies how data is displayed and printed. An Access database provides standard formats for specific data types, as does an Access project for the equivalent SQL data types. You can also create custom formats.) for the column. Any columns you leave empty will be deleted when you save the datasheet.

7. When you've added data to all the columns you want to use, click Save on the toolbar to save your datasheet.
8. Microsoft Access asks you if you want to create a primary key (primary key: One or more fields (columns) whose values uniquely identify each record in a table. A primary key cannot allow Null values and must always have a unique index. A primary key is used to relate a table to foreign keys in other tables.). If you haven't entered data that can be used to uniquely identify each row in your table, such as part numbers or ID numbers, it's recommended that you click Yes. If you have entered data that can uniquely identify each row, click No, and then specify the field that contains that data as your primary key in Design view (Design view: A window that shows the design of these database objects: tables, queries, forms, reports, macros, and data access pages. In Design view, you can create new database objects and modify the design of existing ones.).

How?

1. Open a table in Design view (Design view: A window that shows the design of these database objects: tables, queries, forms, reports, macros, and data access pages. In Design view, you can create new database objects and modify the design of existing ones.).
2. Select the field or fields you want to define as the primary key (primary key: One or more fields (columns) whose values uniquely identify each record in a table. A primary key cannot allow Null values and must always have a unique index. A primary key is used to relate a table to foreign keys in other tables.).

To select one field, click the row selector (row selector: A small box or bar that, when clicked, selects an entire row in table or macro Design view, or when you sort and group records in report Design view.) for the desired field. To select multiple fields, hold down the CTRL key and then click the row selector for each field.

3. Click Primary Key on the toolbar.

Note If you want the order of the fields in a multiple-field primary key to be different from the order of those fields in the table, click Indexes on the toolbar to display the Indexes window (Indexes window: In an Access database, a window in which you can view or edit a table's indexes or create multiple-field indexes.), and then reorder the field names for the index (index: A feature that speeds up searching and sorting in a table based on key values and can enforce uniqueness on the rows in a table. The primary key of a table is automatically indexed. Some fields can't be indexed because of their data type) named Primary Key.

6.4. Queries and Filters

Queries and filters are primary ways to find and organize your data. A filter is saved with a table and can't be reused for other objects unless you save it as a query. Queries can be used to answer questions themselves, but can also be used as the foundation for forms and reports.

Creating queries and filters involves tasks such as sorting data, choosing data (setting criteria), and selecting tables and fields. Queries are more versatile than filters and you can use them to mass update, delete, and add records to a table. You can also do substantial calculations with queries.

Action Query: Append Query

An append query provides a method for adding records to one or more tables. This is useful when you want to transfer records from one table, or set of related tables, to another. You can also use the append query to write data to the same fields in matching records between two tables. For notes about action queries, see "Action Query: Create" first.

Steps

1. In the Database window, highlight the table or query for the basis of the append query and choose Query from the New Object button on the toolbar. The New Query dialog box is displayed. Click OK to accept the default.
2. Click the Query Type button on the toolbar and select the Append Query option. Enter the name of the target table in the Table Name box. Click either Current Database or Another Database to specify the target table; then choose OK.
3. Drag the fields from the Field List that you want to append to the Query Design grid, along with any fields you will use for selection criteria.
4. Enter the criteria for creating the result set in the Query Design grid.
5. Click the View button on the toolbar to preview the records to append.
6. Click the Run button to append the records to the table(s) you specified.

Action Query: Create

An action query collects records that meet your search criteria, and changes the data contained in those records in a single step. Access allows four different action queries: delete, update, append, and make-table query. A delete query removes the groups of records returned from your query from your table. An update query alters the information contained in your result set and writes the changes back to your table. An append query adds the records from your result set to your table. Finally, a make-table query creates an entirely new table from your result set.

CAUTION: Because action queries modify your data, it is a good idea to first create a select query with the fields and criteria you want. View the results of the query to make sure you have the correct records. Then, turn the select query into an action query by selecting one of the options on the Query Type button on the toolbar.

First follow the steps to create a select query. (See "Query: Create with Design View" or "Query: Create with Wizard.")

Steps

1. In your query's Design View, enter criteria, add a sort order, and create any calculated fields. Click the Datasheet View button to make sure your criteria are OK.
2. Return to the design view by clicking the Design View button.
3. Turn the query into an action query by clicking the drop-down arrow on the Query Type button and choosing one of the four action query types (Make-Table, Update, Append, and Delete).
4. If prompted, identify the target table. Click the Run button to perform the action query.
5. Click the Save button on the toolbar. Enter a name in the Save dialog box, and then choose OK.

Action Query: Delete Query

The delete query enables you to remove a set of records from the table you specify. If you have already created a relationship that enforces referential integrity with cascade deletes, you will only need to delete records from parent table. (See "Relationships between Tables" in the Table and Database Design part of this book.) The records from the related child table will delete automatically.

Steps

1. In the Database window, highlight the table or query for the basis of the delete query and choose Query from the New Object button on the toolbar. Click OK.
2. Drag any fields you need to identify records into the design grid. Then click the Query Type button on the toolbar and select the Delete Query option.
3. Enter any criteria for deleting records, and they appear under where in the Delete cell.
4. Click the View button on the toolbar to preview the records to be deleted.
5. Click the Run button to delete the records from the table.

After closing the dialog box, the records in your result set are removed from the table you specified.

Action Query: Make-Table

The make-table query enables you to create a table for export; it provides the basis for a report; it provides a method for making backups; and it gives a snapshot of your data at a point in time. The make-table query also enables you to improve the performance of your forms and reports by working from a set of records stored to disk that don't have to be retrieved from a large data set or from a network. You can also copy a table from the Database window and if necessary, delete or add any additional fields you want. (See "Database Object: Copy" in the File Management part of this book.)

Steps

1. In the Database window, highlight the table or query for the basis of the make-table query and choose Query from the New Object button on the toolbar. Click OK.
2. Drag any fields you need to identify records into the design grid. You can also add an additional table and any other fields from the second related table if you want to use fields from more than one table. Then click the Query Type button on the toolbar and select the Make-Table Query option.
3. Enter a name in the Table Name text box, select either the Current Database or Another Database option button, then choose OK.
4. Enter any criteria for choosing records in the Criteria row. Click the View button on the toolbar to preview the records to be included.
5. Then Click the Run button to create the new table.

After dismissing the dialog box indicating that a new table will be created, Access writes your result set to disk as a table in the database you specified.

Action Query: Update Query

An update query can make global changes to selected records in a table or a set of related tables. This type of query is useful for replacing information quickly.

A common example for an update query would be where you would increase the price for an item. In the Update To cell under the price field in the Query Design grid you would type the expression [Price]*1.02 (to increase the price by 2%).

1. In the Database window, highlight the table or query for the basis of the update query and choose Query from the New Object button on the toolbar. Click OK.
2. In the Query Design View, click the down arrow next to the Query Type button on the toolbar, then select the Update Query option.
3. Drag the fields from the Field List to the Query Design grid that will be in the new table. Enter the criteria for your result set, and any sort you want.
4. In the Update To cell, enter the expression or value to be used as a replacement for the field(s) selected.
5. Click the View button to see a list of records that will be updated. Then click the Run button on the toolbar.

After closing the dialog box, Access replaces your old data with the new values in the result set you specified.

Criteria: Blanks, Nulls, and Empty

When you create select or action queries or use the Advanced Filter/Sort option to create a filter for a table, you often might want to see which records have no values. For example, you might want to find all addresses without zip codes so you can look them up before you do a mailing. You may also want to find which fields have zero-length strings.

Criteria: Date

When you are working with date fields, there are some criteria you might want to keep in mind. You can choose to show just today's date or a specific month, day, or year. Another option is to include a range of dates.

Steps

1. In Design View of a query or filter, click in the criteria row under the desired field.
2. If you want to enter a specific date, type the date. Regardless of the format for the date, you can enter the date in its simplest format for the criteria: For example, 1/1/98. When you leave the criteria cell Access translates this to #1/1/98#.
3. If you want to find all records with today's date, type Date (). If you want all those after today's date, type >Date (). If you want all those up to and including today's date, type <=Date ().
4. If you want all records between two days use the between and expression as in the example: Between 1/1/97 and 3/5/98.
5. To find all records for a specific month, year or day, use the * (asterisk). 1/*/98 finds all records in January 1998. */*/92 finds all records in 1992.
6. Choose the Datasheet View button to see the results of the query or choose the Run button to update records if the query is an action query.

For date functions, see also "Functions: Date" in the Calculations part of this book.

Criteria: Multiple

If you are searching for data that meets more than one criteria, you can use the Query Design grid or the keywords AND and OR.

To enter criteria, be sure you are in the Design View of a query or filter.

Steps

1. To set criteria for multiple fields where all criteria must be met (for example, City is Denver and Address includes Broadway), type the expression for the first field, move to the second field in the same criteria row and type the second expression. Repeat for all necessary fields.
2. To set criteria for multiple fields where any criteria can be met, type the expression for the first field, move down to the next criteria row (labeled or) and type the second expression under the second field. Move down again if there are the third criteria.
3. If you are looking for multiple possibilities in the same field, type in one criteria cell and type OR between each expression (for example: CO or NE). If you have many entries you can use the IN keyword (for example, IN (CO, AL, NE, KS)).
4. If one field must meet two criteria use the AND keyword (for example >5 AND <10).
5. Choose the Datasheet View button to see the results of the query or choose the Run button to update records if the query is an action query.

Criteria: Numeric

When you are looking for numeric data, there are some handy expressions for use with numeric criteria. To enter criteria, be sure you are in the criteria cell of the Design View of a query or a filter.

Steps

1. Type the number in the criteria cell to see just this value.
2. Type <Number or <=Number to see all numbers less than or less than or equal to the number.
3. Type >Number or >=Number to see all numbers greater than or greater than or equal to the number.
4. Type Between Number1 and Number2 to find all numbers between two numbers (including both numbers).
5. Type >Number1 and <Number2 to find all numbers between two numbers (not including both numbers).
6. Choose the Datasheet View button to see the results of the query or choose the Run button to update records if the query is an action query.

Criteria: Specify

You can enter selection criteria into filters and into queries. Queries are more generally useful in that they can work with related tables of records and direct the output of the result set to several different places. Filters apply only to the current table or query and cannot be used elsewhere.

Steps

1. Move to the criteria row and enter the expression into the design grid of the Query or Filter.
2. If you cannot see the entire criteria, press Shift+F2 to expand the cell into a window. Choose OK when finished editing the criteria.
3. If you want to enter complicated criteria, click the Build button on the toolbar and use the Expression builder.

Access allows for a wide range of values and expressions, and the Query Design View is a powerful tool for composing queries and applying criteria for selection. For some of the criteria types, see the other Criteria sections in this part. (See also "Expression: Create with Builder" in the Calculations part of this book.) Access translates the query into SQL and applies it to the appropriate data sources (tables and grids) that the query operates on.

Filter Data: Advanced Filter

The most complex filters you can create enable you to both filter and sort records in a single operation for a single table or query. The Advanced Filter/Sort window is similar to the Query Design View in construction in that you work in a design grid where you specify the criteria used to filter your records and the sort order. The Advanced Filter/Sort feature can operate on tables or queries, but cannot provide related tables.

Steps

1. Open a table, query, or form in the Datasheet View, or a form in the Form View.
2. Choose *Record, Filter, Advanced Filter/Sort*.
3. Enter the criteria and sort you want in the design grid.
4. Click *Apply Filter* on the toolbar.

Filter Data: By Form

If you want to select a set of records in a datasheet or a form, the simplest way to do this is to set a filter. A filter is a single set of criteria that can be applied to your data set. When you apply another filter to a result set from a previous filter, you narrow your result set even further.

Access remembers your last filter in a session and lets you reapply it at any time. If you apply a filter to a table or form, Access remembers that filter until you apply a new one. Filters applied to queries are not entered into the query grid, but can be applied later separately. You can also sort filtered records. You might find that filters provide much of the find and query capability you need in your work.

Steps

1. Open a table, query, or form in the Datasheet or Form View.
2. Click the *Filter By Form* button on the toolbar to open a *Filter By Form* window.
3. Click the field you want to filter by and enter the selection criteria that records must match to be returned in a result set.
4. To enter a value to search for, select that value from the list in that field; or enter the value manually.
5. To enter a value of a check box, option button, or toggle button, click that button. Entering a value in two fields on the same line in the *Look For* tab (see the bottom of the window) requires both values to be matched in the result set.
6. To perform a filter based on alternative values, click the *OR* tab at the bottom of the window and enter additional criteria. Click the *Apply Filter* button on the toolbar to perform the selection.

Query: Add Field

When you edit or build a query you might need to insert fields in the appropriate place on the grid. Open up any query in *Design View* to add a field.

Steps

1. To add a field at the end of the query grid, double-click the field.
2. To add a field between two existing fields, drag the field name from the list box onto the right field.
3. To add all fields in the grid, first clear the grid if necessary with *Edit, Clear Grid*. Double-click the asterisk (*) in the *Field List*.

4. If you want to add all fields to the grid and you are going to use sort or criteria from any of the fields, double-click the title bar of the list box and drag from one of the fields to the grid.

Query: Add Table

You can use more than one table in the query. In almost all cases the tables need to be related. Open up any query in Design View to add a table.

Steps

1. In Query Design View, click the Show Table button on the toolbar.
2. Double-click each table or query you want to add; choose close when done.
3. If necessary, draw a join line between the two related fields in the Field Lists. Generally, you will be drawing a line between two fields with the same or similar names (for example, Emp ID and Employee ID).
4. Double-click fields from any of the Field Lists to add them to the design grid.

Query: Change Column Heading Names

When you make calculated columns in a query, you will probably want to add a column name instead of the Expr headings that Access defaults to.

Steps

1. In Query Design View, click before text in any Field cell.
2. Type the new column name and a colon (:).

Query: Create with Design View

Queries are recipes for finding, selecting, and sorting data in tables. Access stores the definition of a query, runs the query, and returns a result set when the query is requested. Queries can be used as the underlying data set for forms and reports. Queries can also be used to select, append, delete, and update records in the database.

Steps

1. Click the Query tab in the Database window, and then choose the New button. Select Design View in the New Query dialog box; then double-click the table(s) you want from the Show Table dialog box, choose Close.

If you add related tables, Access will automatically create join lines between the tables. To create a relationship between two tables, drag the key field of the parent tables to the related field of the child table.

2. Double-click any fields from the Field Lists for each table you want as part of the query.
3. Click in the Sort row and select Ascending or Descending for any field that you want to sort. Fields are sorted in their order from right to left, the left field being the primary sort key. To re-order the fields, click and drag the column header.
4. Uncheck the Show check box for any field you want to hide in the Query.

Fields can be used in queries that do not appear in the query output.

5. Enter any expression in the criteria cell for that field. Click Save in the Query Design toolbar. Enter the name of the form in the Query Name text box of the Save As dialog box, then choose OK.

See the Criteria sections of this part for examples of criteria. When you run a query, the data you see reflects the data that conforms to your query at runtime. You can update, delete, or append the data in a result set for most queries.

Query: Create with Wizard

The Query Wizard is easier for novices to create queries but provides less flexibility than Query Design View. (See "Query: Create with Design View.")

Steps

1. On the Query tab of the Database window, choose the New button and choose Simple Query Wizard.
2. Choose a table or query from the Table/Query drop-down box.
3. Double-click any fields you want as part of the query. Repeat Steps 2 and 3 for additional tables if necessary; choose Next.
4. If you want to see every record, click the Detail option button.
If you want to only see summaries of the records such as totals or counts, choose the Summary Option button and choose the types of summaries you want; choose OK.
5. On the next choices in the wizard choose any additional options for grouping your data and naming your query; choose Finish when done. Save and close your query.

Query: Delete Field

To remove a field from a query you need to be in Design View. If that field is needed in sorting or criteria, uncheck the Show box in the design grid.

Steps

1. In the query or filter design grid, click the black down arrow mouse pointer on the gray field selector above the field name and press Delete.
2. To remove all fields, choose Edit, Clear Grid.

Query: Description

If you want to explain your query in more detail than the field name allows, you can use the Description property.

Steps

1. If you are in the Database window, right-click the query name, choose Properties, and type the text in the Description text box.
2. If you are in Query Design View and the properties window is not in view, right-click the gray background behind the Field List(s) and choose Properties. The Query Properties dialog box opens. On the General tab type the text in the Description text box.

Query: Run

You can run a query from Query Design View or directly from the Database window.

Steps

1. From the Query tab of the Database window, double-click the query name to run it.
2. From the Query Design View, click the Datasheet View button to show the results of a select query or preview the results of an action query.
3. From the Query Design View, click the Run button to execute the action query. This button functions the same as the Datasheet View button for select queries.
4. From Datasheet View, if you want to require (perhaps you want to redisplay the input box for a parameter query), press Shift+F9.

Query: Show All Fields

No matter which fields are used in the grid, a filter shows all fields. When a filter is saved as a query, all fields also display. When you create a new query through Design View or through a wizard, only those fields you use in the grid (and that have the Show box checked) display in Datasheet View.

Steps

1. Select the query in the Database window and choose the Design button.
2. If the Properties window is not displayed, right-click the gray background behind the Field Lists(s) and the title bar of the query, and choose Properties. The Query Properties sheet opens.
3. Change the Output All Values property to Yes.

Query: Sort Columns

You can apply a sort order to the result set of a query in either Form or Datasheet View. You can also sort the result set of a filter or an advanced filter/sort.

The sort order for a query is usually determined by the Sort row of the Query Design grid. You can sort the query independent of the property, however, with the following steps.

Steps

1. Click the column(s) or field(s) you want to sort on.
2. Click either the Sort Ascending or Sort Descending buttons on the toolbar.

Sub queries: Create

Once in awhile you might want to create a query that uses the results of another query to run. One option is to create a query and then use that query as the basis for the next query. Another option is to copy the SQL statement and place it in a Criteria cell.

You might need to find the average price for all products and then find all products that exceed the average price.

Steps

1. If you want to have both query and sub query listed in the Database window, highlight the first query name in the Database window, click the New Object button and choose Query. Create the second query using the first queries fields.

2. If you want to have only one query in the Database window, first create the sub query with only one field and one record as an output (create a Totals Query with no grouping). Display the sub query in SQL view and copy all text. Create the main query and move to the Criteria row under the field. Type any operator (such as =, <, >), then type an open parenthesis, paste the SQL statement, and then type a close parenthesis.

Chart: Data Labels

You can attach labels to data points on your chart. This can help the viewer interpret the data in a chart more easily. Data labels can represent the value for that data point or the category axis label associated with the data point. You can attach data labels to individual data points, a single data series, or all data points in a chart.

Steps

1. In Design View of a report or form, double-click the chart to open Microsoft Graph.
2. Select the data point(s) to which you want to add labels: to select an entire data series, click any point in the series; to select an individual point in the series, click the data point twice (not double-click); to insert labels on all data points for all series; click outside the chart to select the entire chart.
3. Right-click the selection and choose Format Data Series (or Point) or Chart Options choice on the shortcut menu. Then click the Data Labels tab in the dialog box.
4. Select the Data Labels option you want to use, such as Show Value, Show Percent, or Show Label. (Depending on the chart type, some options might not be available.) Choose the None option if you want to remove existing data labels. Click OK.

Controls: Combo Box Create

A combo box enables the user to type or choose from a list of predetermined options. A combo box is especially useful if you have a code you need to place in a form and the code corresponds to a value. Instead of having to remember the codes, a user can select from more meaningful data. Using a combo box can also help avoid data entry errors.

The source for the drop-down list in a combo box can be a table or query, values you type during design or a list of field names from a table or query. If you drag a field from the Field List whose data type is already a Lookup Field, Access will automatically create a combo box for you from the properties of the field in Table Design (see "Lookup Column: Create with Wizard" in the Table and Database Design part of this book). As an alternative to a combo box, you can also use a list box.

Steps

1. From the Design View of a form, click the Toolbox if necessary and make sure the Control Wizards button is selected.
2. Click the Combo Box button on the toolbar and click in the form where you want the combo box to appear. The Combo Box Wizard opens.
3. To type your own values of what will appear in the combo box, choose I Will Type the Values I Want, choose Next, and type the number of columns and values in each column you want. If you type more than one column, choose which column will be the source for the data to store in the field underlying the combo box, which field you want to store the value in, and the label for the combo box on the next screens.
4. To use an existing table or query, on the first screen of the Combo Box Wizard, choose the I Want the Combo Box option. Choose the table or query, the fields you want to see when you choose the drop-down arrow, the column width of the fields, and whether you want to hide the key column. As in Step 3, also choose which column becomes the value to store, which field you want to store the value in, and the label for the combo box on the next screens of the wizard.
5. If you want to use the combo box to move the form to a specific record, you usually place the box in the form header. On the first step of the Combo Box Wizard, choose the Find a Record (third choice), choose the fields you want, the column widths, and the label for your combo box on the next screens of the wizard.

After you finish the wizard, the combo box appears on your form. To see or modify the properties, right-click the combo box and choose Properties. The important properties and the property tab they appear on are as follows:

- control source (data tab). this property is the field in your table where you're storing data.
- row source (data tab). the name of the table or query used to lookup values. you can click the build button (...) to access the query builder and choose the fields and sort order of items that appear in the drop-down list. if you typed the list, the values appear separated by semi-colons with text enclosed in quotes.
- column count (format tab). the number of columns from the row source used for the list.
- column widths (format tab). the width displayed for each column in the list; 0 will not display a column.
- bound column (data tab). the column from the row source that will be placed in the field on the form.

List Width (Format tab). The width of the entire drop-down list. Limit to List. This property determines whether you want to limit values to the table/query/list for your combo box or enable the user to type other values as well.

Reports: Create with Report Wizard

The Report Wizard gives you the most flexibility in creating reports. You will be prompted for the fields you want from one or more tables or queries, how you want to group and sort your data, if you want to add summaries, and the layout and style for your report. While you can accomplish these features in Design View, the job is often tedious. However, if you have a simple report to create, consider using Auto Report.

The steps and options of the wizard change depending on which options you select.

Steps

1. Click the Reports tab in the Database window, and then choose New. Choose the table or query for your data source from the drop-down list and then double-click Report Wizard.

2. In the first step of the wizard, double-click the fields you want to see on your report in the Available Fields list box. For any related tables, select those tables from the Tables/Queries list box, and add the additional fields, then choose Next.

If you get an error message such as Subscript out of Range, you chose fields from two unrelated tables. Double-click the incorrect fields in the Selected Fields list box to remove them.

3. Depending on the fields you chose, the next two steps of the wizard will ask you how to group your data. If the fields you chose come from different tables, Access will ask you how you want to view your data. Specify the table used to group your data and choose Next.

On the next step, select the field(s) used to group your data, and position them in a priority order. If you want to change the group interval (first letter for text, months or years for dates, or range for numbers) choose the Grouping Options button, make your choices, and choose OK. Choose Next.

4. Select the sort field(s) of your data with the top sort field being the primary sort key; click the Sort button to specify ascending or descending sorts.

If you chose any grouping options in Step 3, the Summary Options button might be available. Choose that button to find the sum, average, minimum, or maximum of numeric fields, show a summary or detailed records, and if you want to calculate percents. Choose OK to return to the sort step. From the sort step, choose the Next button.

5. Select a layout and orientation for your report, then choose Next. Select a presentation style for your report, and then choose Next.

6. Enter a title for the report, and click either Preview the Report or Modify the Report's Design in the last step of the Report Wizard; then choose Finish.

Access creates the new report and saves it to disk. If you selected Preview, Access opens the report in the Preview mode; otherwise, it appears in the Report Design window.

To switch between views of your report, select the appropriate command from the View menu, or from the View button's drop-down menu in the Report Design toolbar.

Reports: Grouping

When you want to see subtotals for numeric values, and you want to see the records that make up the subtotals as well, you need to use the grouping feature of reports. In a query, you can see the records or the subtotals only, but not both. When you group records, all of one value group together, then there is a break (usually group footer with subtotals) and then the next value group together. You can also have a group header with text introducing the group. In addition to doing subtotals, you can also group for lists of data, such as an employee phone list where the A's entire are grouped together, all the B's, and so forth.

You can create a grouped report through the Report Wizard. If you need to add grouping to a report, follow the procedures in these steps.

Steps

1. Open the report in Design View and click the Sorting and Grouping button if the Sorting and Grouping window is not visible.
2. In the Field/Expression box, choose a field from the drop-down list or type an expression.
3. In the Sort Order box, choose Ascending or Descending for the order in which the group will appear.
4. If you want a group header or footer section to appear for this group, choose Yes for either in the lower half, Group Properties section of the Sorting and Grouping window. If you do not choose Yes for either the header or footer, you do not get grouping. As soon as you choose a header or footer, Access puts a grouping icon to the left of the field name.
5. Depending on the field data type you are grouping, the options in Group On will change. If the field is a date, choose a time unit such as Year or Month, and then type how many of those units you want to group together in the Group Interval box. For example, if you want to group on five-year intervals choose Year in Group On and type 5 in Group Interval. If your field is a text or numeric value, you can choose Each Value in the Group On box. Then for every change in the value, you get a group header or footer. You can also choose prefix characters in the Group On box and then type the number of characters in the Group Interval box. If you are typing an alphabetical list, choose prefix characters and set the Group Interval to 1. If the first three characters of an employee ID determine the department, type a Group Interval of 3.
6. Set the Keep Together property to No to not worry about where the page breaks. Set it to With First Detail to keep the group header with the first record. If you have a small group that you want all to fit on one page, choose Whole Group.

Summary

Access enables you to open one database at a time. If you have a database open in view and you open another database, Access closes the first one and opens a new one (in other words, you do not have to close one database to open another).

A blank database is a database file that contains no objects or data. It is an empty shell that you will use to add new tables, queries, forms, and reports. If you want Access to create some of your tables, forms, and other objects, see "Database: Create New with a Wizard."

Queries and filters are primary ways to find and organize your data. A filter is saved with a table and can't be reused for other objects unless you save it as a query. Queries can be used to answer questions themselves, but can also be used as the foundation for forms and reports.

Queries are recipes for finding, selecting, and sorting data in tables. Access stores the definition of a query, runs the query, and returns a result set when the query is requested.

Review Questions

1. What is Database?

2. Write the steps to create a database design.

3. Explain the two ways to create a table

4. What is query?

CHAPTER SEVEN

MICROSOFT POWERPOINT

7.1. Chapter Objectives

This unit shows you how to work on presentations using Microsoft PowerPoint. At the end of this course you would be able to:

- o Understand basic concepts about the uses of PowerPoint presentations;
- o Create and manage presentations;
- o Format presentations;
- o Apply custom animations, and interactive formats;

7.2. About Creating Presentations

Creating a presentation in Microsoft PowerPoint involves starting with a basic design; adding new slides and content; choosing layouts; modifying slide design, if you want, by changing the color scheme or applying different design templates; and creating effects such as animated slide transitions. The information below focuses on the options available to you when you start the process.

The New Presentation task pane in PowerPoint gives you a range of ways with which to start creating a presentation. These include:

- blank start with slides that have minimal design and no color applied to them.
- existing presentation Base your new presentation on one that you have already written and designed. This command creates a copy of an existing presentation so you can make the design or content changes you want for the new presentation.
- design template base your presentation on a PowerPoint template that already has a design concept, fonts, and color scheme. In addition to the templates that come with PowerPoint, you can use one you created yourself.
- templates with suggested content use the autocontent wizard to apply a design template that includes suggestions for text on your slides. you then type the text that you want.
- a template on a web site create a presentation using a template located on a web site.
- a template on Microsoft.com Choose from additional PowerPoint templates in the Microsoft Office Template Gallery. These are arranged according

7.3. Create a Presentation Using Blank Slides

1. On the Standard toolbar, click New .
2. If you want to keep the default title layout for the first slide, go to step 3. If you want a different layout for the first slide, in the Slide Layout task pane, click the layout you want.
3. On the slide or on the Outline tab, type the text you want.
4. To insert a new slide, on the toolbar, click New Slide, and click the layout you want.

5. Repeat steps 3 and 4 for each new slide, and add any other design elements or effects you want.
6. When you finish, on the File menu, click save, type a name for your presentation, and then click Save.

7.4. Working with Slides

Insert a new slide

1. To insert a new blank slide, do either of the following:
 - o on the formatting toolbar, click new slide .
 - o with the insertion point in the Outline or Slides tab, press Enter.
2. In the Slide Layout task pane, click the layout you want.

Change slide order

Do one of the following:

- ON THE OUTLINE TAB IN NORMAL VIEW, SELECT ONE OR MORE SLIDE ICONS, AND THEN DRAG THE SELECTION TO A NEW LOCATION.
- ON THE SLIDES TAB IN NORMAL VIEW, SELECT ONE OR MORE SLIDE THUMBNAILS, AND THEN DRAG THE SELECTION TO A NEW LOCATION.
- IN SLIDE sorter view, select one or more slide thumbnails, and then drag the thumbnails to a new location.

To select multiple slides in a row, press SHIFT before clicking the slide icon or thumbnail.

Delete a slide

1. On the Outline tab or Slides tab in normal view, select the slides you want to delete. (If you want to select slides in order, press SHIFT as you click; for slides not in order, press CTRL as you click.)
2. On the Edit menu, click Delete Slide.

Hide a slide

1. On the Slides tab in normal view, select the slide you want to hide.
2. On the Slide Show menu, click Hide Slide.
The hidden slide icon appears with the slide number inside, next to the slide you have hidden.

Note The slide remains in your file, even though it is hidden when you run the presentation.

7.5. Formatting slides and Presentations

Apply a slide layout

1. On the Format menu, click Slide Layout.
2. On the Slides tab in normal view, select the slides you want to apply a layout to.
3. In the Slide Layout task pane, point to the layout you want, and then click it.

Apply a different color scheme to slides

1. On the Formatting toolbar, click Design, and in the task pane, click Color Schemes.
2. If you want to apply the color scheme to selected (rather than all) slides, select the slides on the Slides tab.
3. In the task pane, under Apply a color scheme, point to the color scheme you want, and then do one of the following:
 - o To apply the scheme to all of your slides, click the scheme.
 - o To apply the scheme to selected slides, click the arrow on the color scheme, and then click Apply to Selected Slides.
 - o If you have applied more than one design template and want the color scheme applied to all slides, click the arrow on the color scheme, and then click Apply to All Slides. To apply the color scheme only to a set of slides that follow a certain design template, click a slide in that group, point to the color scheme, click the arrow, and then click Apply to Master.

Insert a slide master or title master

1. On the View menu, point to Master, and then click Slide Master.
2. Do any of the following:
 - o To insert a slide master that uses the default styles in Microsoft PowerPoint, on the Slide Master View toolbar, click Insert New Slide Master.
 - o To insert a slide master by adding a new design template, on the Formatting toolbar, click Design, point to the design you want, click the arrow, and select one of the options on the shortcut menu.
 - o If you want to insert a title master for an existing slide master, select the slide master thumbnail on the left, and on the Slide Master View toolbar, click Insert New Title Master.

Note: When you insert a new master or add a design template, the design appears in the Slide Design task pane under Used in this presentation. The design is then available to apply to any new slides when you are working in normal view.

Add bullets or numbering to text

1. Select the lines of text that you want to add bullets or numbering to.
2. Click Bullets or Numbering.

Create a table

1. Select the slide you want the table on.
2. Do one of the following:

Insert a basic table

1. On the Standard toolbar (toolbar: A bar with buttons and options that you use to carry out commands. To display a toolbar, click Customize on the Tools menu, and then click the Toolbars tab.), click Insert Table.
2. Point to select the number of rows and columns you want and then click.

7.6. Start a Slide Show Presentation

Do one of the following:

Start a slide show from within Microsoft PowerPoint

1. Open the presentation you want to view as a slide show.
2. Do one of the following:
 - o Click Slide Show at the lower left of the PowerPoint window.
 - o On the Slide Show menu, click View Show.
 - o Press F5.

Start a slide show from your desktop

1. In My Computer or Microsoft Windows Explorer, locate the presentation file you want to open as a slide show.
2. Right-click the file name, and then click Show.

Start a PowerPoint Show (.pps.)

Use this procedure to open and play a slide show you have saved as a PowerPoint Show (.pps).

1. In My Computer or Microsoft Windows Explorer, locate the PowerPoint Show file you want to open.
2. Double-click the file name to open it.

Tip

To create a shortcut to your PowerPoint Show, use the right mouse button to drag the file to your desktop. When you release the mouse button, click Create Shortcut Here.

Review Questions

1. What is the use of Presentations?

2. Describe the various ways to create presentations.

3. Write the steps to apply a scheme to a PowerPoint Presentation.

4. What is the use of Master view?

VISUAL BASIC PROGRAMMING

Visual Basic (VB) is an ideal programming language for developing sophisticated professional applications for Microsoft Windows. It makes use of Graphical User Interface for creating robust and powerful applications. The Graphical User Interface as the name suggests, uses illustrations for text, which enable users to interact with an application. This feature makes it easier to comprehend things in a quicker and easier way.

Coding in GUI environment is quite a transition to traditional, linear programming methods where the user is guided through a linear path of execution and is limited to small set of operations. In GUI environment, the number of options open to the user is much greater, allowing more freedom to the user and developer. Features such as easier comprehension, user-friendliness, faster application development and many other aspects such as introduction to ActiveX technology and Internet features make **Visual Basic** an interesting tool to work with.

Visual Basic (VB) was developed from the BASIC programming language. In the 1970s, Microsoft started developing ROM-based interpreted BASIC for the early microprocessor-based computers. In 1982, Microsoft QuickBasic revolutionized Basic and was legitimized as a serious development language for MS-DOS environment. Later on, Microsoft Corporation created the enhanced version of BASIC called Visual Basic for Windows.

Visual Basic (VB) is an event-driven programming language. This is called because programming is done in a graphical environment unlike the previous version BASIC where programming is done in a text only environment and executed sequentially in order to control the user interface. Visual Basic enables the user to design the user interface quickly by drawing and arranging the user elements. Due to this spent time is saved for the repetitive task.

Important Features of Visual Basic (VB)

- Full set of objects - you 'draw' the application
- Lots of icons and pictures for your use
- Response to mouse and keyboard actions
- Clipboard and printer access
- Full array of mathematical, string handling, and graphics functions
- Can handle fixed and dynamic variable and control arrays

Sequential and random access file support

- Useful debugger and error-handling facilities
- Powerful database access tools
- ActiveX support
- Package & Deployment Wizard makes distributing your applications simple

Visual Basic 6 vs Previous versions of Visual Basic

The original Visual Basic for DOS and Visual Basic For Windows were introduced in 1991.

Visual Basic 3.0 (a vast improvement over previous versions) was released in 1993.

Visual Basic 4.0 released in late 1995 (added 32 bit application support).

Visual Basic 5.0 released in late 1996. New environment, supported creation of ActiveX controls, deleted 16 bit application support.

Visual Basic 6.0 - released in mid 1998s - some identified new features of Visual Basic 6.0:

- Faster compiler
- New ActiveX data control object
- Allows database integration with wide variety of applications
- New data report designer
- New Package & Deployment Wizard
- Additional internet capabilities.

If you ever used Visual Basic 3, you too could have known everything. Visual Basic 3 was a reasonably small but powerful language. Visual Basic 4 added classes to the language and made Visual Basic much more complicated. Versions 4, 5, and 6 added more support for database programming and other topics such as custom controls, but Visual Basic was still a fairly understandable language, and if you took the time you could become an expert in just about all of it.

Visual Basic.NET accelerated the expansion of Visual Basic tremendously. The .NET Framework added powerful new tools to Visual Basic, but those tools came at the cost of increased complexity. Associated technologies have been added to the language at an ever - increasing rate, so, today, it is impossible for anyone to be an expert on every topic that deals with Visual Basic.

System requirements for Visual Basic depends on the version of Visual basic software. Visual Basic 6 for windows requires at least Microsoft Windows 95/Windows NT 3.51, 486 processor and a minimum of 16 MB of RAM. A complete installation of the most powerful version of Visual Basic 6.0, the Enterprise Edition, requires more than 250 MB of Hard Disk space.

Freetutes.com has **Visual Basic** Tutorials explained with examples and source code.

[Learn Visual Basic 6.0 \(VB6 Beginners tutorial \)](#) - A comprehensive **Visual Basic 6** starter kit for beginners to **Visual basic** programming. If you are new to programming or to **visual basic** this, beginner level tutorial will be the definite guide which you really should go through. Step by step lessons with examples and source code will help you to understand the lessons easily and quickly. [Click here](#) to view the table of contents of [VB6](#) for beginners.

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