

# **UNDERSTANDING MATHEMATICS, STATISTICS AND COMPUTER**

**Units 1 – 9**

**Code No. 359**



**Allama Iqbal Open University  
Islamabad**

**Code # 359**

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## PREFACE

The branches of Mathematical Sciences i.e. Mathematics, Statistics and Computer Sciences are now essential to study in all fields of social and natural sciences. It was rightly stated by an eminent philosopher that God had created this universe mathematically. To improve our livings and to make the best use of natural resources available, understanding the basic concepts of Mathematics, Statistics and Computers are necessary. For the last so many years I had been realizing the extensive need of such an intermediate level course to be offered through distance Education System. After taking over the charge as a Vice-Chancellor, I decided to materialize my dream and am now happy to see the material in the form of a unique book.

This text, with its performance-based format, has been developed to provide the essential elements of basic Mathematics, Statistics and Computers. A lot of effort was put in and discussion were made to develop this new format. I hope that this style will appeal to the intuition of students and provide a great deal of visual reinforcement. An applied orientation which motivates students and provides a sense of purpose for studying Mathematics has been adopted. A traditional approach which involves rigorous Mathematical proofs has been discouraged in this book.

I wish to express my sincere appreciation and congratulation to all those persons who have contributed either directly or indirectly in the development of this book in the shortest span of time.

(Prof. Javaid Iqbal Syed)  
Vice-Chancellor



## ACKNOWLEDGEMENTS

I wish to express my sincere appreciation to those persons who have contributed either directly or indirectly in the development of this course. I feel pleasure to acknowledge the authors of this course who have worked very hard to evolve a new technique of writing. I wish to thank Miss Faiza Tabassum, Mr. Irshad Ahmad Arshad and Mr. Niaz Hussain Sher of the Departments of Mathematics, Statistics and Computer Sciences, Allama Iqbal Open University. A very special note of thanks goes to Prof. Syed Abrar Hussain and Mr. Shahid Afzal for their conscientious and extremely detailed reviews and suggestions.

I would like to thank Mrs. Shahida Shah for editing this course on priority basis. Special thanks go to Mr. Muhammad Haroon, Senior Designer of AIOU for his work on the design of this book on the basis of latest modern techniques. The esteemed administration and staff of Islamabad Computer Complex, Islamabad, Shifa International Hospital, Islamabad and Pakistan Computer Bureau, Islamabad deserve special mention. They were extremely helpful and showed patience while taking photographs of their facilities.

The authors of this book are highly grateful to Prof. Dr. M. Aslam Asghar, Dean, Faculty of Basic and Applied Sciences for his advice and encouragement during the preparation of this book. I am highly grateful to Prof. Javaid Iqbal Syed, Vice-Chancellor, AIOU for giving creative ideas of writing difficult mathematical concepts in a simple way and provided all facilities to complete this course in the shortest possible time.

Suggestion and criticism to improve the text will be highly appreciated.

(Dr. Arshad Mahmood)  
Course Coordinator





## **COURSE INTRODUCTION**

Numbers suffuse the fabric of our society at almost all folds. The politicians, the economists, the sociologists, the media and even the sportsmen are all engaged in number games. Every citizen needs to be provided literacy in basic Mathematical skills, appreciation of Computer and Statistical thinking. These are the components of Quantitative Literacy (Q.L), which is the ability to understand and critically evaluate quantitative results that permeate our daily lives.

Our society is endangered by four Mis-es Misunderstanding about sources of information, Misperception about willingness of citizens to provide information, Mistrust about how the information will be used, Misgivings about the value of information for guidance in public and private choices.

These Mis-es deeply rooted in society's lack of Q.L. We must make changes in our educational system to embrace Q. L. standards. There is a need to add Q. L. to the skills of citizens to make difference in their personal and professional pursuits. As we endeavor to enhance Q. L. we will enrich the society in which we live. No attempt has so far been made in our country to introduce Q. L. Allama Iqbal Open University has taken the initiative and this course is aimed at that direction.

### **Objectives of the course**

The course aims to teach the students basic concepts of Mathematics, Statistics and Computer and also create value for their use in practical life situations.

The objectives of the course are:

- To develop in students an understanding of Mathematics, Statistics and Computer
- To present the material in a way which is helpful in motivating the students to study these subjects at a higher level.

### **How the course is organized**

The text is divided into nine units in one volume. An attempt has been made to present the material in an informal way. Only those topics of Mathematics, Statistics and Computer are

covered which are thought to be useful for you. For example you started studying Mathematics when you were in class one and you studied it till class 10th. In spite of this most of you do not have full command on every day arithmetic.

Unit-1 covers some basic concepts of everyday arithmetic which will help you to operate with decimals, rates, ratio, proportion, percent and their applications. Unit-2 is designed to provide you necessary tools needed in further study of Mathematics. Various types of equations and their solutions are introduced in this unit. You might have noticed that the land for cultivation is usually divided into different geometrical shapes, such as square, rectangle, triangle. Similarly these shapes can also be seen in construction of buildings. In practical situations, sometimes you are interested to find the area of such shapes. In unit-3 some basic rules of calculating both the area and volume are given.

Daily you come across such statements, "will it rain tomorrow?" or "Pakistan is very likely to win this match". Have you ever thought what these statements mean to you? All such predictions are related with a branch of knowledge, known as probability. In unit-4 a brief introduction to probability is given.


You might have observed that television and newspapers frequently used graphs and numbers to propagate information. It is essential for you to know how to interpret graphs and numbers. Unit-5 deals with basic concepts of statistics. Presentation of data in a meaningful way both in tabular and graphical forms are discussed in this unit. The next step is analyzing of data which are introduced in unit-6.

This is an age of high technology, computers are one of the products of hi-tech, they are now widely and effectively used in every field of human activity. Units-7 to 9 are about computers. We are not claiming that after reading these units you will become a computer expert but at this stage it is important for you to have some understanding of computer so that you can think about its utility. Although we are unable to provide you the opportunity of working on computers but we have tried our best to present the material with the help of illustrations.

In unit-7, types of computer, utility of computers and various hardware components of computer are introduced to you. Unit-8 is about computer software. We have tried to introduce some basic commands of DOS which are necessary to start a computer. In unit-9, some applications of computers in different fields of life are given.


## **How to use the course**


It is often said that we learn by doing. We have followed this approach in writing this course. This is an activity – based course. Generally speaking a number of questions are asked which are broadly divided into two types; some questions appear within text while some are given at the end of each sections.

The within-text questions are indicated by the symbol . After such questions usually a space for writing your answer is provided. You are supposed to write your answer, whether correct or not and then move further. In fact we have tried our best not to spoon feed you rather you learn by doing. Keep a pencil and a rubber with you whenever you study this course.

The other type of questions are Self-assessment Questions (SAQs) given usually at the end of a concept or a section. Their answers are given at the end of each unit. First solve the SAQs go and then check your answers. If you get 80% or above marks in SAQs go to the next section otherwise revise that section. Try to do activities and if you face problems consult your tutor or directly write to the Course Coordinator.

Given below is the list of symbols with explanations, which have been used in the text of this course.

 This symbol is used to indicate within — text questions. This symbol is used when we want you to study a particular paragraph very carefully and to be ready to answer the question to be asked. Infact we want to make you think about a particular point so these questions are those which you should ask yourself. Do not hesitate to write your answer in the given space. Always write your answer whether it is correct or not. Such questions actually lead to a concept to be given afterwards.

 The symbol of pointed hand is used to indicate an important piece of information, it might be a concept or a definition or a point to *remember*. This symbol is usually given after the within-text question.

(Ms. Faiza Tabassum)  
Course Development Coordinator



**Unit - 1**

# **BASIC ARITHMETIC**

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## **INTRODUCTION**

Most of the people have been facing difficulties during calculations especially in adding, subtracting, Multiplying and dividing decimal numbers. We have been using Pakistan for the last more than 30 years but still we are not very clear while calculating. During arithmetic operations a problem of round off arises which has been discussed in this unit. Rate, ratio, proportion and percentage have also been explained from every day problems. Use of calculator has been explained.

## **OBJECTIVES**

After studying this unit, you will be able to:

1. differentiate between different number systems;
2. add, multiply, subtract and divide decimal numbers;
3. calculate percentages;
4. round off decimal numbers;
5. use of calculator for all types of calculations.



## 1. DECIMAL NUMBERS

? If we are to measure the thickness of small parts in a motor car, we may use fractions. If the width of the part is  $\frac{1}{2}$  cm, it is more appropriate to measure as 0.5cm. 0.5 cm means that if we divide 1cm into 10 equal parts we take 5 parts of 10. If we take one part out of 10, then it will be written as 0.1 cm.

Now look at the following figure

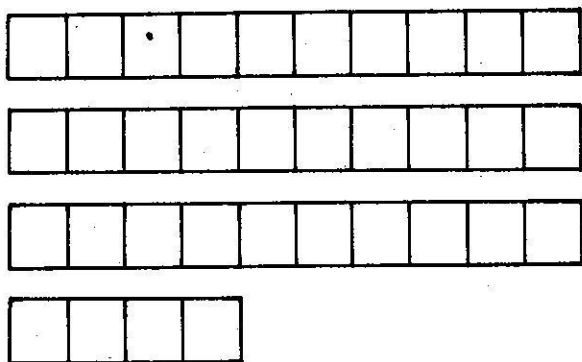


Fig. 1-1— Representation of Decimal Numbers

This figure represents 3.4. Explain why?

The reasons for 3.4 are:

- ☞ (i) 3 complete rods which is also known as integral part.
- (ii) .4 represents four parts out of 10 parts from the fourth rod. This portion is known as decimal fractional part.

Now you think if we write 3.4 in the fractional form, then it will not be easy for calculations.

? Why a decimal number is also called a decimal fraction?

Since these two forms are easily interchangeable so we call decimal number as decimal fraction.

? Is there any difference between decimal number and decimal number system?

Yes, numbers which include decimal point or base 10 are decimal numbers and the number system with the base 10 is decimal number system.

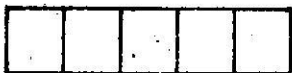
? If the time is quarter to nine, we write 8.45. Is it correct? If wrong, then write the correct way.

No, the correct way is 8:45 since this is not a decimal number.

### ACTIVITY

Write the decimal numbers for the following pictures in the box given against every figure.

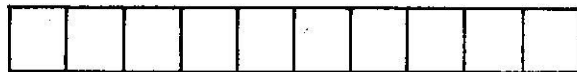
(i)



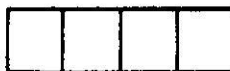
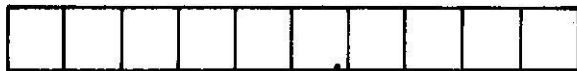
(ii)



(iii)





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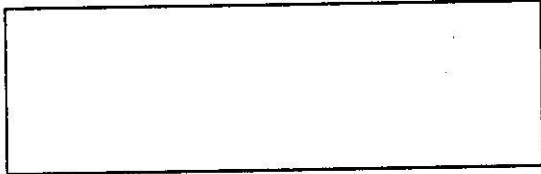
1.2

Fig. 1-2

9

The bigger amount is Rs. 98.50  
 so first enter 98.50. 98.50  
 Press  and then enter the  
 second amount 25.75 25.75  
 Press  we get 72.75  
 the required answer is Rs. 72.75

Q.1 Solve  $3.856 - 1.574$  using calculator.




Ans: 2.282

Q.2 Subtract 5 cms from 10 cm. (tick the right one)

- (a) 5 meters
- (b) 5 cms.
- (c) 9.5 meters
- (d) 9.5 cms

### 1.3 Multiplication of Decimal Numbers

 Multiplication of two decimal values is achieved by two simple operations. The first operation, multiplication is performed as if the decimal numbers were whole numbers. The second step is to count the total number of decimal places contained in both the multiplier and the multiplicand. The correct placement of the decimal point in the answer is found by then counting off, from the right side of the answer, the number of previously counted places. Let us consider one example:

#### Example:



Ashraf wants to give some money to 5 children. If he gives Rs. 1.25 to each child, then how much did he spend?

#### Solution:

Money given to each child Rs. 1.25  
 No. of Children = 5  
 Total amount spent. = ?  
 You write 1.25 and 5 as follows

$$\begin{array}{r} 1.25 \\ \times 5 \\ \hline 6.25 \end{array}$$

Multiplying these two numbers and then put the decimal point according to the rule mentioned above.

On the Calculator enter Rs. 1.25 1.25  
 press  and then enter 5 5  
 Press  and we get the 6.25

#### Self-Assessment Questions-1

Solve with the help of a calculator and tick the right answer.

Q.1 Multiply 3.285 and 0.25 and write answer up to 3 places of decimal.

- (a) 0.82 (b) 0.822 (c) 0.82125 (d) 0.8212


Q.2 Multiply 0.002 and 120.

- (a) 0.24 (b) 0.25 (c) 0.241 (d) 0.251

Q.3 Solve  $\frac{1}{5} \times 0.009$  and write answer up to 5 places of decimal

- (a) 0.00180 (b) 0.0018 (c) 1.8 (d) 1.00008

### 1.4 Division of Decimal Numbers.

 We must be clear while operating division of two decimal numbers. Its different steps are as follows:

1. Convert the decimal divisor into a whole number. This is done by moving the decimal point to the right side of the last value.
2. Count the number of places that the decimal point was moved to obtain the whole-number divisor.

3. Move the decimal point within the dividend the same number of places.
4. Place a decimal point in the quotient directly above the point in the dividend and proceed with the division.

The calculator does all the steps automatically. If we want to divide two decimal numbers with the help of a calculator, we take the following example:

**Example:** Chaudhry Muhammad Hussain has 135 kg. of rice. He wants to divide it into 11 persons. How much each person will get the rice?

**Solution:**

Quantity of rice	
to be distributed	= 135kg
No. of Persons	= 11
Share of each person	= ?

i.e the answer is 12.2727..... or 12.273 kg.

Enter 135 K.g. into the Calculator 135.

Press  $\boxed{=}$  and enter 11 11

Press  $\boxed{=}$  and we get answer as shown on the calculator  $\boxed{=}$  12.27272727

We round off up to three places of decimal i.e. we get 12.273 k.g.

- (b) 0.0155
- (c) 0.016
- (d) 0.156

## 2. ROUNDING OFF

Let us divide 1 by 3 by calculator, the following number will be displayed on the screen of the calculator.

0.33333.

Similarly if we divide 2 by 3 on the calculator, the following decimal number will be resulted on the screen.

0.666666 .

You can take many examples where the answer is like the above. Often you do not need so many digits after the decimal point. You may require only two or three digits. You say your answer is to be rounded off to two places. The rules governing rounding off are as follows:

(1) When the figure beyond the last retained figure in the decimal is less than 5, the last retained figures is unchanged.

**Example:** Round off 7.8542 to two places of decimal.

**Solution:** You want to round off to two places. The figure in the third place is 4 and so you do not change the second place. Thus the answer is 7.85.

(ii) When the figure beyond the last retained figure is more than 5, or equal to the last retained figure is increased by 1.

**Example:** Round off 3.86553 to three places of decimal.

## Self-Assessment Questions-2

Q.1 Divide 5.685 by 0.51 and write the answer up to three places of decimals. (Tick the right one)

- (a) 10.14705
- (b) 11.147
- (c) 11.148
- (d) 111.480

Q.2 Simplify  $18.6 \div 1200$  to three places of decimals (Tick the right one)

- (a) 0.01550

**Solution:** Since the figure after .865 is 50, so .865 will be increased and written as .866 which will be the result.

(iii) When the figure beyond the last retained figure is exactly 5, with zeros after it, then the following operations are performed.

(a) If the retained figure is even, leave it unchanged.

**Example:** 1.6650 Round off to two decimal places. We get 1.66

(b) If the retained figure is odd, increase it by 1.

**Example:** 2.5350 Round off to two decimal places) We get 2.54

### Self-Assessment Question-3

**Q.1** Divide 3 by 7 and write down the figure displayed on the calculator. Round off up to 3 places of decimal and write the answer. (Tick the right one)

- (a) 0.428571428, 0.429
- (b) 2.3333333, 2.333
- (c) 0.42857, 2.42

## 3. PERCENT AND PERCENTAGE



Percent means "Out of one hundred" i.e. We are looking for an amount in one hundred units. If 20 is the required figure out of 100, then 20% will be called percent and 20 will be percentage.

Consider another example. Suppose you have Rs.80/- and you spend Rs.10/-. Calculate

how much can you spend if you have Rs.100/-?

The answer is Rs.12.50

You can calculate it by the unity method.

If 80 rupees, then expenditure Rs.10/-

If 1 rupee, then expenditure =  $\frac{10}{80}$

If you have 100 rupees, then expenditure =

$$\frac{10}{80} \times 100$$

$$= \text{Rs } 12.50$$

In the above calculations, write down percent and percentage.

<p>percent =</p> <p>percentage =</p>
--------------------------------------

The percent is 12.5% and percentage = 10  
This is very important to note that percent is out of 100 and percentage is out of the amount under consideration. In the above example Rs 80/- is the amount under consideration. Mathematically such types of amounts are called base.

**Example:** Mr. Raiz has monthly income of Rs 3000/-. He spends 60% of this amount on foodstuff. Determine his monthly expenditure on foodstuff.

Total income = Base = Rs 3000/-

Spending = Rate or percent = 60%

Total expenditure = Percentage = 60% of 3000

$$= \frac{60}{100} \times 3000$$

$$= \text{Rs } 1800/-$$

If you are clear about percent and percentage, then choose some problems of daily life and make practice on percent and percentage.



**Example:** Govt. of Pakistan increases 20% of the basic salary. If an employee has basic salary Rs 3920/ per month, then calculate his new basic salary.

Basic salary = Rs 3920/

Increase = 20%

new salary = ?

Manually we can solve as follows:

$$20\% \text{ of } 3920 = \frac{20}{100} \times 3920$$

$$\frac{20}{100} \times 3920 = 784$$

New basic salary =  $3920 + 784 = \text{Rs } 4704/-$

We can also use calculator to solve the above the above mentioned problem-as follows:

Enter 3920 into the calculator      3920

Press  $\times$  and enter 20      78400

Press  $\div$  and enter 100      784

Press  $+$  and enter 3920      4704

Thus the new basic salary = Rs 4704/-

“%” is one of the keys on the calculator.

You can use this key of the calculator to find percentage. For example if you have Rs 15/- in yours pocket and you spent Rs 3.50/- out of it, then calculate your expenditure in percent.

If to solve this problem manually, you can proceed as follows:

Total amount = Rs 15/-

Money spent = Rs 3.50/-

$$\text{Expenditure in percent} = \frac{3.50}{15} \times 100$$

$$= \frac{35}{100} \times 100 = 23.33\%$$

By using  $\boxed{\%}$  key on the calculator you can find percent as follows:

Enter Rs. 3.50/-

Press  $\boxed{\div}$  key and then enter

Press  $\boxed{\%}$  key and we get 23.33333

Rounding off we get Rs.23.33%

Here you should keep one thing in mind that some calculators have % key on the second operation (i.e. **Shift**) key. So to get the operation of  $\boxed{\%}$  we proceed as follows:



First press **Shift** and then press  $\boxed{\%}$

Q. 1: What is the purpose of **Shift** key?

Q. 2: Take your calculator and write down the steps to get “%” of some number.

Sometimes the concept of percent cheat you. Consider the following example.

In a certain farm the production of wheat per acor is 1000 kg. By introducing a new variety of seeds, the production increases by 25%. After three years the production decreases by 21%. What will you recommended: the old seed or new seed?

Definitely the old seed. The reason is as follows:

Initial Production = 1000 kg.

Increase = 25%

Total production after 25% increase = 1250 kg.

Decrease = 21%

Production after decrease of 21% = 987.500 kg.

So the new type of seed is not recommended. But if we just look at the first 25% increase and second 21% decrease, we can say that still new seeds are good. So the concept of percent and percentage must be clear.

Many international agencies mislead the people of poor countries by giving % instead of actual figures.

#### Self-Assessment Questions-4

Q. 1: Does percentage mean out of 100

True                  False

Q. 2: Calculate  $4\frac{1}{2}\%$  of Rs.3900/-

- (a) Rs.273/-                  (b) Rs.2.69  
(c) Rs.500/-                  (d) Rs.565.5

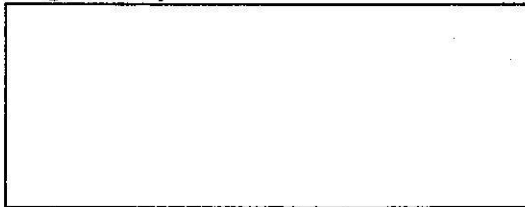
Q. 3: Match with  $\leftrightarrow$  equal decimals and percentages in the following two columns:

Percentage	Decimal
4%	0.09
14%	0.04
9%	0.5
34%	0.34
50%	0.14
45%	0.45
90%	0.9
$12\frac{1}{2}\%$	0.125

#### 4. RATIO AND PROPORTION

##### (a) Ratio

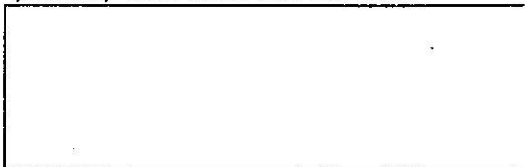
Consider a family in which Haji Muhammad Din's age is 3 times the age of Akram? If Akram's age is 15 years, then find the age of Haji Muhammad Din.



If we divide the age of Haji Muhammad Din by the age of Akram, we will get 3. In other words if we multiply the age of Akram with 3, we get the age of Haji Muhammad Din.

$$\frac{\text{Age of Haji Muhammad Din}}{\text{Age of Akram}} = 3$$

In this particular example "3" is called ratio. So ratio is one type of comparison between two similar things. Remember that ratio has no unit. In the above example how can you say that ratio has no unit.



If Akram's age is 15 years and Haji Muhammad Din's age is 45 years, then we can write as follows:

$$\frac{\text{Age of Haji Muhammad Din}}{\text{Age of Akram}} = \frac{45}{15} = \frac{3}{1} = 3$$

In fact ratio is a fraction, but if in the fraction the denominator is 1 then we

can write ratio as a whole number i.e.  $\frac{3}{1}$  can be written as 3.

Consider another example of a classroom which is 20 meters long and 15 meters wide. What is the ratio between two measurements?

$$\frac{\text{Length of room}}{\text{Width of room}} = \frac{20}{15} = \frac{4}{3}$$

So the ratio between length and width is 4 and 3. In symbolic form we can write as 4 : 3. The mathematical symbol for ratio is ":".

### Self-Assessment Questions-5

Tick the right one

Q. 1: The numerator and denominator in ratio are quantities of the same type.

- (a) True (b) False

Q. 2: The numerator and denominator can be interchanged in finding the same ratio.

- (a) True (b) False

Q. 3: Which information can we have from ratio?

- (a) How much is one quantity bigger/smaller than the second quantity?  
(b) How many times is one quantity bigger/smaller than the second quantity?  
(c) It does not give any information.

### (b) Proportion

? Consider a problem of a water tank in your home which has a hole in it. You

observe that in one minute of time, the tank loses 3 gallons of water. How many gallons of water will be lost in 30 minutes.



The answer is quite easy. Since in one minute the loss of water is 3 gallons, so in 30 minutes the loss of water will be  $3 \times 30 = 90$  gallons.

In this problem we see that if time increases from one minute to 30 minutes, the loss of water also increases from 3 gallons to 90 gallons. We see ratios as follows:

$$\text{Ratio between times} = \frac{1 \text{ minute}}{30 \text{ minutes}} = \frac{1}{30}$$

$$\text{Ratio between losses of water} = \frac{3 \text{ gallons}}{90 \text{ gallons}} = \frac{1}{30}$$

Look at these ratios which are equal

$$\text{i.e. } \frac{1}{30} = \frac{1}{30}$$

We can also write as follows:

$$1:30 = 1:30$$

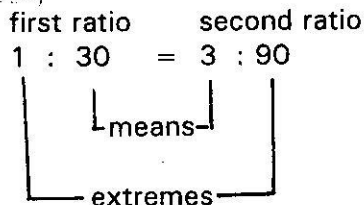
Since the second ratio was originally equal to  $\frac{3}{90}$ , we can write  $1:30 = 3:90$

☞ When two ratios are equal, their four terms from which is called a proportion.

A proportion may be expressed in one of two forms; by an equal sign, =, or a :: between the ratios. The proportion  $\frac{1}{30} = \frac{3}{90}$  could thus be expressed in the form

$$1 : 30 :: 3 : 90$$

It is useful to show this relationship as follows:



Where the product of the extremes must equal to the product of the means. This product will, then performing the product of the means and extremes.

$$30 \times 3 = 1 \times 90$$

? What can you say about the unit of the first ratio and the unit of the second ratio?

The units of the first ratio must be alike and similarly the units of the second ratio must also be alike.

? Consider the above example. Let x represents number of gallons water flow out in 30 minutes, then in proportion form it will be written as follows:

$$\frac{1}{30} = \frac{3}{x}$$

By cross – multiplying, we have

$$1 \times x = 30 \times 3$$

$$x = 90 \text{ gallons}$$

The problems in which if one figure increases and second figure also increases, then it will be called "DIRECT PROPORTION" problem

? If in some problem first figure decreases and the second figure also decreases, then what can we say about the problem?

As the direction of both the terms are same i.e. both of them are decreasing so the proportion is DIRECT.

There are some situations when if one term increases and second term decreases or vice versa, then such cases are called INVERSE PROPORTION. Consider the following example:

**Example:** It has been observed that 4 men can build a wall in 7 days. How many men would be required to complete the same wall in 5 days.

**Solution:** It should be obvious that to reduce the time by 2 days, we would need more than 4 men performing the work i.e. days are decreasing and men are increasing, so it is an Inverse Proportion problem.

$$\frac{4 \text{ men}}{x \text{ men}} = \frac{1}{\frac{7 \text{ days}}{5 \text{ days}}}$$

The right hand side ratio in which numerator is '1' is because of inverse proportion.

$$\text{i.e. } \frac{4 \text{ men}}{x \text{ men}} = \frac{5 \text{ days}}{7 \text{ days}}$$

Performing the cross – multiplication and solving for x, we get

$$5 \times x = 4 \times 7$$

$$x = \frac{4 \times 7}{5} = \frac{28}{5} = 5 \frac{3}{5} \text{ men} = 5.60 \text{ men}$$

Although the calculation is right but for men the answer in terms of fraction is not possible. So we round off and get the answer equal to 6 men (approximately).

☞ In the problems of ratio and proportion, we have to determine whether it is a Direct ratio problem or Inverse ratio problem.

### Self-Assessment Questions-6

Q. 1: Write situation from daily life which

shows DIRECT PROPORTION.

- i). both the terms increase.
- ii) both the terms decrease.

Q. 2: In a certain material voltage is proportional to current. Let the drop of voltage is from 220 Volts to 150 volts. How much will be the current at 150 volts if the current at 220 Volts is 5 amperes. (Taking resistance constant).

Q. 3: The ratio of miles driven to gallons of gas used was 55 to 4. How far was it possible to drive on a 20 gal tank of gas?

Q. 4: The ratio of distance in inches shown on a map to actual distance in miles is 1 to 50. If the map distance between two cities is 9 inches, how many miles is it from one city to the other?

Q. 5: The ratio of the length and width of a rectangular boxlid is known to be 0.75. What is the length of a lid whose width is 25 inches.

- (a) 3 inch
- (b) 18.75 inch
- (c) 18.75 inch

Q. 6: Take some example in daily life in which "INVERSE PROPORTION" exist.

## 5. ANSWERS TO SELF-ASSESSMENT QUESTIONS

### Self-Assessment Questions-1

- (1) 0.821
- (2) 0.24
- (3) 0.0018 or  $1.8 \times 10^{-3}$

### Self-Assessment Questions-2

- (1) 11.147
- (2) 0.016

### Self-Assessment Questions-3

- (1) 0.428571428, 0.429 (if the Number is even then there will be no change so it remains as 0.428).

### Self-Assessment Questions-4

- (1) False
- (2) Rs.565.50

### Self-Assessment Questions-5

- (1) True
- (2) False
- (3) (b)

### Self-Assessment Questions-6

- (2) 3.41 amperes
- (3) 275 miles
- (4) 450 miles
- (5) 18.75 inches.



# **EQUATIONS AND SYSTEM OF EQUATIONS**

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## INTRODUCTION

Combining numbers with alphabets give us mathematical expressions. These expressions are written as mathematical statements by using the equal sign '='. These mathematical statements are termed as equations. The problems in business, agriculture and in science are translated into a mathematical model. These models may be simple or complicated but give a very beautiful relation. In this unit we consider simple cases. We convert problems into equation form, which involve variables and constants. Typically, when faced with a mathematical statement involving a variable, we are asked to find values of the variables that cause the statement to be true. This process is called "Solving equations". There are many methods of solving the equations depending upon the nature of the equation. In this unit we take simple methods to solve linear equations. We also solve system of equations by different methods. Concepts of graphs have also been discussed to solve equations and system of equations.

## OBJECTIVES

After studying this unit, you will be able to;

1. form linear equations;
2. find out the solution of the linear equations;
3. translate problems into mathematical model;
4. solve system of equations graphically;
5. solve system of equations by elimination method.




## 1. LINEAR EQUATIONS IN ONE VARIABLE

? Suppose you have Rs. 6/- in your pocket and your father gives you Rs.10/-. What is the total amount you have?

The amount will be Rs. 16/-, because you can think in the form as follows:

$$6 + 10 = 16$$

The above mentioned is simply a statement. Now you think the same problem in another way. Suppose you have Rs. 6/- in your pocket. Your father gives you some money which you put into your pocket without counting. You find now that the total money in your pocket is Rs.16/-. How much money did your father give?

 To find an answer to this problem, let  $x$  rupees be the money given by your father, then you can write a mathematical statement as follows:

$$6 + x = 16.$$

This statement is called an equation with ' $x$ ' as unknown quantity. This statement consists of two mathematical expressions on either side of the symbol '='. Your aim is to find that value of  $x$  which makes the two sides equal. Now you try putting  $x = 0, 1, 2, 3, \dots, 9$  and you will see these values do not make the two sides equal. If we replace ' $x$ ' by '10', then the statement will be true. " $x = 10$ " is called the solution of the above equation.

? What are the important characteristics of the equation  $6 + x = 16$ ?


The important characteristics of this equation are as follows:

- (i) It has a single unknown ' $x$ ', so is called a simple equation
- (ii) The highest power of ' $x$ ' is '1', so it is called linear.

The idea of equations was first given by a Muslim Arabic Mathematician Al-Khawarizmi (813-846) at Baghdad. He also developed the idea of quadratic equation and its solution. He gave very interesting properties of equation. Do you know what are those properties?


The properties are as follows:

- (i) Consider  $4 + 6 = 10$

Add '4' to both sides, you will get

$$4 + 6 + 4 = 10 + 4$$
$$14 = 14,$$

Similarly if you add the same number on both sides of the above, it will remain unchanged. Again if you subtract the same number on both sides, then it will remain unchanged.

Consider another statement  $5 + 10 = 15$ .  
Multiply both sides of this statement with any number say with '3', then the statement will become as follows:

$$\begin{array}{rcl} 3 \times (5 + 10) & = & 3 \times 15 \\ 3 \times 5 + 3 \times 10 & = & 45 \\ 15 + 30 & = & 45 \\ 45 & = & 45 \end{array}$$

This indicates that if you multiply both sides of equation, then the equation will remain unchanged. Similarly if you divide any equation by some number except zero, the resultant equation will remain unchanged.

? Now you think that if to divide an equation by zero, you get wrong result. For example consider the statement  $0 = 0$   
 $0 \times 4 = 0 \times 3$  (Multiply a number with zero gives zero)

Now divide by zero, you get

$$\frac{0 \times 4}{0} = \frac{0 \times 3}{0}$$

$$4 = 3$$

Which is wrong give reason

Now you take some examples to solve simple equation.

**Example 1:** Solve  $x + 4 = 20$

**Solution:** To solve an equation means to get the value of unknown 'x' which satisfies the equation or in other words to leave x on the left side and number to the right side. For this purpose subtract 4 from both sides, you will get

$$\begin{aligned} x + 4 - 4 &= 20 - 4 \\ x &= 16 \end{aligned}$$

Thus  $x = 16$  is the solution of the above problem.

**Example 2:** Solve

$$3x + 5 = 30$$

**Solution:** To solve the above equation, subtract 5 from both sides, you will get

$$\begin{aligned} 3x + 5 - 5 &= 30 - 5 \\ 3x &= 25 \end{aligned}$$

You want to know the value of 'x' and not the value of '3x'. So to remove '3' from '3x', you divide both sides by 3, you will get

$$\frac{3x}{3} = \frac{25}{3} \text{ or } x = \frac{25}{3}$$

which is the solution of the problem.

### Self-Assessment Questions-1

Solve for x:

Q.1  $3x - 4 = 8$

Q.2  $4(x - 6) = x - 3(2x + 1)$

Q.3  $\frac{2}{3}(x - 6) = \frac{1}{4}x + \frac{1}{4}$

## 2. LINEAR EQUATIONS IN TWO VARIABLES

? Consider the following example.

• Suppose the distance covered by a plane is changing with time, given by the equation:

$$S = 2t + 1$$

Where 'S' stands for distance covered in k.m. and 't' stands for time in seconds. Find the distance covered in 30 seconds.

**Solution:** Since the plane moves according to a certain rule and the distance covered by it follows the following equation

$$S = 2t + 1$$

Put  $t = 30$  seconds in the above equation, you will get,

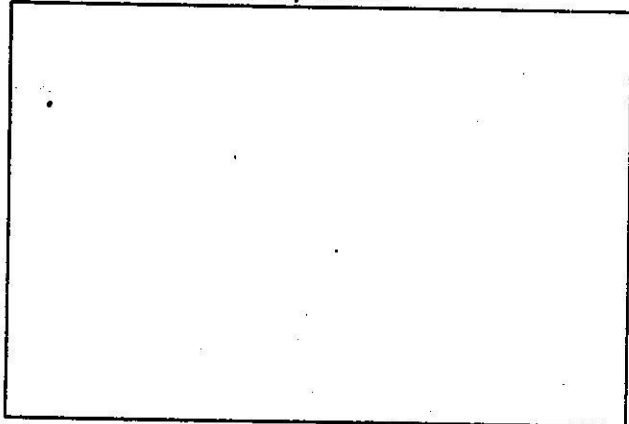
$$S = 2(30) + 1$$

$$S = 60 + 1$$

$$S = 61 \text{ k.m.}$$

? If you want to know the position of the plane at every moment, then the graph method is the best solution.

What is a graph? How can you draw graph for a simple linear equation?

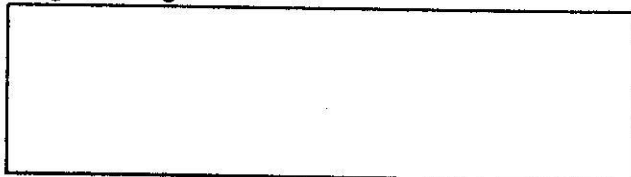


When a coordinate system is defined, the relation between the independent and the dependent variables may be displayed graphically. In this section, we develop a two-dimensional coordinate system that is based on the use of number lines for both axes. This system is called rectangular coordinate system.

The rectangular coordinate system is constructed by intersecting a horizontal number line and a vertical number line at their origins

(zero positions). The point of intersection is called the origin of the coordinate system. The horizontal number line is called the x-axis and has positive direction to the right. The vertical number line is called the y-axis and has positive direction upward.

Which sides of x-axis and y-axis have negative signs?



Left side of x-axis and downward side of y-axis have negative signs.

The four regions formed by the two number lines are called quadrants as shown below:

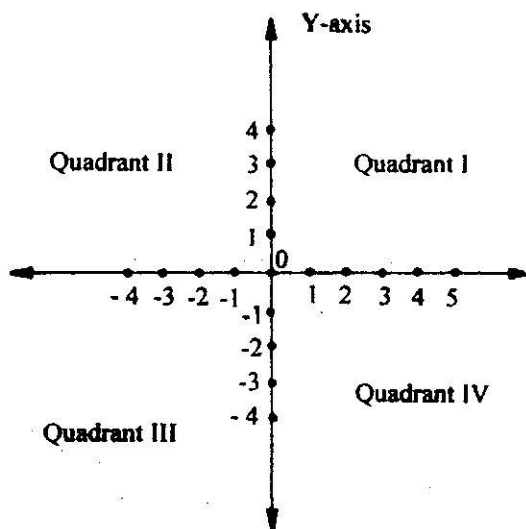


Fig. 2-1

In the rectangular system, each point is characterized by a pair of numbers. This pair of numbers gives the distance of the point from each of the coordinate axes. The

numbers are called the coordinates of the point. These coordinate can, in turn, be associated with the independent and dependent-variables values in the equation. The point that corresponds to the coordinates is located as follows:

**Example:** Locate a point  $(-1, 4)$

**Solution:** First draw horizontal and vertical lines and mark on these line taking origin as 0.

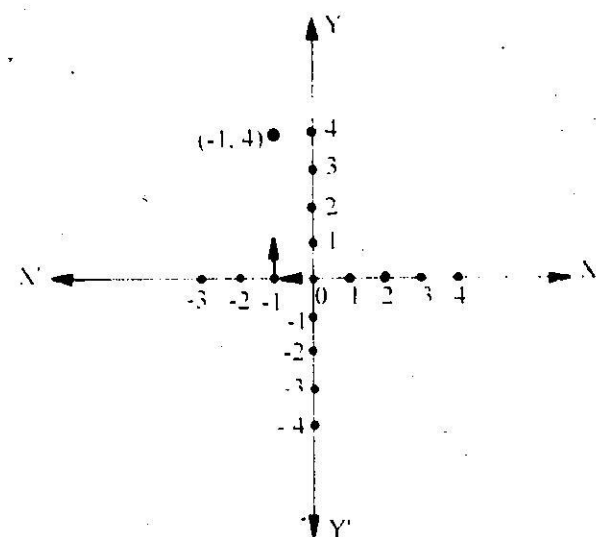


Fig. 2.2

Starting at the origin, move 1 unit to the left. From this point, move 4 units up and place a dot to represent this point. Now you should be able to plot and interpret ordered pairs of numbers as points in a rectangular coordinated system.

Plot the following points on a rectangular coordinate system:

$(0, 3), (-1, 3), (3, 1), (-4, 0), (-2, -4)$



Fig 2-3

As noted earlier, the rectangular coordinate system is of particular value in displaying mathematical relations. Such relations are displayed by forming point plots or line graphs. A point plots consists of points in a rectangular coordinate system, each point representing an ordered pair of numbers that satisfies the relation.

**Example:** Construct a point plot of the mathematical relation  $y = x - 3$  as  $x$  varies from  $-2$  to  $5$  in steps of 1 unit.

**Solution:** First you construct a table of ordered pairs that satisfies the relation. Substitute into the equation  $y = x - 3$  to obtain these ordered pairs.

x	-2	-1	0	1	2	3	4	5
y	-5	-4	-3	-2	-1	0	1	2

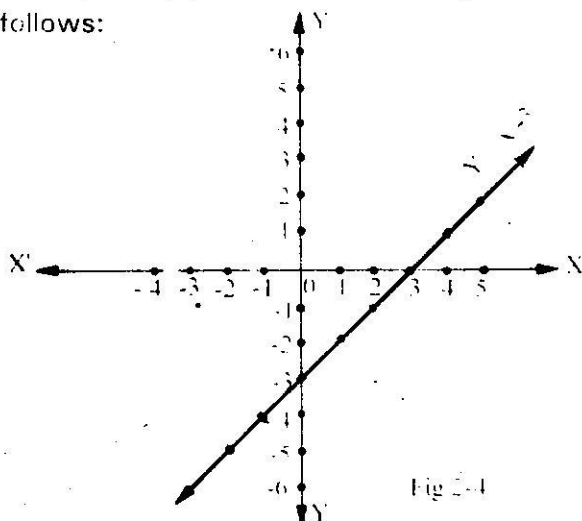
Now you plot each ordered pair in a rectangular coordinate system. What are the ordered pairs?



The ordered pairs are as follows:

$(-2, -5), (-1, -4), (0, -3), (1, -2), (2, -1), (3, 0), (4, 1), (5, 2)$ .

Plot these ordered pairs as points then join these points, you will see a straight line as follows:



Mathematical relations are more clearly portrayed by a line graph rather than by a set of points. A line graph is formed by connecting representative points to form a smooth curve. This curve gives much more information than a table.

### Self-Assessment Questions-2

Q.1 Graph the equation  $V = \pi r^2 h$  over the interval 1 to 5 in  $h$  and let  $r = 2$ . (This equation which is linear in  $h$ , represents the volume of a circular cylinder of radius  $r$  as a function of its height.)

Q.2 Construct a line graph to represent the restoring force of a spring,  $F = -kx$ , as  $x$  varies from -2 to +2. Assume  $k = 4$

## 3. QUADRATIC EQUATIONS

? If you put money in a savings account, the bank will pay you interest. At the

end of a year, the bank will start paying you interest on original amount. For the second year the bank will give you interest on both the original amount and the interest. This is called compounding interest annually.

Consider the following example:

**Example:** Rs. 1000/- invested at 16% for 2 years compounded annually will grow to what amount?

**Solution:** An amount of money 'P' is invested at interest rate 'r' compounded annually. In  $t$  years it will grow to the amount A given by

$$A = P(1 + r)^t$$

In the example

$P = 1000$ ,  $r = 16\% = 16/100 = 0.16$   
and  $t = 2$ . Putting these values in the above formula you will get

$$A = 1000 (1 + 0.16)^2$$

$$A = 1000 [ (1)^2 + 2(1)(0.16) + (0.16)^2 ]$$

$$\text{or you can write } A = 1000 (1.16)^2$$

To Calculate  $(1.16)^2$ , use the key  $(a^b)$  in the calculator as follows.

Enter 1.16

Press **[Shift]** and press **[a<sup>b</sup>]**

Enter 2

Press **[=]** you will get

Multiply with 100, you will get

$$A = 1345.60$$

Thus the amount is Rs. 1345.60.

When  $t = 2$ , the above equation becomes

$$A = P(1 + r)^2$$

Because of this power 2 of  $(1 + r)$ , you call this equation as Quadratic equation.

This relation or formula was first given by Al-Khawrzmi, a great Muslim Mathematician. He also used this idea to solve the problems of land which was asked him by King Al-Mammon of Baghdad.

Let us see an example involving area

**Example:** A rectangular garden is 80m by 60m, part of the garden is turn up to install a strip of lawn around the garden. The new area of The garden is 800 m<sup>2</sup>. How wide is the strip of lawn?

**Solution:** We first make a drawing. Let  $x$  = the width of the lawn

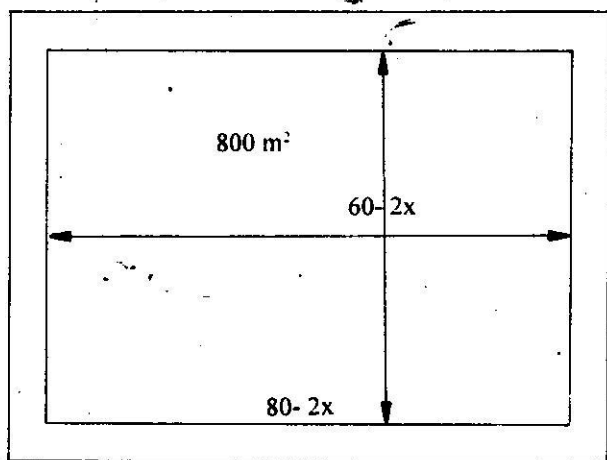


Fig. 2-5

Since  $A = 800 = (80 - 2x)(60 - 2x)$  you solve this equation to find the value of  $x$

$$\begin{aligned} \text{so,} \\ (80 - 2x)(60 - 2x) &= 800 \\ 4800 - 160x - 120x + 4x^2 &= 800 \\ 4x^2 - 280x + 4800 &= 800 \\ 4x^2 - 280x + 4000 &= 0 \end{aligned}$$

Dividing by '4', you will get

$$x^2 - 70x + 1000 = 0$$

We have,  $a = 1$ ,  $b = -70$  and  $c = 1000$

using quadratic formula, you will get,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

putting values, we have

$$\begin{aligned} x &= \frac{70 \pm \sqrt{4900 - 4000}}{2} \\ &= \frac{70 \pm \sqrt{900}}{2} \\ &= \frac{70 \pm 30}{2} \\ &= \frac{70 + 30}{2}, \frac{70 - 30}{2} \\ x &= \frac{100}{2}, \frac{40}{2} \\ x &= 50, 20. \end{aligned}$$

You see that  $x = 20$  satisfies the condition of the problem. Hence the width the lawn is 20 meters.

**Example:** Consider a cube. Let the length of each edge is  $x$  cm, so the volume of this cube is  $x^3$ . Let the increase in Volume be  $98 \text{ cm}^3$  when the edge is increased by  $2 \text{ cm}$ . Find the original length of each edge of the cube?

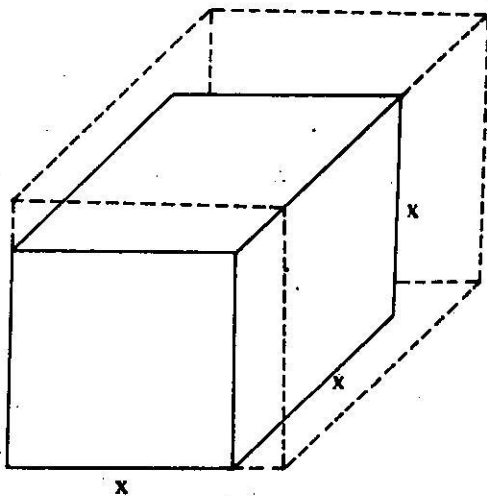


Fig. 2.6

**Solution:**  $x$  cm is the original length of each edge of the cube. Since the volume of a cube is equal to its edge cubed, the original volume is  $x^3$ . The new volume is then  $(x+2)^3$ , because each edge is increased to  $(x+2)$ . Then the increase in volume is the new volume minus the original volume. That is,

$$(x + 2)^3 - x^3 = 98$$

$$\text{or } x^3 + 8 + 6x(x + 2) - x^3 = 98$$

$$\text{or } x^3 + 8 + 6x^2 + 12x - x^3 = 98$$

$$\text{or } 6x^2 + 12x + 8 = 98$$

$$\text{or } 6x^2 + 12x - 90 = 0$$

$$\text{or } x^2 + 2x - 15 = 0$$

$$\text{or } (x + 5)(x - 3) = 0$$

$$\text{or } x + 5 = 0 \text{ or } x - 3 = 0$$

$$\text{or } x = -5, \text{ or } x = 3$$

The first solution  $-5$  is not possible because the original length of a cube can never be negative. So  $x = 3$  cm is the original length of the cube.

### Self-Assessment Questions-3

Q.1 The square of an integer is equal to three times itself minus 2. Write the statement in equation form and determine the integers.

Q.2 In two years you need to earn Rs. 3000/-. If you get an interest rate of 15.75% compounded annually, how much do you need to invest now.

Q.3 The area of a trapezoid is 15 sq. meters. The altitude is  $\frac{1}{3}$  of the lower base and the lower base is 8 meters longer than the upper base. Write down the statement in equation form for the

problem and determine the lengths of the lower and upper base.

## 4. SYSTEM OF EQUATIONS

In this section, you will see that a problem that might otherwise be considered difficult is easy when translated to a system of equations. Consider the following example.

**Example:** On a particular day 411 people (including children and adults) visited a Zoo. Admission was Rs. 3/- for adults and Rs. 1.50/- for children. The receipts that day were of Rs. 1200/- How many adults and children visited Zoo on that day?

**Solution:** Let  $x$  = No. of adults  
 $y$  = No of Children

This problem can be translated into mathematical equations as follows:

The adults and the children total number is 411 i.e.

$$x + y = 411 \dots\dots\dots(1)$$

Since each adult pays Rs. 3/- so receipts for adults are  $3x$ . Similarly receipts for children are  $1.5y$  or  $\frac{3}{2}y$ . Since the total receipts amount to Rs. 1200/- therefore

$$3x + \frac{3}{2}y = 1200 \dots\dots\dots(2)$$

The two equations together (1 and 2) known as system of equations in two unknowns ( $x$  and  $y$ ).

Now we solve the problem as mentioned before i.e.

$$x + y = 411 \dots\dots\dots(1)$$

$$3x + \frac{3}{2}y = 1200 \dots\dots\dots(2)$$

Multiply equation No. 2 with 2 you get

$$6x + 3y = 24000 \dots\dots\dots(3)$$

$$x + y = 411 \dots\dots\dots(4)$$

Our aim is to find the values of the unknown  $x$  and  $y$  for which the statements i.e. equations No. (1) and (2) are true at the same time.

There are many methods to solve system of linear equations. But we will discuss only two of them as follows:

- (i) Graphically Method.
- (ii) Elimination Method.

Now we discuss them in detail.

#### 4.1 Graphical Method

To graph a linear system of two equations in two variables, you graph each linear equation of the system. Since, each individual equation graphs as a straight line, the system graph will appear as a pair of straight lines.

The following possibilities exist:

- (i) If two lines are paralleled, then you will get **No Solution**.
- (ii) If two lines intersect at one point, then you will get **One solution**.
- (iii) If two lines are coincident i.e. the two lines lie one over the other and look like one line, then you will get **Many solutions**

● If the graph is pair of lines that intersect at a point, the coordinates of the points of intersection is the solution of the system of equations.

**Example: 2** Solve graphically

$$x + y = 4 \dots\dots\dots(1)$$

$$2x - y = 5 \dots\dots\dots(2)$$

**Solution:** You write equation No. (1) as  $y = 4 - x$

Then suppose the values of  $x$  and calculate the corresponding values of  $y$  as follows:

x	0	1	2	3	4	5
y	4	3	2	1	0	-1

Similarly table for equation No. (2)  $y = 2x - 5$  is as follows

x	0	1	2	3	4	5
y	-5	-3	-1	1	3	5

Draw graphs for the above mentioned two tables

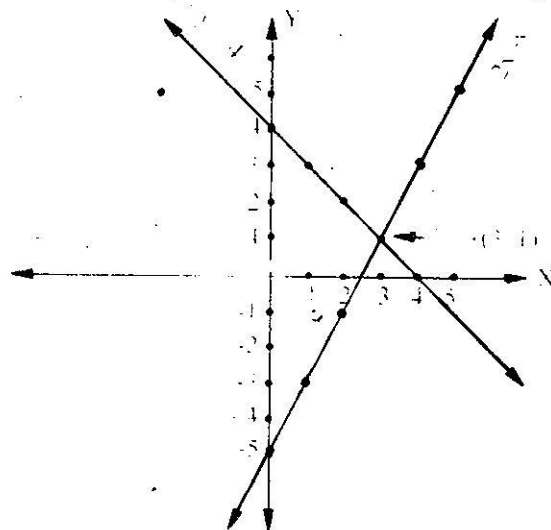


Fig 2.7

(3,1) is the point of intersection and hence the solution.

**Example:** Solve the following system of equations graphically :

$$y = \frac{1}{3}x + 1 \dots\dots\dots(i)$$

$$x - 3y = 6 \dots\dots\dots(ii)$$

**Solution:** Table of equation (i)

x	0	1	2	3	4
y	1	4/3	5/3	2	7/3

Table of equation (ii)

x	0	1	2	3	4
y	-2	-5/3	-4/3	-1	-2/3

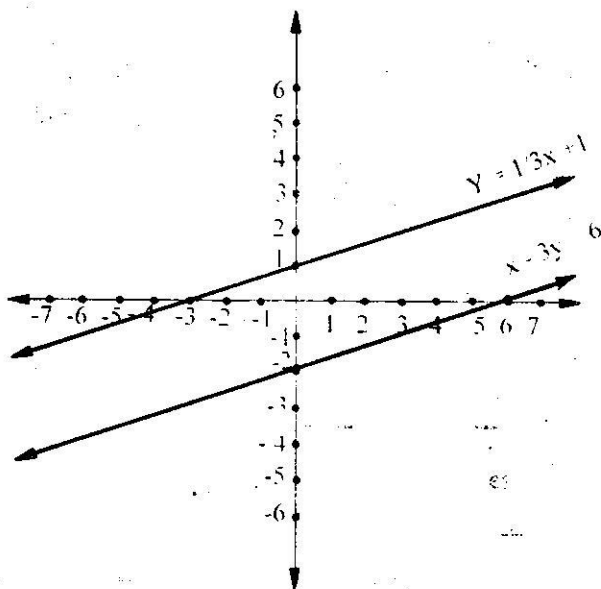


Fig 2.8

Since the lines are parallel, thus there is no solution to the problem

**Example 3:** Solve the following system of equations graphically.

$$y = \frac{1}{2}x + 3 \dots\dots\dots(i)$$

$$-x + 2y = 6 \dots\dots\dots(ii)$$

**Solution:**

Table for equation (i)

x	0	1	2	3	4
y	3	7/2	4	9/2	5

Table for equation (ii)

x	0	1	2	3	4
y	3	7/2	4	9/2	5

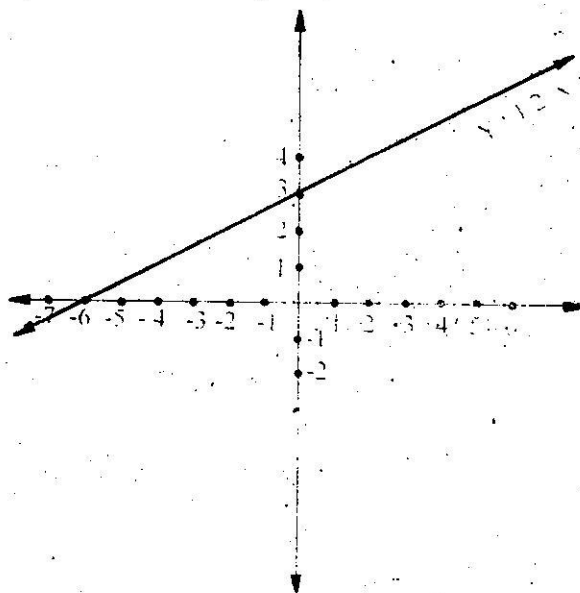


Fig 2.9

The two equations of the system give the same table. To draw graphs for two equations give line which are coincident.

#### Self-Assessment Questions-4

Q.1 The perimeter of a rectangle is 76cm. The width is 17cm less than the length. Find the length and the width?

Q.2 Solve the system of equations graphically and write the solution.

$$2x - y = 4$$

$$4x - 2y = 8$$

Q.3 On solving a system of equations, if we do not get any solution then what will be the shape of graph?

#### 4.2 Elimination Method

Now you solve the same problem by elimination method.

$$x + y = 411 \quad (1)$$

$$6x + 3y = 2400 \quad (2)$$

First you eliminate one of the unknowns  $x$  or  $y$ .

Let us eliminate ' $x$ ', then multiply equation No.1 with 6, you get

$$6x + 6y = 2466 \quad (3)$$

$$6x + 3y = 2400 \quad (2)$$

Subtracting eq. (2) from Eq. (3), you get

$$3y = 66$$

$$\text{or } y = 22$$

Putting  $y = 22$  in equation No.1, you obtain

$$x + 22 = 411$$

$$x = 389$$

Thus  $x = \text{No. of adults} = 389$

$y = \text{No. of children} = 22$

? In elimination method, to decide which variable is to eliminate is in fact a matter of convenience.

**Example:** A Chemist has one solution that is 80% acid (and the rest is water) and another solution that is 30% acid. What needed is 200 litres of a solution that is 62% acid. The

chemist will prepare it by mixing the two solutions on hand. How much of each should be used?

We can draw a picture of the situation. Let the chemist use ' $x$ ' litres of the first solution and ' $y$ ' litres of the second solution.

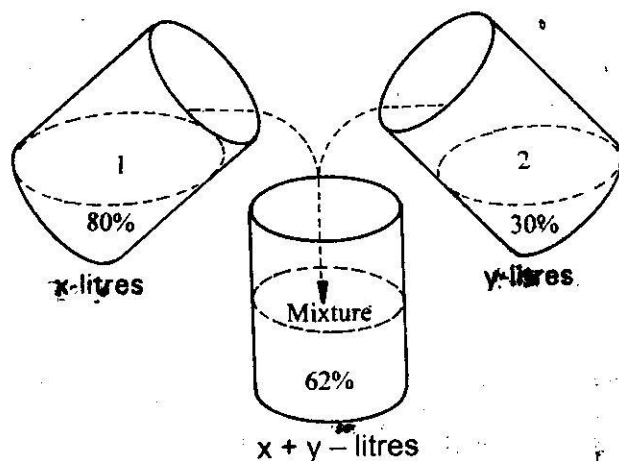


Fig 2.10

Type of Solution	Amount of Solution	Percent of Acid	Amount of acid in solution
1	$x$	80%	$80\%x$
2	$y$	30%	$30\%y$
Mixture	200 litres	62%	$62\% \times 200$ or 124 litres

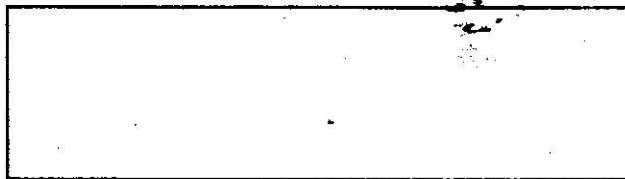
$$x + y = 200, 80\%x + 30\%y = 124$$

The chemist uses ' $x$ ' litres of the first solution and ' $y$ ' litres of the second. Since the total is to be 200 litres, we have

$$x + y = 200 \quad (1)$$

The amount of acid in the new mixture is to

be 62% of 200 litres. How much is this?



This is equal to 124 litres.

The amount of acids from the two solutions are 80% $x$  and 30% $y$  Thus

$$80\% x + 30\% y = 124 \quad (2)$$

$$\text{or } \frac{80}{100}x + \frac{30}{100}y = 124$$
$$\frac{8}{10}x + \frac{3}{10}y = 124$$

Multiply both sides with '10', we get,

$$8x + 3y = 1240 \quad (3)$$

Multiply equation (1) with (-3), we get

$$-3x - 3y = -600 \quad (4)$$

$$8x + 3y = 1240 \quad (2)$$

On adding, we get

$$5x = 640$$

Dividing by 5

$$\frac{5x}{5} = \frac{640}{5}$$
$$x = 128$$

Put  $x = 128$  in equation (1)

$$x + y = 200$$

$$128 + y = 200$$

$$y = 72$$

The solution is  $x = 128$ , and  $y = 72$

*Check:*

The sum of 128 and 72 is 200. Now 80% of 128 is 102.4 and 30% of 72 is 21.6. These add up to 124. Thus the chemist should use 128 litres of the stronger acid and 72 litres of the other.

### Self-Assessment Questions-5

Q.1 The sum of two numbers is 15. One number is four times the other. find the numbers.

Q.2 The perimeter of a rectangle is 90cm. The length is 20 cm greater than the width. Find the length and the width. (Perimeter of a rectangle is the sum of four sides of the rectangle)

Q.3 A computer requires a total of 24 microseconds to fetch data and perform a certain computation on that data. This requirement may be expressed as

$$T_d + T_c = 24$$

Where  $T_d$  is the time required to get the data and  $T_c$  is the computation time. Computing requires twice as much time as getting the data. That is,  $T_c = 2T_d$ . Find the values for  $T_d$  and  $T_c$ .

Q.4 Solve the following linear systems.

$$8x - 4y = 3$$

$$5x + 2y = 3$$

## 5. ANSWERS TO SELF-ASSESSMENT QUESTIONS

### Self-Assessment Questions-1

- (1) 4
- (2)  $2\frac{1}{3}$
- (3)  $10\frac{1}{5}$

### Self-Assessment Questions-2

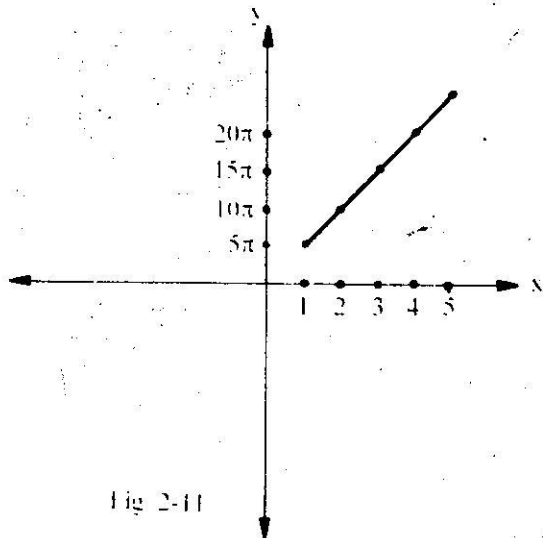


Fig 2-11

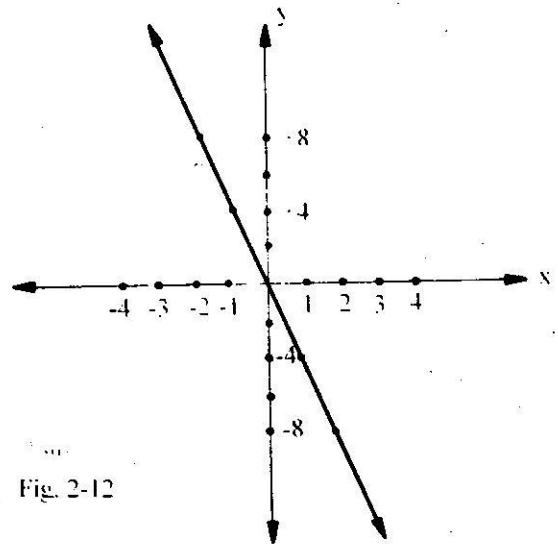


Fig. 2-12

### Self-Assessment Questions-3

- (1)  $x^2 - 3x + 2 = 0$ , 2 and 1
- (2) Rs. 2238. 80
- (3)  $x^2 + 12x - 13 = 0$   
Upper base = 1, Lower base = 9,  
Altitude = 9

### Self-Assessment Questions-4

- (1) (23.25, 14.75)
- (2) (4, 4)
- (3) Parallel Lines

### Self-Assessment Questions- 5

- (1) (12, 3)
- (2)  $(32\frac{1}{2}, 12\frac{1}{2})$
- (3)  $T_c = 16$  microseconds and  
 $T_d = 08$  microsecond
- (4)  $(1/2, 1/4)$



## **UNIT- 3**

# **AREA AND VOLUME**

*Written by:*

**Niaz Hussain Shar**

*Reviewed by:*

**Professor Abrar Hussain**



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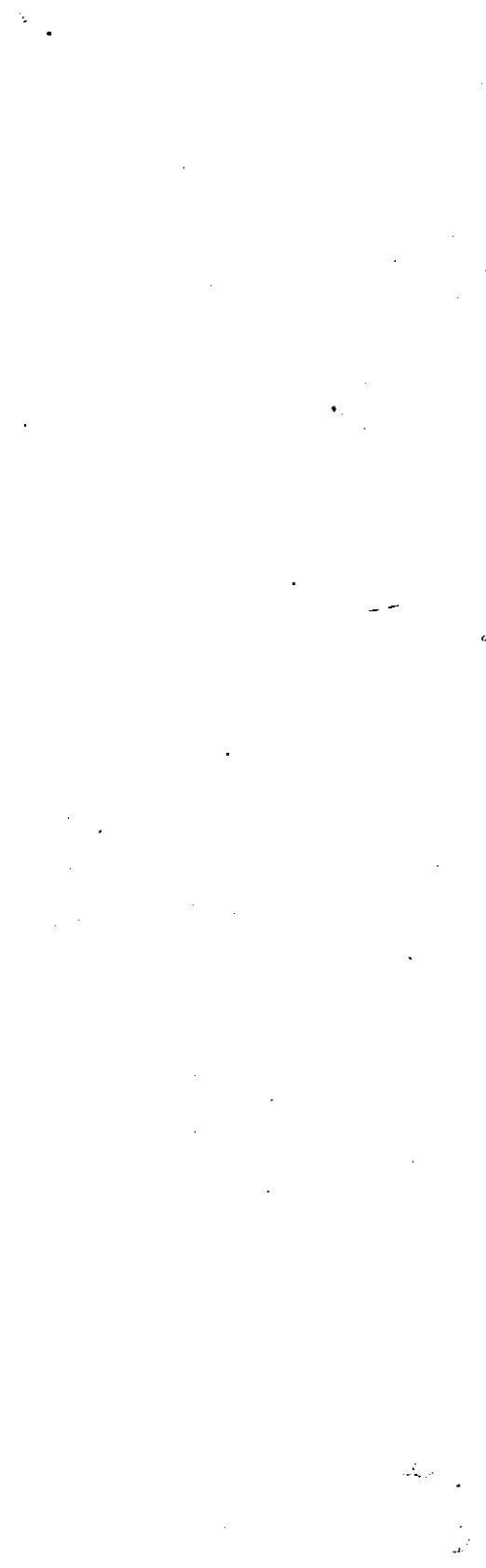
## INTRODUCTION

Historically, the concept of calculating area, came from Egypt. Along the bank of the river Nile, many tribes were living, every year after the flood in the river, the boundaries of the farms owned by different people were dismarked, the rulers of that time submitted a request to mathematician or philosophers to find the solution of the problems. The solution of the problem came out in the form of different geometrical shapes, and similarly the conflict on distribution of water for drinking and irrigation purposes, resulted in the form of formula for calculating volume. As the use of geometry in our every day life is constantly indicated so that the student does not feel that the subject is merely one of academic interest very little "practical geometry" involving drawing and measurements is employed as it is thought to be difficult ?

## OBJECTIVES

After reading this unit, you will be able to :

- calculate the area of rectangle, triangle, square, circle, cylinder, sphere and cone;
- calculate the volume of cylinder, sphere and cone;
- differentiate between different geometrical figures.



# 1. BASIC PLANE GEOMETRICAL FIGURES (Rectangle, square, triangle, circle)

Throughout the world, man makes use of various shapes of forms such as buildings, machinery, commercial products and layouts of cities. The use and knowledge of these forms belong to geometry. The two dimensional figures that have a dimension of length and width to define and build the ground work of some of the basic terms and definitions of the following are given.

(i) **Rectangle**:- Do you observe when farmers grow crops how they give shape to plots of land? The farmers make the plots of land such as:

The opposite sides of the plots are parallel having same lengths at the opposite sides. In geometry these types of plots are known as rectangle shaped.

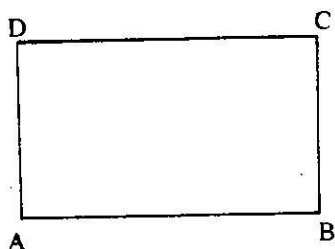


Fig. 3-1 - Plot of land having a rectangular shape

? You have many books at home. See their shapes. What will you say about their shapes?



☞ Mostly we have observed that the shapes of the books are in a rectangular form, because the opposite sides of the books are equal in lengths and width.

(ii) **Square**: Daily you watch television having a size of 35 sq.cm, 40 sq.cm, 50 sq.cm,.... so on, can you tell about the shape of the televisions?

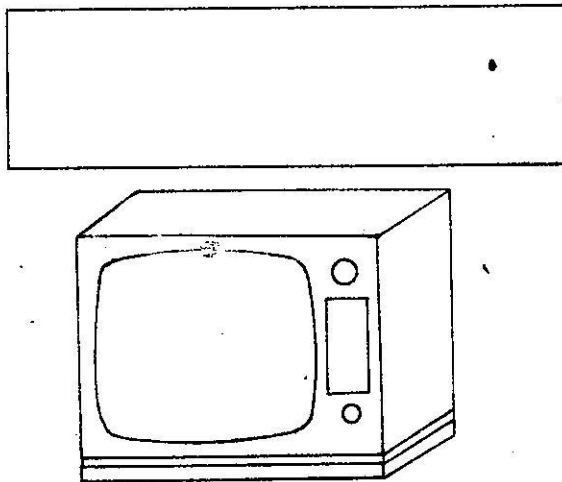


Fig. 3-2- Television

☞ We watch television daily, the widths and the lengths of the sides of the television are equal, so in geometry such shape of things are known as square.

? If you have a room of 5 meters length and 5 meters width, what would you say about the shape of the room?



☞ As the width of the room is 5 meters and the length of the room is 5 meters. The length and the width of the room is equal, hence, we can say that the room is square in shape.

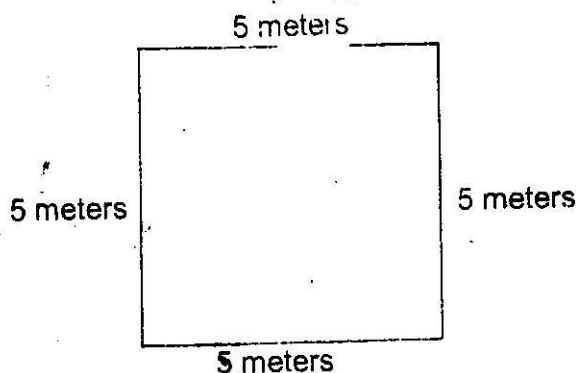


Fig. 3-3- Square

(iii) *Triangle:*

? What do mean by a triangle?



☞ Triangle is a union of three non-collinear points in a plane, and the three segments connecting them.

Non-collinear are points that do not all lie on the same line. The three points, which are end points of the segments, are the vertices of the triangle.

? See the following figure of triangle and state how many vertices are in it?

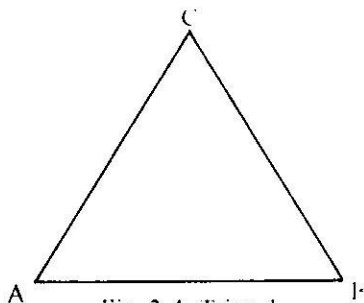


Fig. 3-4 Triangle

☞ There are three vertices in the triangle ie A, B and C. Triangle is geometrical model which reminds a person of physical objects, such as the sails of a boat, certain pieces of land and wedge.

(iv) *Circle:*

? Have you observed a fan while it is rotating?

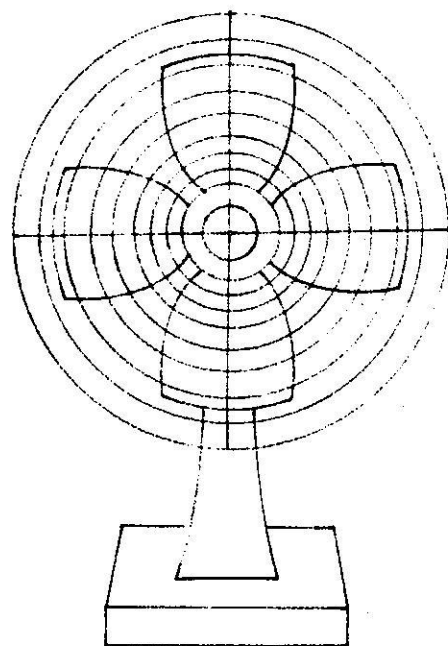


Fig. 3-5 Table Fan

☞ yes, we have observed a fan while it is rotating. Its rotation is circular and when wheel is rotating on a ~~axis~~ **the rotation** of the wheel on axil is also circular.

## 2. AREA OF THE RECTANGLE

While carpetting the house , we need to know the area of the drawing room and bed rooms for calculating the cost of carpetting/ While painting the walls ceiling, we should know the area of the walls and ceiling. The question arises that what is an area? How can we calculate the area of the objects having different shapes. Can you tell how can we calculate or find the area of the rectangular shaped objects?



? if your room is 6 m long and 6 meters wide and you want to put a carpet at the rate of Rs 99 per meter what is the total



area occupied by the carpet? How much it will cost?

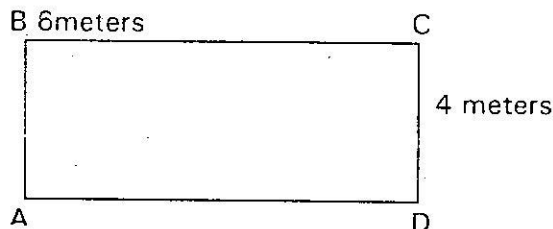
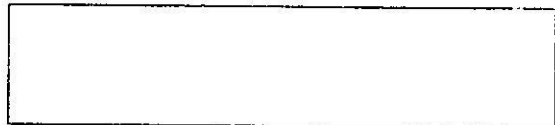


Fig. 3-6 Rectangle

As the sides of the AB and DC are altitudes and AD is the base of the room and the room is rectangular shaped.

(i) First we find the total area occupied by the room.

As Length of the room is 6 meters and the width of the room is 4 meters

Area of the Rectangle =  $a \times b$

Where  $a$  is the altitude of the rectangle and  $b$  is the base of the rectangle.

$$a = 4 \text{ meters}$$

$$b = 6 \text{ metres}$$

$$A = a \times b$$

$$A = 4 \times 6 = 24 \text{ sq. meters.}$$

The unit of area is always taken in square (why?)

(iii) Now we want to find the cost of the carpeting.

As the cost of carpet per sq. m is Rs. 99/-

Then the cost on 24 sq. meters will be

$$24 \times 99 = 2376.$$

Which is the total cost of the carpet

### Self-Assessment Questions-1

Q.1 Your room is 5 m long and 3m wide. find the area of the room?

Q.2 If your dinning table is 60 cm wide and 40 cm in breadth. Find the total area occupied by the table.

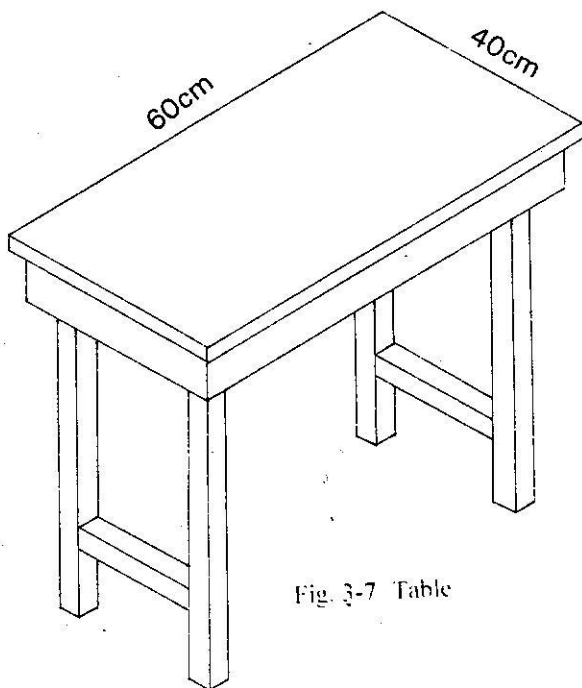


Fig. 3-7 Table

Q.3 If you are given a rectangle with an area equal to 64 sq. cm. The base of the rectangle known to be 32 cm long. Find the value of altitude?

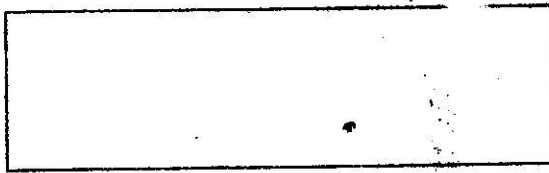
### Activity

Measure all the rooms of your home and find the area occupied by the rooms.

## 3. AREA OF SQUARE

You have seen so many things in this world whose width and breadth is equal. For example, television screen which you watch daily is an example of a square and the formula for finding the area of a rectangle is the same as that of square. the square is the special form of the rectangle whose all sides are equal.

If you have plot of land having 100 meters width and 100 meters breadth. What is the total area of the plot?



As all the sides of the plot are equal in breadth and width.

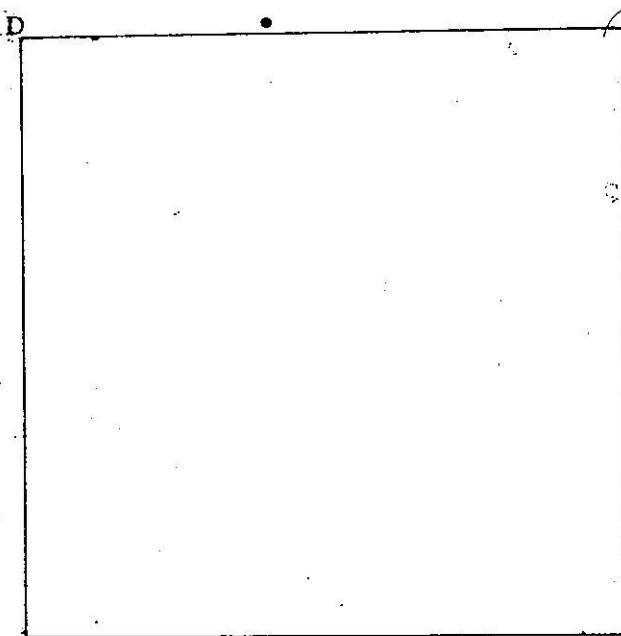


Fig. 3-8-Square Area = Length AB x Length BC

In the figure CD is the base and AC is the altitude. By using the formula

$$A = a \times b$$

$$A = 100 \times 100$$

$$A = 10,000 \text{ sq. meters.}$$

#### 4. AREA OF A TRIANGLE

To fully understand the solution of problems involving areas solution of a triangle is often encountered in the technical world. The area of any triangle is

equal to one half of the product of its base and altitude. i.e.

$$A = 1/2 a.b \text{-----(1)}$$

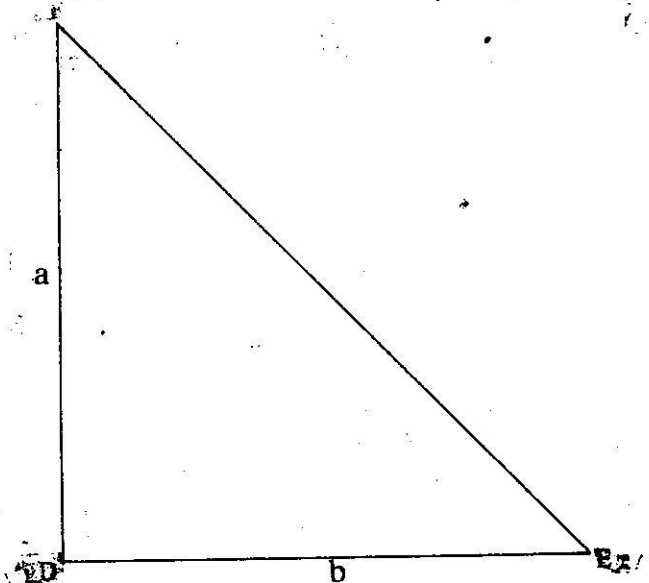


Fig. 3-9-Area of Triangle =  $1/2 \times \text{length} \times \text{height}$

(.) show the multiplication of a and b.

$\overline{DE} = b$  (base of the triangle)

$\overline{DF} = a$  (altitude of the triangle)

$$\text{or } A = \frac{1}{2} (DF \times DE)$$

To solve a and b the following equations are offered.

$$a = \frac{2A}{b} \text{ (altitude of the triangle)}$$

$$b = \frac{2A}{a} \text{ (base of the triangle)}$$

#### Self-Assessment Questions-2

Q.1 Find the area of triangle, whose base is 5 cm and altitude of the triangle is 6 cm?

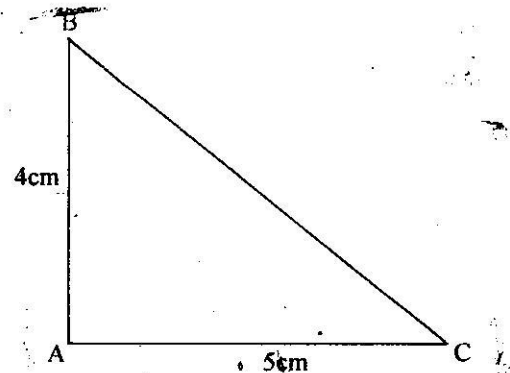
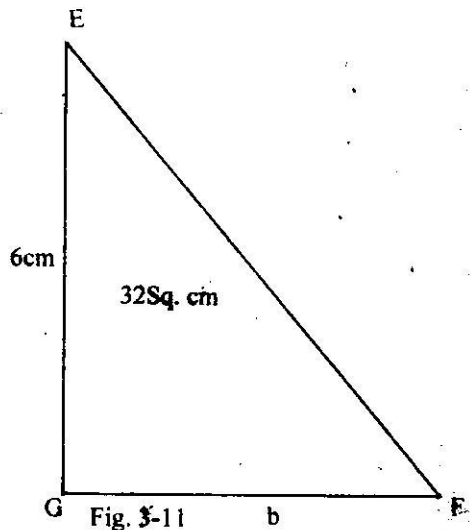


Fig. 3-10

Q. 2 Find the base of the triangle whose area is 32 sq. cm and altitude of the triangle is 8 cm.



### Activity

Make any two triangles, measure the base and altitude of triangle and find their areas respectively

## 5. AREA OF A CIRCLE

Knowledge of circle and its basic elements form a power full tool used in many problems solutions, astronomy, Navigation, the design of gears and pulleys and many other problems situations involve the circle in one form or another.

Possibly one of the most frequent uses of the circle is in its use to represent and describe Graphically the rotation of a shape such as the motion of an electric motor or wheel of an automobile.

If you are asked to define rotation or revolution, how can you define?

Rotation/revolution is defined as the circular motion of any shaped body about a common point.

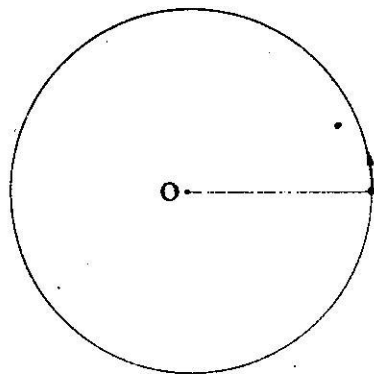


Fig. 3-12—Rotation about the Centre O

Do you know about center of rotation?

The common point about which rotation takes place is called the centre of the rotation.

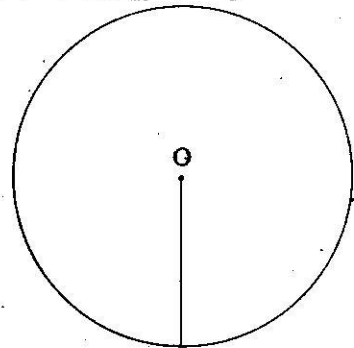




Fig. 3-13—O is called centre of rotation

In the above figure O is the centre of rotation.

Can you define the full revolution of a circle?

 A full rotation or revolution is defined as a rotation of any and all points simultaneously in the shape through a full 360° degree of motion. That is whe. a certain point on the body rotates around its beginning position a full revolution has occurred.

**?** How many revolution are completed by an hour of watch clock in twenty four hours?

 In twenty four hours two revolution are completed by the hours hand.

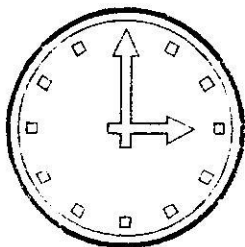



Fig 3.14

## 5.1 Circumference of a Circle

**?** It is necessary to define the circumference of a circle and how it is found?

 If one construct the unit circle, that has a radius equal to 1/2 cm, the diameter of the circle is equal to 2r or 1 cm (a unit circle)

Circumference

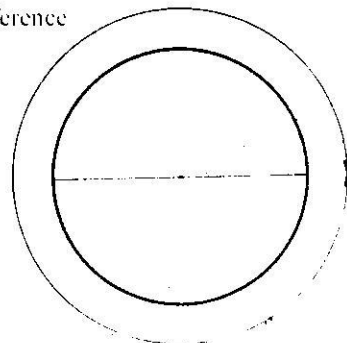


Fig. 3-15 A unit Circle

$$\text{Circumference} / \text{Diameter} = \pi = 3.1416$$

A unique relation ship between the diameter of circle and its total path length (circumference) can now be presented if the circumference of a circle could be measured and the diameter of that circle would evenly divide into this length 3.1416 ( $\pi$ ) times. This ratio of circumference to diameter is true for all circles and therefore becomes known as constant.

If the radius or diameter is measured in feet, the circumference will be in feet.

What is the formula for circumference of circle?

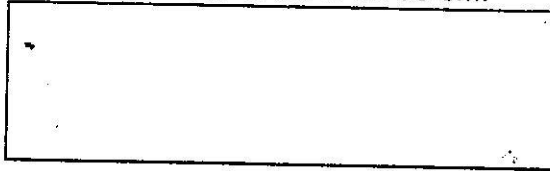
The circumference of a circle will be equal to:

$$\begin{aligned} C &= \pi d \\ &= 2\pi r \text{-----(i)} \\ d &= C/\pi \text{-----(ii)} \\ r &= C/2\pi \text{-----(iii)} \end{aligned}$$

Where  $\pi = 3.1416$ , r is the radius, and d is the diameter of the circle.

1a

- ? Find the circumference of the circle if the radius of the circle is 0.750 cm.



As we know that the circumference of a circle is:

$$\begin{aligned} C &= 2\pi r \\ C &= 2 \times 3.1416 \times 0.7550 \\ C &= 4.7124 \text{ cm.} \end{aligned}$$

The area of circle =  $\frac{1}{2}$  (Circumference)  $\times$  r

$$A = \frac{1}{2} \times 2\pi r \times r$$

$$A = \pi r^2$$

If the formula is expressed in diameter, it will be:

$$\begin{aligned} A &= \frac{1}{2} \times 2\pi \frac{d}{2} \times \frac{d}{2} \\ A &= \frac{\pi d^2}{4} \end{aligned}$$

### Self-Assessment Questions-3

- Q.1 Find the area of the circle if the diameter of the circle is 4cm take  $\pi = 3.1416$
- Q.2 Find the diameter of the circle if the circumference of the circle is 3 cm.

## 6. AREA AND VOLUME OF A CYLINDER

Of widespread use through out the world is the cylinder and its variations, these take the form of round solid rods, barrels, cans, pipes, storage tanks and a host of other needed items, working knowledge of cylinder is therefore very important when the need arises to compute the capacity, weight, or

the flow of the material through hollow cylinders.

If a person is interested to find the surface area of water tank, that is in the cylindrical shape.

- ? How can you find the surface area of the cylindrical tank or water tank?

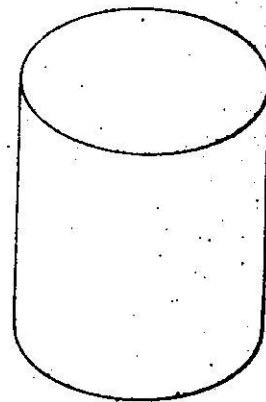


Fig. 3-16 Cylindrical Water tank



You can find the surface area of the water tank, if the radius of the tank and height of tank is known. Now we may write a formula for the total surface area of the cylinder

$$\begin{aligned} S &= \text{area of base} + \text{curve surface} \\ S &= 2\pi r^2 + 2\pi rh \\ S &= 2\pi r (r + h) \end{aligned}$$

Where r is the radius of the cylinder and h is the height of the cylinder and  $\pi$  is the ratio of circumference of the circle to diameter of the circle which is always constant.

So it is very easy to find the surface area of the water tank.

- ? Find the surface area of the water tank, if the radius of the tank is 3 meters and the height of the tank is 5 meters.

\* As the radius of the tank is 3 meters and height of tank is 5 meters

$$S = 2 \pi r (r + h)$$

by putting the values

$$\begin{aligned} S &= 2 \times 3.1416 \times 3 (3 + 5) \\ &= 18.85714 \times 8 \\ &= 150.857 \text{ meter}^2 \\ &= 150.857 \text{m}^2 \end{aligned}$$

### 6.1 Volume of a Cylinder

The volume of a cylinder, as in all volume solutions, is measured by its capacity to contain a number of cubic units, it is therefore important that we first reduce the dimensions of the figures to a common form, that is in inches, feet, meters. The following equations computes the volume of the cylinder.

$$V = \pi r^2 \cdot a$$

Where  $V$  is the volume of the cylinder  $\pi r^2$  is the area of one circular base plane and 'a' is the altitude of cylinder.

For any cylinder if the radius is 2 meters, then the volume of the cylinder is as under and the altitude of the cylinder is 4 meters by using the formula.

$$V = \pi r^2 \cdot a$$

Where  $\pi r^2$  is the area of the circular base of the cylinder.

$$\begin{aligned} V &= \pi r^2 \cdot a \\ V &= 3.1416 \times (2)^2 \times 4 \\ V &= 3.1416 \times 4 \times 4 \\ V &= 31.416 \times 4 \\ V &= 125.664 \text{m}^3 \end{aligned}$$

### Self-Assessment Questions-4

Q.1 Find the approximate number cubic cm of a material below

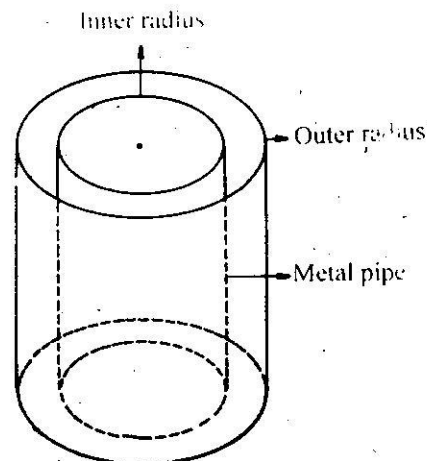
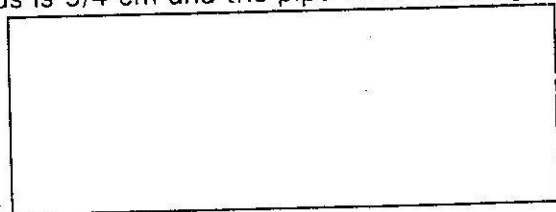


Fig. 3-17

If the interior radius is one cm and the outer radius is  $5/4$  cm and the pipe is .11 cm long?



### 7. AREA AND VOLUME OF A CONE

The cone is a shape used often by man to effect a size transition. The nose cone of a rocket, for example serves as a transition surface, to lessen the air friction encountered by the rockets atmospheric flight. In every day uses, the joining of two pipes, each of different diameters is achieved by use of a type of cone or conic section.

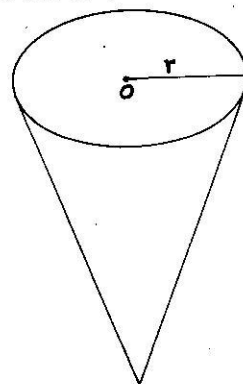


Fig. 3-18 Surface Area of Cone

The formula for surface area of the cone is as follows:

$$S = \pi r^2 + \pi rs$$

$$S = \pi r (r + s)$$

? A cone has the height of 3 meters and the radius of the cone is 2 meters. What is the surface area of the cone?

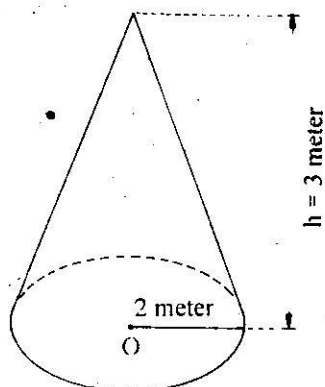


Fig. 3-19 Cone

A. The formula for the surface area of the cone is

$$S = \pi r^2 + \pi rs$$

$$= \pi r (r + s)$$

by putting the values we will get the result

$$S = 3.1416 \times 2 (2 + 3)$$

$$= 220/7 = 31.42 \text{ m}^2$$

### 7.1 Volume of a Cone

The volume of a cone is one-third the product of the area of base and the height of cone.

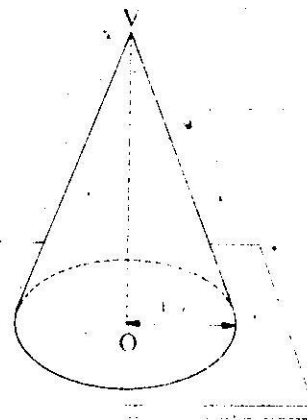


Fig. 3-20 Volume of Cone

$$\text{Volume of the Cone} = \frac{1}{3} \pi r^2 h$$

Where  $\pi r^2$  is the area of the base  $r$  is the radius of the base and  $h$  is the height of cone.

? Find the volume of a cone full of ice-cream if the radius of the cone is 4 cm and the height of the cone is 6 cm.

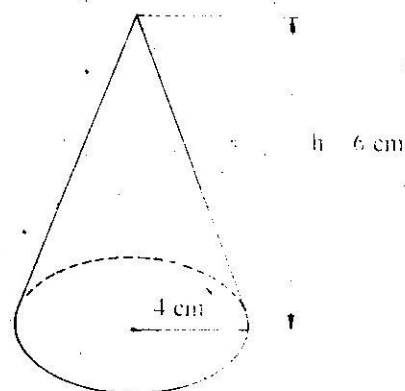
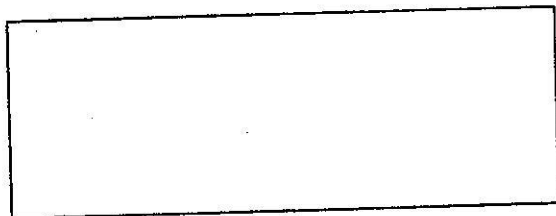


Fig 3.21

The cone occupies less material than the cylinder. Secondly it looks more beautiful.

## Self-Assessment Questions-5

Q.1 Define Cone?



Q.2 The ice-cream pot is not as a cone  
Yes/No

gases or liquids, spherical tanks with hemispherical shaped ends are most often used.

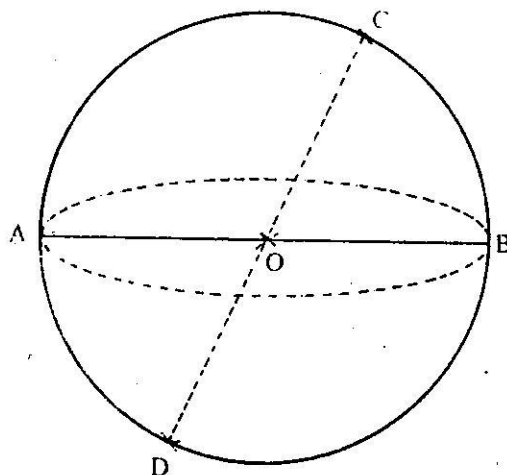


Fig. 3-22 Diameter of Sphere = AOB = COD

## 8. AREA AND VOLUME OF SPHERE

The sphere is the three dimensional shape. That serves man in variety of ways. At present the sphere is used mostly in the bearing and pressure fields. A bearing is a device that permits the somewhat frictionless, high speed rotation of a shape within a fixed support.

Another common use of spheres is in the creation and the storage of high-pressure

The sun which gives us enormous amount of heat and energy is also in spherical shape. The moon which gets energy from the sun is also a spherical

The total surface area of a sphere is as under

$$A = 4 \pi r^2$$

where  $r$  is the radius of the sphere, i.e.

$$A = 4 \pi r^2$$

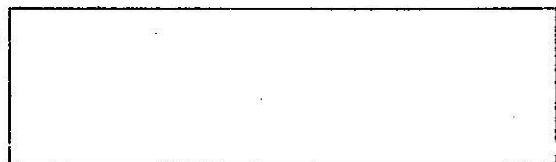
As we know the formula for the volume of the cone

$$\begin{aligned} V &= \frac{1}{3} \pi r^2 h \\ r &= 4 \text{ cm} \\ h &= 6 \text{ cm} \\ V &= ? \end{aligned}$$

$$\begin{aligned} V &= \frac{1}{3} \times 3.1416 \times (4)^2 \times 6 \\ &= \frac{1}{3} \times 3.1416 \times 16 \times 6 \\ &= \frac{1}{3} \times 3.1416 \times 36 \\ V &= 100.5313 \text{ cm}^3 \end{aligned}$$

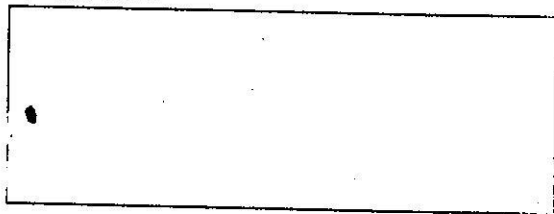
## Self-Assessment Questions-6

Q.1 If a ball has a radius 4 cm, then what is the surface area of the ball?





- Q.2 *Activity:* Suppose you are playing cricket with a hard ball, find the volume of the ball.



## 9. ANSWER TO SELF-ASSESSMENT QUESTIONS

### Self-Assessment Questions-1

- (1) 15 sq. meters
- (2) 24 sq. cm.
- (3) 2 cm.

### Self-Assessment Questions-2

- (1) 15 sq. cm.
- (2) 8 cm.

### Self-Assessment Questions-3

- (1) 12.5663 sq. cm.
- (2) 0.954 cm.

### Self-Assessment Questions-4

- (i) 53.996 Cubic cm.

### Self-Assessment Questions-5

- (1) See page 50
- (2) No.

### Self-Assessment Questions-6

- (1) 201.06 Sq. cm.



# PROBABILITY

*Written by:*

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*Reviewed by:*

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# INTRODUCTION

The branch of human knowledge which helps to answer the questions like "will it rain tomorrow" is known as probability. The origin of probability was in the games of chance but now it has wide applications in medicine, agriculture, engineering, business and political science. This unit is aimed at providing an introduction to probability and to create interests for study of the subject.

An attempt has been made to introduce the concepts with the help of everyday life situations. This unit is a first exposure of you to probability and accordingly the emphasis here is to create an understanding of the topic rather than involving you in calculations.

## OBJECTIVES

After studying this unit, you should be able to:

- explain the concept of probability.
- calculate probability of an event.





# 1. CONCEPT OF PROBABILITY

? Suppose you are holding a pencil in your hand. If you loosen the grip then what would happen? Tick the appropriate choice:

- ☐ It will remain in the air
- ☐ It will fall down
- ☐ It will go upwards.

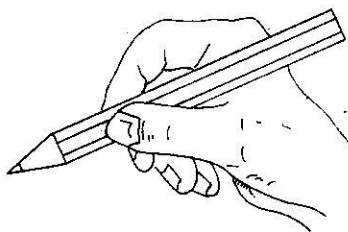


Fig 4-1 Holding a Pencil

Yes, it will fall down because of the force of gravity. This is a result of the famous Newton's Law of Gravitation and according to this law every object which is left unsupported will fall down.

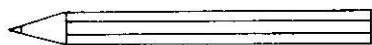
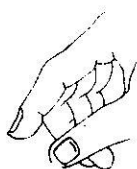


Fig 4-2 It will fall down

? The above experiment is carried out under certain conditions. What are these conditions? Write your answer in the space given below:

Holding the pencil in your hand and then loosening your grip are conditions of the experiment. When the experiment is carried out under these conditions the pencil is left unsupported and as a result it falls down. In other words the pencil will always fall down whenever you loosen the grip of your hand.

→ The result of this experiment is certain to occur therefore certainty is the word which is associated with this experiment. Examples of such experiments which are performed under certain conditions

and give the same result everytime can be seen in the world of Physics and Mathematics. For example the sum of three angles of a triangle is always  $180^\circ$

## Self-Assessment Questions-1

Write down one situation when you are certain about the result.

---

---

---

? If you look around, you will notice that in most of the situations the result cannot be predicted with surety. For example you are watching a Hockey match between Pakistan and Australia on television shown live from the stadium. Definitely you would like to guess the result of the match. Could you tell with surety the name of the winning team?


Yes

No

Definitely your answer would be No. It means that you are not very sure which of the two teams will win the match.

Why your answer in the above question was in No.?

It was in 'No' because there is no such law by which you can predict with hundred percent surety the result of an action which is under process.

 Uncertainty is a word which is associated with such situations. Everyday you come across situations where you are uncertain of the result. For example you daily ask a question, "will it rain tomorrow" or "will there be an accident on Indus Highway this afternoon". In the coming sections of this unit you will read how these problems can be solved.

### Self-Assessment Questions-2

Write down a situation from your personal life when you are uncertain about the result.

### Self-Assessment Questions-3

Indicate which of the following situations are related with certainty and which are related with uncertainty.

1. The square root of 64 is 8

Certainty      Uncertainty

2. You will get A grade in the test to be taken by you next week.

• Certainty      Uncertainty

3. You stop five strangers in a street, were all of them born on Monday?


Certainty      Uncertainty

4. Water heated to  $100^{\circ}\text{C}$  begins to boil.

Certainty      Uncertainty

5. You purchase 20 prize bonds of Rs.100 each. Will you win a prize in the next draw?

Certainty      Uncertainty

 You might be thinking that when in most of the situations the result is unpredictable why should we discuss uncertainty? From the earlier examples you might have noticed that factor of uncertainty is present everywhere in all human activities. Thus there is a need for having a tool which can measure uncertainty. The branch of human knowledge which is concerned with the study of uncertainty is called PROBABILITY.

- ? Read carefully the following statements:
- It will probably rain this afternoon.
  - We are likely to win this match.
  - The chances of my promotion are very bright this year.

Each statement suggests that we expect something to happen but we are not sure of its happening. You can say the factor of uncertainty is present in these statements. This factor has been indicated by using some typical words. Can you list down these words from the above statements?

1. \_\_\_\_\_  
2. \_\_\_\_\_  
3. \_\_\_\_\_

Since the time of stone age the man has been using words like: may be, chance, probably, likely, luck, fate in his everyday language. Therefore the history of probability is as old as the history of man. Usually you use your own judgement and the available evidence to estimate the probability of occurrence of certain event. For example on the basis of available evidence you expect the weather to be wet in the afternoon. Now the question arises can we always make personal judgements about the occurrence or non-occurrence of an event and also how accurate our estimates could be?

☞ Yes-there are situations when we use personal judgements. But in most of the situations we have to use different scientific and statistical methods to calculate the probability of an action taking place. Probability had an humble origin in games of chance also known as gambling. Today probability is used in almost every field of human activity:

- The biologist uses it to study hereditary characteristics.
- The politician uses it to plan his election campaign.
- The meteorologist uses probability to forecast weather.
- The insurance company uses it to calculate the cost of insurance.

## 2. PROBABILITY OF AN EVENT

? Before the start of the cricket match both the captain of two-teams toss a coin to decide who will bat first. Activity like tossing a coin is an **experiment**. How many faces does the coin have? Tick the appropriate box:

2	1	3	0
---	---	---	---

Yes — a coin has two faces designated as Head and Tail and abbreviated as H and T respectively. Our coins do not bear a head, rather a crescent and star. Star is one face which may be called head (H), while the other face is tail (T). See Fig. 4.3.

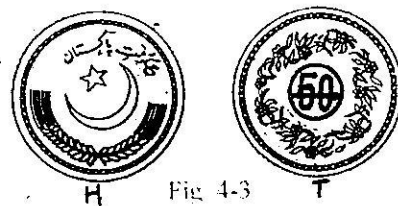


Fig 4-3

? When you toss a coin, what are the possible results?

---

When a coin is tossed there are two possibilities. Either a head will show uppermost or a tail will show. In probability language the possible results of an experiment are known as *outcomes*. In this case there are two possible outcomes i.e. either head or tail.

☞ The collection of all possible outcomes of an experiment is known as *Sample Space*, abbreviated as 'S', while a part of sample space is known as an *event*.

? Refer back to coin tossing experiment. Suppose it has been decided that if head occurs team A will bat first. What is the probability of occurrence of head? Spend few minutes on thinking and then go ahead. Write your answer in the space given below:

---




---



---



---

 The probability of occurrence of head is calculated as:

Sample space consist of two possible outcomes head and tail. Out of these one outcome is favourable to the occurrence of head. In other words you can say that the chances are 1 in 2 that head will occur. The probability of head expressed as  $P(H)$  and written as:

$$P(H) = 1/2 \text{ or}$$

$$P(H) = \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}}$$

Thus the probability that Team A will bat first is  $1/2$  or  $0.5$  or  $50\%$ .

In the similar way you can calculate the probability of the occurrence of tail when a coin is tossed. Write your answer in the space given below:

---



---




---



---

Yes-the chances are 1 in 2 that tail will come up. Therefore  $P(T) = 1/2$  that is probability of tail is also  $1/2$ . This method of calculating the probability of an event is known as "Classical Probability".

 You have just seen that in coin tossing experiment  $P(H) = P(T)$  which means that when we toss a coin it is likely to fall showing head as it is to fall showing tail. When this is the case we say that the outcomes of tossing a coin are *equally likely*. See Fig. 4.4





Experiment	Possible Outcomes	We say
 Toss Coin	  Head 1 Each outcome is equally likely to happen	 The chances are 1 in 2 that a head will come up in one toss. The probability of tossing a head is $1/2$


Fig. 4.4: Equally Likely Outcomes

#### Self-Assessment Questions-4


Playing the match is an experiment. Answer the following questions related with this experiment:

- What are the possible outcomes?
- Are the outcomes equally likely?
- What is the probability of occurrence of any of the outcome.

### 3. PASCAL'S TRIANGLE

 Suppose two coins, one of 50 paisas and other of 25 paisas are tossed simultaneously. What are the possible outcomes and what are their respective probabilities? Spend few minutes on thinking and then go ahead.

You might say that there are three possible outcomes which are HH, TT, HT. Note that HH means that both coins show heads, TT means the two coins are showing tails while HT means one coin shows head and the other shows tail. Therefore you can say that the probability is  $1/3$  that one of the outcomes will occur.

 The above illustration is wrong, because when one coin is tossed

there are two possible outcomes so in case of tossing two coins there are  $2 \times 2 = 4$  possible outcomes which are listed below:









Frist Coin	Second Coin
	
	
	
	

Fig. 4-5



There might be situations when you have to toss 2 or more than 2 coins at a time. The question arises is there any tool for calculating probabilities in coin tossing experiments.

Yes - the problem can be solved by using a triangle known as Pascal's Triangle. You could be glad to know that this triangle was originally developed by the famous muslim scientist Umar Khayyam but now wrongly known as Pascal's Triangle. Pascal a French Mathematician used this triangle for the expansion of  $a+b$ ,  $(a+b)^2$ ,  $(a+b)^3$ ....  $(a+b)^n$ , which can further be used to find the probabilities.

It is very easy and interesting to use this triabgle. You can get each line of numbers in the triangle by writing 1, at each end and under each pair of numbers which are side by side their sum are written.

See Fig. 4.6:

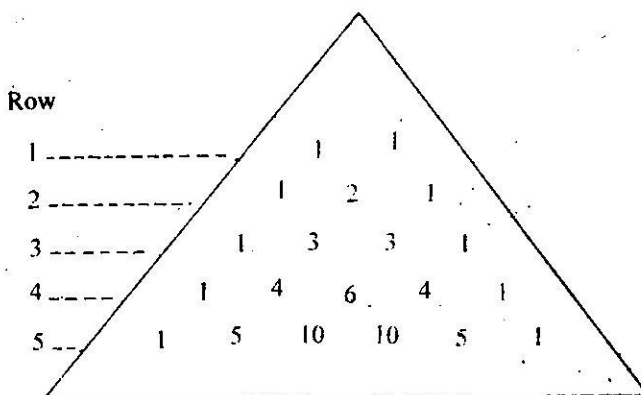


Fig. 4.6: Pascal's Triangle.

#### Self-Assessment Questions-5

Refer to Fig.4.6. What would be the 6th row?

Consider Fig. 4.6. The first number in a line is for all heads while the next number to the right is for less head and 1 more tail. The numbers in row 1 indicate that when a single coin is tossed there are  $1+1$  or 2 possible outcomes, the numbers in row 2 indicating that when two coins are toosed there are  $1+2+1=4$  possible outcomes. Can you write down the possible outcomes when 3 coins are tossed? 4 coins are tossed?



Now you will read how the probabilities can be calculated by using the Pascal's Triangle. When two coins are tossed, try to calculate the probability of getting 2 heads, 2 tails, 1 head and 1 tail.

$P(HH) =$  \_\_\_\_\_

$P(TT) =$  \_\_\_\_\_

$P(HT) =$  \_\_\_\_\_

As you have already read that row 2 is showing the outcomes when 2 coins are tossed. Therefore the sample space consists of 4 outcomes so the chances are 1 in 4 that head will occur on both the coins. In the same row the number next to 1 is 2 which is indicating that the chances are 2 in 4 of getting a head and a tail, so the probability is  $2/4$ . Similarly you can calculate the probability that both coins show tails, which is  $1/4$ .

? The third line of triangle is showing the outcomes when three coins are tossed. In this line the number 1 is representing TTT, next to 1 there is number 3 which means that there are 3 possible outcomes that 2 coins show heads and one coin shows tail. These three outcomes are HHT, HTH, THH. In the same way interpret the number next to 3 which is also 3:

There are 3 chances in 8 of getting 2 heads and 1 tail i.e.  $P(2 \text{ heads and } 1 \text{ tail}) = 3/8$ .

#### Self-Assessment Questions-6

- 3 coins are tossed, calculate the following probabilities.  
(i)  $P(3 \text{ heads})$  (ii)  $P(\text{tails})$  (iii)  $P(1 \text{ head})$
- 4 coins are tossed, calculate the probability of getting 4 heads.

Generally speaking if 'n' number of coins are tossed together then the sample space will consist of  $2^n$  outcomes where  $n = 1, 2, \dots$ . When  $n=1$  it means that one coin is tossed so sample space will consist of  $2^1 = 2$  outcomes. If 4 coins are tossed then sample space will consist of  $2^4 = 16$  outcomes.

From the previous discussion you would have noticed that probability values are always assigned on a scale from 0 to 1 inclusive. A probability near zero indicates that an event is unlikely to occur and a zero probability refers to an impossible event. On the other hand a probability near 1 indicates that the event is certain to occur. It should be remembered that an event with probability 1 known as sure event.

#### Activity-1

Toss a coin 50 times and keep a record of the number of heads and tails that come up.

- Does this experiment support your belief that the probability of getting a head on any one face is  $1/2$ .
- Find the ratio of number of heads to the number of tosses.

Hint: Find  $\frac{\text{No. of heads}}{50}$

- Is the ratio in part (i) very close to the probability of  $1/2$ ?

## 4. THROWING A DIE

? Ludo is a common and popular game. This game is played with the help of a cube known as die (plural dice). The die has six faces as shown in Fig. 4.7.

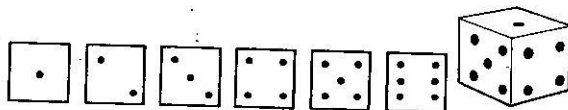



Fig. 4.7

Write down all the possible outcomes when a die is rolled (thrown).

When a die is rolled one of the six faces shows most upper. Thus the experiment results in one of the six outcomes which may be written as 1,2,3,4,5,6. The chances are 1 in 6 of the occurrence of any of the 6 outcomes. For example probability of getting face 1 is  $1/6$ , written as  $P(1) = 1/6$ .

### Self-Assessment Questions-7

1. A die is rolled. What is the probability that a 'six' will occur?
2. A die is rolled. What is the probability that a 'zero' will occur?

 In coin tossing experiment when we say that the outcomes are equally likely to occur it means that the experiment is performed with a symmetrical coin or a fair coin or an honest coin. Similarly examine a die you will find it symmetrical and not loaded in favour of any face. This die is known as balanced die therefore all the outcomes are equally likely to occur.

### Activity-2

Perform the following experiments:

- (i) Take a coin with a bent edge (see Fig. 4.8), toss it and find the probability of obtaining a head. Are the outcomes equally likely?



Fig. 4-8-Bent Coin

- (ii) Take a coin and write head on both sides of the coin, as shown in Fig. 4.9.

Toss it and calculate.

- (a)  $P(\text{Head})$
- (b)  $P(\text{Tail})$

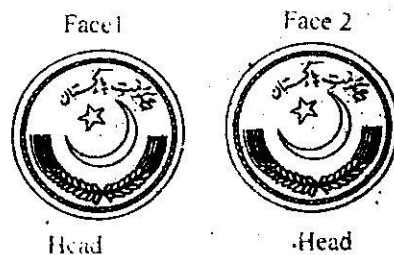



Fig 4.9

## 5. STATISTICAL PROBABILITY

 When a bent or unfair coin is tossed, you cannot assign equal probabilities to head and tail. In other words the outcomes are not equally likely. Similarly in rolling an unbalanced die you cannot say that the probability of every face is  $1/6$ . Now the question arises how this problem can be solved? Consider another example.

**?** Can you determine the probability of a driver having a car accident at a given intersection Friday afternoon?

Yes ~~~~~ No

With the help of probability which you have studied so far this probability cannot be determined. Can you give any reason why?

Because the events having an accident and not having accident are not equally likely. If however proper statistical records are kept on this phenomena then the probability can be determined approximately. Suppose it has been observed that on Friday afternoon 3000 cars passing this intersection, 5 cars have been observed to have accident. The probability that a car will have an accident at



this intersection on Friday afternoon can be calculated approximately as

$$\frac{5}{3000} = 0.0016$$

? Suppose you want to determine the probability of getting 3 when a loaded (unbalanced) die is rolled. In this case the outcomes are not equally likely so how you will calculate  $P(3)$ ? Think for a while and then go ahead. The probability can be determined by throwing a die a number of times say 500 and observing the number of time face 3 occurred. The ratio:

$$\frac{\text{The number of times 3 occurred}}{\text{Number of times die is rolled}}$$

is an estimate of  $P(3)$ .

☞ Generally speaking the probability of an event A when the experiment is repeated a large number of times is given by a ratio.

$$P(A) = \frac{\text{Number of times 'A' occurred}}{\text{Number of times experiment is repeated}}$$

This is known as relative frequency approach or sometimes statistical probability.

### Self-Assessment Questions-8

An amusement store offers dice for sale that are loaded in favour of a particular face. Suppose that the die is thrown 1000 times and the number of occurrences for each face is as follows:

Face:	1	2	3	4	5	6
No. of Occurrences:	214	152	178	188	163	105

Calculate probability for all the six faces.

Hint:  $P(1) = 214/1000 = 0.214$ .

☞ Now a days insurance is such a business which relies heavily on probability. It is important for an insurance company to know how to measure the risks against which people are buying insurance.

? Life insurance companies use statistics to predict how many people of the same age will die in a particular year. For example you can get information like "what is the probability that a man of age 25 years will die this year?"

This probability can be calculated if you have some information. You need to know the number of persons living under this age group and also approximate number of deaths per year in this age group. Such information can be got from tables known as Life Tables. Suppose under the age 25 years it has been observed 9575363 people are living and approximately 18481 people are reported to have died under the same age. The probability that a man of age 25 years will die this year is calculated as:

$$\begin{aligned} & \frac{\text{Number of deaths}}{\text{Number of people living}} \\ &= \frac{18481}{957,5363} = 0.0019 \end{aligned}$$

This is the basic approach which Life Insurance Companies use to compute such probabilities. You might have noticed that this is an application of statistical probability.

☞ By using this approach some more interesting problems can also be solved. Suppose you are 20 years old and you want to know the probability that you will live at 50 years of age. Suppose it has been estimated that there are 9664, 994 people living under the age 20 years, while under the age 50 years the number of



persons living is 8762306. The probability is calculated as:

$P(20 \text{ year man living to } 50 \text{ years})$

$$= \frac{8762306}{9664994} = 0.906$$

### Self-Assessment Questions-9

1. What is the probability that a person of age 30 years will die this year? Given the following information.

Number living: 9480,358

Number of deaths: 20,193

2. Calculate the probability that a person of 25 years living to 60 years? Given that:

Number living of age 25 years: 9575636

Number living of age 60 years: 5698698

- (ii) Find the ratio of number of times the black ball is drawn to the number of times the experiment is repeated (which is 50).
- (iii) The probability of drawing a black ball is  $4/10$ . Is the ratio in part (ii) is very near to  $4/10$ ?

### Activity-4

In newspapers and magazines you might have seen "Crisscross Puzzle". This puzzle is basically designed to test the knowledge of vocabulary in languages. One such puzzle is given here to test your knowledge of probability concepts which you have read so far in this unit. You are requested to go through the hints and with the help of these hints solve the puzzle.

### Activity-3

Put 4 black balls and 6 white ball in a small basket.

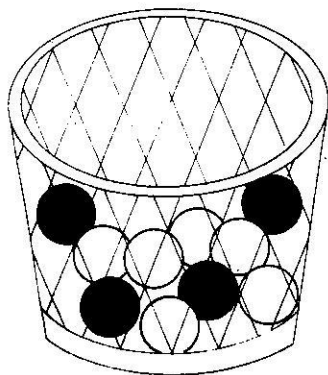


Fig. 4-10

- (i) Without looking draw one ball from the basket. Record its colour and then return it back to the basket. Draw and replace the balls 50 times.

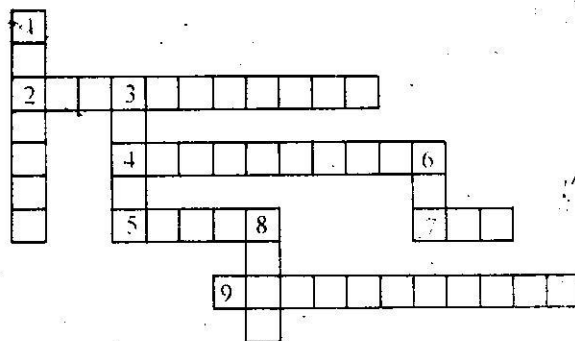


Fig. 4.11

Hints:

**Across:**

2. A concept directly associated with probability

4. An action like tossing a coin.
5. In tossing a coin the outcomes a head and \_\_\_\_\_.
7. If an event is sure to happen the probability is \_\_\_\_\_.
9. A branch of human knowledge which deals with questions like, "will it rain tomorrow"?

**Downward:**

1. In tossing a fair coin the outcomes are \_\_\_\_\_ likely to occur.
3. A part of the sample space.
6. In tossing a coin the sample space consists of \_\_\_\_\_ outcomes.
8. A probability 1 indicates a \_\_\_\_\_ event.

**6. ANSWERS TO SELF-ASSESSMENT QUESTIONS AND ACTIVITIES**

**Self-Assessment Questions-3**

- 1, 4 : Certainty  
2, 3, 5 : Uncertainty

**Self-Assessment Questions-4**

- (i) win, loss, draw
- (ii) Yes
- (iii)  $1/3$

**Self-Assessment Questions-5**

1 6 15 20 15 6 1

**Self-Assessment Questions-6**

1. (i)  $1/8$
- (ii)  $1/8$
- (iii)  $3/8, 2-1/16$

**Self-Assessment Questions-7**

1.  $1/6$  2 - 0

**Self-Assessment Questions-8**

$P(2) = 0.152, P(3) = 0.178$   
 $P(4) = 0.188 P(5) = 0.163$   
 $P(6) = 0.105$

**Self-Assessment Questions-9**

1. 0.0021, 2. 0.595

**Activity-4:**

Across: 2-Uncertainty, 4-experiment  
5-tail, 7- one, 9-probability.

**Downward:**

1- equally, 3-event 6-two  
8- sure.

# **UNDERSTANDING DATA**

*Written by:*

**Faiza Tabassum**

*Reviwed by:*

**Prof. M. Abrar Hussain**



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# INTRODUCTION

You might be having your first exposure to data in this unit. Data are all around us in raw form of statistics. In order to put data into meaningful information you have first to put order into the mass of data. This is done by presenting data in tables and graphs. You will study these methods in this unit.

## OBJECTIVES

After reading this unit you should be able to:

- Differentiate between population and sample.
- Present data in tabular form.
- Display data graphically.





## 1. WHAT IS STATISTICS

? While reading newspaper you might have  
• come across such information:

About 87,000 people were sitting in the stadium to see the final match of 1992 Cricket World Cup.

According to 1981 census the population of Pakistan was 84,253,644.

The batting average of Javed Miandad in test matches is 52.57 runs.

Did you observe anything common to these statements? Write in the space given below:

---

---

In these statements numbers or figures e.g. 52.57, 87,000 are used to convey the required information. In everyday language these numbers are called statistics. You can say the word statistics is used to express the facts numerically.

? Is the term statistics used only to  
• express the facts numerically?

Consider the following statements:

An educationist wants to know which of the various methods of teaching is the best.

It has been calculated that the life of the newly built bridge would be 50 years.

From these examples did you observe anything different from the examples given earlier in this unit?

Yes

No

You might have noticed that these problems are mainly deal with predication and decision on the basis of available information. For example on the basis of the design of the bridge, the material used, the flow of traffic and the past records of the construction company it is possible to predict the life of the bridge. The study of such problems is also one aspect of statistics.



The field of statistics involves much more than simply the presentation of numerical facts. It involves the study how numerical facts are collected, analyzed and interpreted. A major reason for collecting, analyzing and interpreting numerical facts is to provide information necessary to make effective decisions.



Consider again the set of three examples, given just at the start of this unit. These examples are related with describing information in the form of numbers. The presentation of facts in this way is related with an area of statistics known as **descriptive statistics**. It deals with collecting, organizing and presenting numerical facts in a meaningful manner.

### Self-Assessment Questions-1

Write down one example of descriptive statistics.

---

---

---



Now consider the other set of examples. These examples deal with Prediction and making decisions on the basis of the available information. This is actually another area of statistics known as inferential statistics. It is the method of drawing conclusions about the whole called population by means of information from a part known as sample.



In the above paragraph you read two words population and sample. These words are frequently used in everyday language. Write down their meanings in daily language.

---



---



In everyday language the word population is used for the total number of human beings. But in statistics it is used to describe the totality of objects to be studied. By object we mean any living or non living thing. For example; total number of books in Jinnah Library, number of Government Schools in Pakistan total number of trees in Changa Manga Jungle. While a part of population is known as sample.

## 2. SAMPLING



Now the question arises why do we take sample from population?

In everyday life you might be using samples to know the population. For example about the quality of cooked rice, you do not have to eat the whole of rice in the pan rather you just take a spoonful of rice to taste and to

decide the quality of cooking. In this example identify the sample and population.

---



---

Yes-the spoonful of rice is a sample and the pan of rice is a population.

### Self-Assessment Questions-2

1. Write down one situation from your every day life when you use sample to judge the population.

---



---



---

2. By considering the example of cooking rice. Write down the advantages of taking sample from population.

(i) \_\_\_\_\_

(ii) \_\_\_\_\_

(iii) \_\_\_\_\_



The process of taking sample from population is known as **sampling**. But it is sometimes important to obtain information about every member of the population and this process is generally known as **census** or **complete count**. Population Census is such an example where information is collected about every individual of a country. In Pakistan Population Census is conducted after every 10 years. The first census was held in 1951 and the last one in 1981.

### Self-Assessment Questions-3

Indicate which of the following situations are related with descriptive statistics and which are related with inferential statistics:

1. A newspaper reports the number of hospitals in Pakistan.  
Descriptive statistics (    )  
Inferential statistics. (    )
2. A sociologist studies whether an increase in police force can decrease the rate of crime.  
Descriptive statistics (    )  
Inferential statistics (    )
3. It has been estimated that the pollution in air in Karachi is four times higher than the international standard.  
Descriptive statistics (    )  
Inferential statistics (    )
4. A student wants to know the average rain fall in Islamabad during summer.  
Descriptive statistics (    )  
Inferential statistics (    )
5. A researcher studies the production of wheat during next five years.  
Descriptive statistics (    )  
Inferential statistics (    )

### 3. DATA



You have just seen that by taking samples or by observing each element of population, you are actually collecting records about various factors. Such records are known as data. For example data on national income, size of population, number

of accidents on G.T road during last year. Data are therefore numbers in some context. It should be remembered that data is used in plural sense while its singular is datum.



In Pakistan data are collected by national organizations some of them are listed below.

- 1- Federal Bureau of statistics (FBS)
- 2- Population Census Organization.
- 3- Agriculture Census Organization.
- 4- Provincial Bureau Of Statistics.

#### Activity-1

Read today's newspaper and look for articles that contain numerical data e.g. business column, sports reports, editorial, crime reports, weather reports and advertisements.

Classify them as descriptive and inferential statistics.

### 4. ORGANIZING THE QUALITATIVE DATA



Consider the following example:

Suppose you are standing on a side of a road and recording the number of vehicles passing through the road in a duration of 10 minutes. Vehicles include car, bus, vans, rickshaws and m/cycle. After 10 minutes the recorded information are as:

car, car, bus, van, car, m/cycle, car, rickshaw  
m/cycle, car, bus, car, car, van, car, van,  
m/cycle, car, car, van, rickshaw, car, bus,  
van, m/cycle, car, car, rikshaw, bus, **bus**.

Just by looking at the data did you get any meaningful information like how many cars have passed during that period of time?

Yes

No


Definitely it would be difficult for you to get such information out of the above data. Which is in raw form known as **raw data**. You will have to organize it in some manner. One way of presenting the data is given below:

**Table 5.1**

VEHICLES	FREQUENCY
Car	13
Bus	5
Van	5
Rickshaw	3
m/cycle	4

This is the most often used way of presenting data. Can you read this table? If yes then how would you interpret it? Try to think over it and then go ahead.

In this way of presenting the data, types of vehicles are written in one column while their corresponding number observed are written in the second column. An arrangement of data in rows and columns is known as table.

 In this table the second column entitled as **frequency**, for example the frequency of car is 13. It means that 13 cars have passed during that period. What does the term frequency mean to you?

The number of particular type of vehicle observed is called its frequency. Due to the use of the word frequency this table is known as **frequency table**. The basic purpose of frequency table is to summarize the raw data in a meaningful way.

#### Self-Assessment Questions-4

In statistics it is important to give a title to a table. Try to give a suitable title to table 5.1 and write in the space given below:

**?** Now we will discuss how frequency table is constructed?

Consider the raw data given earlier. This type of data sometimes is known as **qualitative data** as it does not consist of numbers. To construct the table we write the types of vehicles in the first column, entitled as vehicles. The incomplete frequency table is given below, complete the first column by writing the name of vehicles in any order which you like.

#### INCOMPLETE FREQUENCY TABLE

VEHICLES	TALLY MARK	FREQUENCY
Car	/// <del>///</del> <del>///</del>	13

Look at the first observation in the raw data, it is car. In the above given table under the column Tally Mark put a vertical line (/) against car. This vertical line is known as tally mark. Then note the second observation it is again car, put another tally mark in the same row and same column. The third observation is bus, put a tally mark in the row where bus is written. Continue this process till end of the data.

Remember that every fifth tally is drawn diagonally through the preceding four like  $\text{||||}$  instead of writing  $\text{IIII}$ . The 6th observation is written separately. In other words the observations are written in sets of five, just to make the counting easier. To count the things in a set of five is a natural phenomena, can you give one such example?

Try to read the graph what type of information can you drawn from this graph?

This graph is another way of presenting the data given earlier. What is taken along x-axis and what is taken along y-axis? Write down.

Your hand is an example of counting in a set of five. While the frequencies are obtain by summing the tally marks for each item separately.

Complete the incomplete table in the same manner as you did for the first item. Check your answer from table 5.1 on page 80

## 5. BAR GRAPH

The frequency table which you have constructed just now is one way of presenting the data. The data can also be presented with the help of graphs, graphs are an attractive way of presenting the information.

In constructing a graph, frequencies are always plotted on y-axis while the other items are taken along x-axis. Therefore types of vehicles are marked along x-axis and their corresponding numbers along y-axis.

This graph consists of rectangles also known as **bars**. The length of each bar is representing the frequency of each vehicle. The width of each bar is kept uniform and the bars spaced equally apart.

This graph is known as **bar graph**. It is an important and also frequently used device to present such data. This graph is used to compare various qualitative characteristics. A common example of bar graph is a weekly temperature of a city.

CONSIDER THE FOLLOWING GRAPH

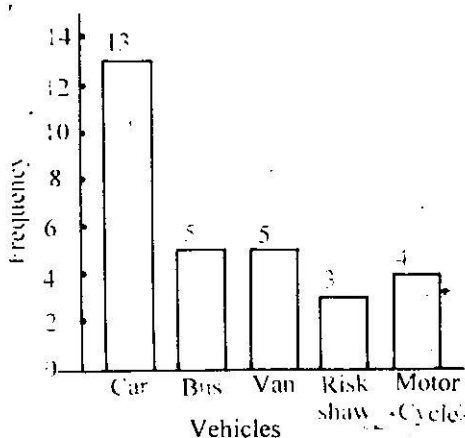


Fig 5.1: Bar Graph

### Self-Assessment Questions-5

If you are asked to draw a bar graph of weekly temperature of your city then what will you take along x-axis? along y-axis?

## 6. PIE CHART

You might be familiar with another graph drawn in circular form, known as Pie

Chart or Pie Graph. Usually a pie chart is constructed to present the various components of data, as shown in fig. 5.2.

car are given below:

$$\frac{43.33}{100} \times 360^\circ = 156^\circ$$

We multiplied it by  $360^\circ$  as a circle consists of  $360^\circ$ .

### Self-Assessment Questions-6

Represent the data of Table 5.1 in the form of percentages and degrees.


Now you are ready to construct a pie. To do it draw a circle of any radius. With the help of a protractor (also known as 'D') measure the angles and join them with the centre, see Fig. 5.2.

### Activity-2

Ask the people of your street the kind of drink they like most. Drinks include tea, lassi, milk, sharbat (any kind) and soft drinks (coke, fanta.....). Record the information.

- Make a frequency table of the collected data.
- Construct a bar graph of the data.
- Represent the data with the help of Pie Chart.

### Activity-3

Keep a record of one week temperature of your city or any city of Pakistan.

- Present the data in the form of table.
- Make a suitable graph for presenting the data.

## 7. ORGANIZING THE QUANTITATIVE DATA

Now consider another set of data.  
Given below are the maximum

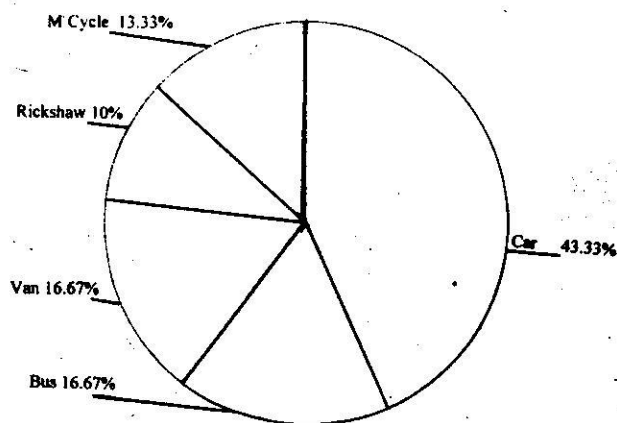


Fig 5.2: Pie Chart

? Examine the Pie Chart how will you interpret it?

The construction of pie chart is very simple. You have to just slice down (cut) the pie in different proportions. Recall your school geometry, a circle consists of how many degrees?

Firstly you have to convert all the data items into percentages. For example consider the first item car, it can be represented as

$$\frac{13}{30} \times 100 = 43.33\%$$

It means that 43.33% vehicles passing in 10 minutes duration are cars. To construct a pie chart we will convert the percentages into their respective degrees, the calculations for

temperature (in centigrades) of Islamabad recorded from 15 February to 15 March.

Date	Temp	Date	Temp	Date	Temp	Date	Temp
15	14	22	12	1	18	8	26
16	14	23	19	2	21	9	16
17	10	24	19	3	21	10	22
18	15	25	16	4	18	11	25
19	11	26	20	5	25	12	29
20	16	27	22	6	23	13	29
21	16	28	20	7	30	14	25
						15	28

The above given data is considered as **quantitative** because it consists of numbers. Just by having a glance over this data, can you get information like how many days the temperature remained between 20°C and 25°C?

Yes

No

Definitely it is difficult to get such information in a short time out of these data.



Now look at the table given below:  
Table 5.2

Temperature	Frequency
10-14	5
15-19	9
20-24	8
25-29	7

This is one way of presenting the above data in tabular form. Here the temperature is divided into four groups (or classes) written

in the first column. Think of what the group 10-14 is indicating. Write below.

The frequency of the class 10-14 is 5. It means that during 5 days out of 29 days the temperature was recorded in an interval of values from 10°C to 14°C. This interval might include the values 10°C, 11°C, 12°C, 13°C, 14°C. The most frequent interval of temperature recorded is 15-19, which means that during 9 days the temperature was recorded between 15°C and 19°C. Here we used the word frequent interval, what is meant by it?

The highest frequency is 9, which is corresponding to the interval 15-19. Therefore this interval is called the frequent interval.



Now you will learn how this table is constructed?

As the data is quantitative so we will have to arrange it in an order. Start writing the data from the lowest value which is 10 and move towards the highest one which is 29. Try to write the data in this order in the space given below:



This method of writing the data is known as making an **array** in ascending order. If you start writing from the



highest value and move towards the lowest value then the array will be in descending order. In this book we will concentrate only on ascending order. The array of the data is given below:

10, 11, 12, 14, 14, 15, 16, 16, 16, 16, 18, 18, 19, 19, 20, 20, 20, 21, 21, 22, 22, 23, 25, 25, 25, 26, 28, 29, 29.

The next step is to decide the number of classes required and also how wide should a class be. The width of a class is known as **class interval**.

**?** To decide on the number of groups required find the difference between the highest and the lowest value, which is **19**.

This difference is known as **range**. The range of this data is 19. To decide the number of classes required a rule of thumb is that divide the range by 5 or multiple of 5 i.e. 5, 10, 15,.....

In this case write the number of classes required.

You need 4 classes as  $19/5$  approximately equals to 4. 5 is taken as class interval also known as class width. Therefore you have to divide the data into 4 equal classes with a class interval of 5

Consider the following incomplete table. Complete the first column by writing the groups.


Temperature	Tally Marks	Frequency
10-14		5

After completing the first column you have to write the frequencies for each class by the method of tally marking. Consider the first group 10-14, you will find five observations lie in this interval which are 10, 11, 12, 14, 14. Put 5 tallies in the second column it means the frequency of the group 10-14 is 5.

**?** Complete the above given table and check your answer from table 5.2, page 83


#### Self-Assessment Questions-7

Give a suitable title to the above constructed table.

 Consider the group 10-14, here 10 is known as the lower class limit and 14 is the upper class limit. By adding the upper and the lower class limits and the dividing the sum by 2 you will get  $\frac{10+14}{2} = \frac{24}{2} = 12$ . 12 is known as the mid point of that class. You regard all the five values in this class as equal to the mid point so it is interpreted as "during 5 days the temperature was recorded as 12°C".

#### Self-Assessment Questions-8

Calculate the mid points for the remaining three classes.

 Consider the first two classes of Table 5.2. Is there any gap between the upper class limit of the first group and the lower class limit of the second group?

Yes

No.

Yes - there is a gap of 1 value. The question arises how this gap can be adjusted. It can be adjusted by subtracting 0.5 from the




lower class limit and adding 0.5 to the upper class limit. After making these adjustments what would be the new classes? write in the space given below.

1.  $0.5-10 \text{ ---- } 0.5 + 14 = \text{ ---- }$

2. \_\_\_\_\_

The adjusted classes are as under:

9.5-14.5, 14.5-19.5, 19.5-24.5, 24.5-29.5

 Consider the adjusted class 9.5-14.5,. Here 9.5 and 14.5 are known as **class- boundaries**, where 9.5 is the lower class boundary and 14.5 is the upper class boundary.

#### Self-Assessment Questions-9

1. For a certain frequency table the lower limit of the first class is 10. The class interval is 20 and there are 5 classes. Identify the other 4 lower class limits.
2. Find suitable value for the class interval.
  - (i) Lowest value = 50,  
Highest value = 99  
Number of classes = 10
  - (ii) Lowest value = 120.  
Highest value = 239  
Number of classes = 8

## 8. HISTOGRAM

You have already seen the graphical presentation of qualitative data. Now you will read how the quantitative data be presented graphically. In constructing a graph of the data on temperature recorded, we will plot class-boundaries (9.5, 14.5 ..... ) on x-axis and frequencies along y-axis as shown below in fig 5.3

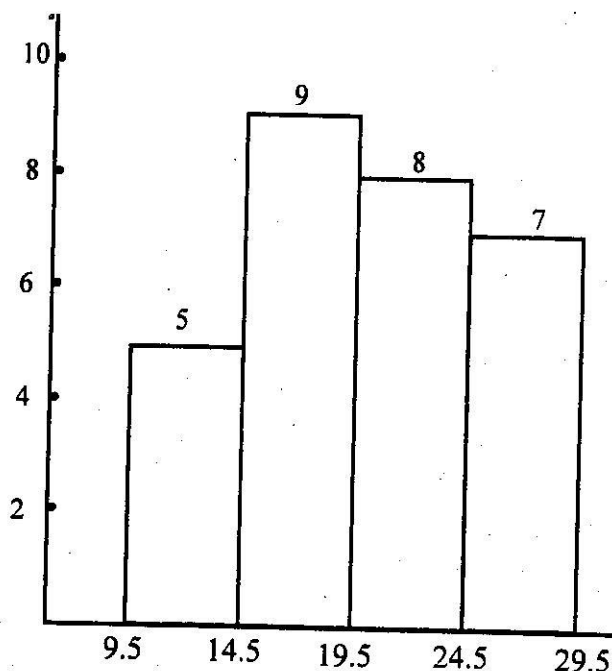



Fig 5.3: Histogram

 Can you list the major characteristics of this graph? Write in the space given below:

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---

In this graph the bars are adjacent to each other and all have equal width, while the length of a bar represents the corresponding class frequency. All the bars are adjacent and this is the reason we plot class-boundaries not class limits. In case of plotting class-limits instead of class-boundaries, what will happen to the graph?

---



---

 The graph so obtained is known as Histogram. This graph is used to depict the frequency table when the data are quantitative. It should be remembered that each class is represented by a bar.

**Activity-4**

From 20 families living in your street collect data on amount of milk (in kg) purchased by them on last Friday

- (i) Make a frequency table of the collected data.
- (ii) Make a suitable graph to represent the frequency table.
- (iii) What conclusions would you draw?

**Self-Assessment Questions-4**

"Vehicles passing in 10 minutes duration".

**Self-Assessment Questions-5**

Along x-axis: Week days,  
Along y-axis: Temperature

**Self-Assessment Questions-6**

Percentages: Bus: 16.67%, Van 16.67%,  
Rickshaw 10%, M/cycle 13.33%.  
Angles: Bus 160°, Van 60°, Rickshaw  
36°, m/cycle 48°

**9. ANSWERS TO SELF-ASSESSMENT QUESTION'S****Self-Assessment Questions-2**

- (i) Time saving
- (ii) Economy
- (iii) Quality and Accuracy. It means that the results of sampling are more reliable than census

**Self-Assessment Questions-3**

Descriptive statistics; 1, 4  
Inferential statistics; 2, 3, 5

**Self-Assessment Questions-7**

"Maximum temperature of Islamabad recorded from 15 February to 15 March."

**Self-Assessment Questions-8**

17, 22, 27

**Self-Assessment Questions-9**

- 1. 30, 50, 70, 90
- 2. (i) 5 (ii) 15

# **DESCRIPTIVE STATISTICS**

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## INTRODUCTION

In the previous unit you have learnt how to summarize the data in tables and represent them by means of graphs. Another very useful method is to describe the data in the minimum possible numbers. You describe weather in terms of temperature, humidity, atmospheric pressure,.... and these are expressed in numbers. In the same manner you try to express the characteristics of data in terms of some numbers. This can be done in a number of ways. But in this unit we will introduce you to just two types of these numerical expressions of data. You will try to locate a value that lies more close to the center of the data. Such a value is called a measure of location or an average. Another number will measure the extent to which the data values are spread about a measure of location. This number will be called a measure of dispersion. In this unit you will be introduced to three measures of location and two measures of dispersion.

## OBJECTIVES

After studying this unit, you will be able to:

- realize need for expressing data in summary numbers.
- explain the meaning of location.
- determine mode, median and mean of a data set.
- realize the importance of variability.
- find range, variance and standard deviation.





## 1. MEASURES OF LOCATION

Often we are interested to know a single value which summarizes the distribution (data) e.g. You have a data of you marks in the Matriculation Examination as 45, 60, 40, 55, 35, 58, 62, 38. When any person asks you about your performance in the Examination, you tell him that you have obtained 45% marks. This figure (45%) actually shows the central tendency of your marks. Such a value which summarize the whole data is called the central tendency and the methods which are used to compute the central tendency are called measures of central tendency or measures of location.

Most commonly used measures are:

- i) Mode    ii) Median    iii) Mean

## 3. MODE

The daily maximum temperature (in centigrade) in Islamabad during the month of June, 1995 was recorded as: 36, 40, 41, 43, 40, 38, 39, 41, 42, 41, 43, 45, 44, 45, 42, 43, 40, 41, 39, 42, 43, 41, 42, 43, 41, 42, 43, 41, 44, 45.

You can locate the temperature which occur most frequently during the month of June. The value which occurs most frequently in the data is called the Mode.

? Can you tell that which value occurs maximum number of times?

Yes, 41 occurs maximum number of times. Therefore 41 is the mode of the temperature data.

You can easily locate mode with the help of dot-diagram. For dot-diagram, take values on X-axis in ascending or descending order. Mark a dot vertically on that point (value) which occurs. If a value occurs two times in the data then there will be two dots on that value. Similarly if a value occurs three times in the data then there will be three dots on that value and so on. After drawing the diagram, observe the value on which maximum number of dots occur that value will be the Mode of data.

? How can you locate the Mode of the above data by dot diagram?

take the values on X-axis. As the smallest value in the data is 36 and the largest value is 45. So the dot-diagram of above data will be as follows:

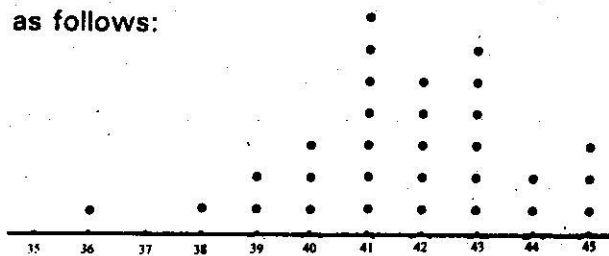


Fig. 6.1

Now you see that maximum dot occurs on 41. Hence the Mode temperature is 41.

? If each value occurs just once in the data.  
• What will be the Mode in such a situation?

If each value occurs just once in the data then there will be no Mode e.g. If you have given maximum temperature during the first week of May as 36, 40, 41, 43, 42, 38, 39, and you are asked to find the Mode of this week, surely your answer will be in no Mode because each value occurs just once. The dot diagram of the data is as follows:

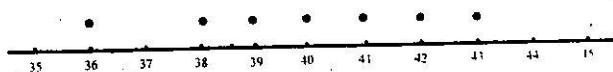


Fig. 6.2

? Pocket money (in rupees) of 10 students of a class is given as:

15, 18, 19, 14, 18, 16, 16, 18, 17, and 16. Find the Mode.

Since 18 and 16 occur most frequently in the data, so the mode of this data is 18 and 16 i.e. there will be two modes of this data. It can be shown with the help of dot diagram as:

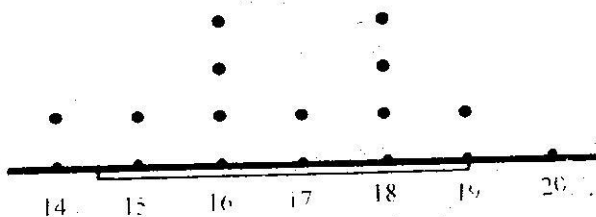


Fig. 6.3

It is clear from the diagram that maximum dots occur on 16 and 18. Hence the mode = 16, 18.

Similarly if three values occur same (maximum) number of times in the data then there will be three modes.

☞ The concept of Mode is more commonly used in qualitative data. You may observe that in our country newspapers are published in various languages. Most of the newspapers are published in Urdu language so, you can say that Urdu's newspaper is the mode of all newspapers. During summer, most of the people like to eat mango so its sale is much more than other fruits. Hence mango is the mode of summer fruits. It was asked from a class of 50 students, which subject they liked most. 20 of them answered Statistics, 10 Mathematics, 8 Economics, 7 English and 5 liked Urdu.

? Can you tell which subject is liked by more number of students.

Yes, Statistics is liked by most of the students. Hence, Statistics is the mode of the subjects.

### Self-Assessment Questions-1

- ..... value in the data is called Mode.
- The Mode of 2, 4, 6, 8, 10 is (select the correct one) (i) 10 (ii) 2 (iii) No Mode (iv) Zero Mode.
- Give an example from practical life which describes the mode.
- A data set may have more than two modes. (Tick the right one) True False
- Number of apples on different branches of an apple plant were recorded as 18,

13, 21, 13, 17, 15, 17, 19, 23. Find the Mode of data.

### Activity-1

Count the words in each line from the introduction page of this book. Find the Mode (the number of words used most frequently in a line).

### 3. MEDIAN

It is the middle (central) value in the arranged data. The prices (in rupees) of different books in a bookshop were as follows:

12, 14, 15, 15, 16, 17, 18, 18, 85.

? Can you find the median price of these books.

---

---

The middle value of the above arranged data is 16. So the median price is 16 rupees.

? The Ages (in years) of five persons is given below:  
25, 31, 24, 19, 43. Find the median?

---


---

To find the median you will first arrange the given data either in ascending or descending order. Then observe the middle value that value will be the median of data.

Let arrange the data in ascending order.

19, 24, 25, 31, 43

Now you see that 25 is the middle value. Hence the median = 25 years.

 You have seen that when the number of observations is odd. Then there is a single middle value in the data. But if the number of observations is even, there will not be a single middle value in the data. How can you find the median in such a situation?

---

---

After arranging the data there will be two values in the middle. The Median can be calculated by adding these two values and dividing their sum by two.

? The prices of 8 books are given as:  
• 14, 15, 15, 16, 17, 18, 18, 85.  
and you are asked to find the median price of these books. How will you find?

---

---

As there are two middle values i.e. 16 and 17, so the median price =  $(16 + 17)/2 = 16.5$  rupees.

---

---

? Earning (in rupees) of different persons of a certain locality is given below: Find median.

934, 1240, 1427, 1363, 1152, 1375, 1021, 1629, 1280.

---

---

First you will arrange the data in ascending order 934, 1021, 1152, 1240, 1280, 1363, 1375, 1427, 1629.

Now if you count from either end, you see that there are four values smaller than 1280 and four values greater than 1280. So 1280 is the middle value. Hence the median is Rs.1280.

### Activity-2

- (i) Select any 9 books. See the prices of these books and find the median price.
- (ii) From these 9 books also note the publishing year of each book. Find the median year.

## 4. MEAN

It is a value obtained by dividing the sum of all the observations by their number and is denoted by  $\bar{x}$  (read as x-bar).

In other words  $\bar{x} = (\text{sum of all the observations}) / \text{number of the observations}$ .

- The marks obtained by 7 students of intermediate class in Statistics are given as:  
54, 47, 39, 42, 51, 35, 40.

If you are asked to find mean of these marks then how will you proceed?

You may recall your elementary school Mathematics where you find the "Average" of a group of values by adding up the values and dividing the total by their numbers. Thus the average marks of 54, 47, 39, 42, 51, 35 and 40 can be found by adding them up ( $54 + 47 + 39 + 42 + 51 + 35 + 40 = 308$ ) and dividing the sum '308' by 7, since there are 7 values.

The average marks of 7 students is

therefore  $308/7 = 44$ . In Statistics this average is called the mean and the Mathematically it is written as:  $\bar{x} = \Sigma x/n$   
Where  $\Sigma x$  (read as "summation x") Means "Sum of the observations" and n is total number of observations.

- How many number of observations are there in the above example?

Since the number of observations are 7, hence  $n = 7$ .

- How can you find the sum of the observation from the above example?

You can find the sum of observations by adding them as  $54 + 47 + 39 + 42 + 51 + 35 + 40 = 308$ . So the  $\Sigma x = 308$ .


- If you have  $\Sigma x = 308$  and  $n = 7$ . Can you find the mean?

Put the values of  $\Sigma x = 308$  and  $n = 7$  in the formula: You get  $\bar{x} = 308/7 = 44$ .

- Height (inches) of 12 plants are measured as: 4.25, 7.30, 3.48, 4.69, 8.27, 5.06, 7.48, 6.15, 9.29, 8.13, 5.93, 6.68. Find mean height of these plants.

We know that  $\bar{x} = \Sigma x/n$

So  $\bar{x} = (4.25 + 7.30 + \dots + 6.68)/12$   
 $= 76.68/12 = 6.39$  inches.

 The mean has the same unit of measurement as the original observations have. See the above example, the original observations are measured in inches hence mean will also be in inches.

### Self-Assessment Questions-2

- Find the mean and median of the following marks. 28, 24, 18, 32, 26, 30, 25, 21.
- Prices of different commodities are given as:  
14, 17, 15, 12, 18, 13, 11  
Find (i) Mean (ii) Median
- The mean has the same unit of measurement as the original observations (Tick the right one) True False
- Mode, Median and Mean are measures of location (Tick the right one) True False

### Activity-3

Measure the height of your family members. Find their mean height.

### 5. VARIABILITY AND ITS IMPORTANCE

You observe that the objects in the nature, even of the same appearance are not similar. Variation is found every where in the world. If things of a kind are similar, then there is no need of much numbers. Then we can summarize the data (things of a kind) by just two numbers e.g. If there are 48 students in a class and height of each student is 62", then we can summarize the data (height of

students) by just two numbers i.e. 48 (number of students) and 62 (height of each student). But this does not happen in the real world. Height of the students of a class never be the same. Even the children of the same parents are not similar in structure, colour, intelligence and in many other aspects. The things produced by a machine are not similar. They are different in size, in shape etc. The performance of students of a class (studying in the same atmosphere) is not similar. The price of commodity vary from place to place and time to time. In agriculture, you see that same size of plots have the same fertility and all other things like seed, fertilizer, water, spray, etc. same, but the yield differs. So, the variation is the natural phenomena. Now the question is how to measure the variation.

In this unit, you will study two measures of variation – range and variance; standard deviation.

### Activity-4


Give any two examples from daily life where you observe the variation?

### 6. RANGE

It is a simple method to find the variation in the data. Range is the difference of the largest and smallest value in the data.

The marks of students in Statistics are given as:

43, 52, 38, 47, 35, 49, 33, 55, 45.

 Can you find the range of these marks?

\_\_\_\_\_

\_\_\_\_\_

Maximum marks obtained by a student is 55 and the minimum is 33. So the range of the students marks is the difference of 55 and 33 i.e.  $55 - 33 = 22$ .

? Can you show this range with the help of dot diagram.

The dot-diagram of students marks is as follows:

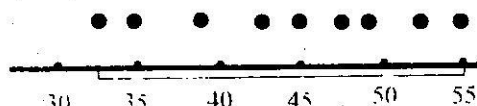


Fig. 6.4

It is clear from the dot diagram that the smallest value is 33 and largest one is 55. Hence the range is difference between 33 and 55, i.e. 22, in dot-diagram the bold line shows the range of marks.

☞ This method is not very much appropriate when there are some unusually large or small values are present in the data e.g. in the above data of students marks if there is another student who obtained 85 marks. Then the range of this data will be  $85 - 33 = 52$ . So only because of one value i.e. 85, the range increases from 22 to 52. It can be shown by the dot diagram as:

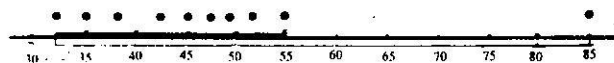


Fig. 6.5

- Not including the unusual value
- including the unusual value.

#### Self-Assessment Questions-4

- Range can be defined as the difference between the largest and smallest value in the data.  
(Tick the right one) True False
- Range is highly effected by the (select most appropriate one).  
(i) Only unusual large value.  
(ii) Only unusual small value.  
(iii) both.
- The price (in rupees) of different commodities are as follows:  
25, 31, 26, 37, 28, 30, 33, 45, 28  
Find the range of these prices.

#### Activity-5

Find out the range height of your family members.

#### 7. VARIANCE; STANDARD DEVIATION

(a) **Variance:**

If two angles of a triangle are  $60^\circ$  and  $90^\circ$ . What will be the value of third angle?

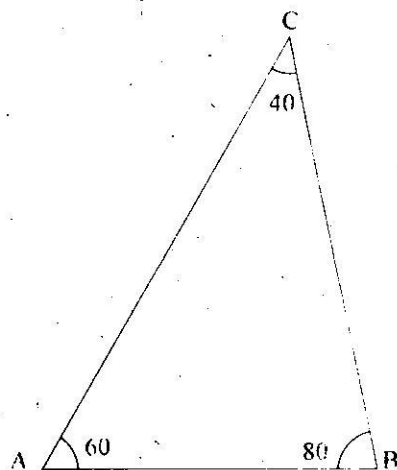


Fig. 6.6

As you know that sum of the angles of a triangle is  $180^\circ$ . So by subtracting sum of these two angles from  $180^\circ$  you can find the third angle that will be  $180^\circ - (60^\circ + 80^\circ) = 40^\circ$ .

? Now if you are asked to tell that how many angles of a triangle are independent what will be your answer?

If any two angles of a triangle are known then the third will depend upon the given angles. Hence two angles of any triangle are independent i.e. they can take any value but the third angle is dependent i.e. the value of this angle depends upon the values of other two angles.

? If five values are given under the condition that sum of these values is zero. Can you tell that how many values are independent?

Here you see that four values will be independent, because if one value is missed you can find it. Suppose the four values are 2, -4, 3, 5. What will be the fifth value.

Sum of these four values is 6, but under the given condition the sum of all five values should be zero. So the fifth value will be  $0 - 6 = -6$ .

➡ Number of independent values are known as degree of freedom. In the

above example degree of freedom is 4. If there are  $n$  values whose sum is zero, then independent of them will be  $n-1$  and these  $(n-1)$  values also called degree of freedom.

? If you are interested to know the variation (spread) of observations from their mean.

How can you find it?

For calculating the variation of the values from their mean. You will first compute the Mean of the observations. After taking the difference of each observation from the mean, take the square of each difference. After summing up the squared differences, divide it by degree of freedom, result thus obtained is known as variance which is a measure of variability. So if you denote a value by a variable  $x$ . Then the variance can be defined in Mathematica from as

$$\frac{\sum (x - \bar{x})^2}{n-1}$$

where  $(x - \bar{x})$  is the difference or spread of values from their mean,  $\sum (x - \bar{x})^2$  is sum of square of differences from mean and  $n-1$  is the degree of freedom. Variance is usually denoted by  $s^2$ .



To find the variance why do you take the square of differences, whereas, you simply need the difference of the observations from their means?

If we take only the differences then we cannot find the variance because the sum of these differences is zero, which is the property

of mean i.e. the sum of differences of the observations from their mean is always zero. So due to this reason, we will take square of the differences which causes the square of unit of measurement.

? The weight (in kg.) of 7 sheep are recorded as:

30, 40, 25, 15, 24, 49, 32

Find the mean weight of sheep and show that the sum of the differences of the observations from their mean is zero.

If we denote a value by a variable  $x$ , then

Column-I $x$	Column-II $x - \bar{x}$ ( $x - 32$ )
36	36-32=4
40	40-32=8
25	-7
18	-14
24	-8
49	17
32	0

$$\Sigma x = 224$$

$$\Sigma(x - \bar{x}) = 0$$

$$\bar{x} = \frac{\Sigma x}{n} = \frac{224}{7} = 32$$

So the mean weight of sheep = 32 kg.

Now see the 2nd column. The sum of this column is zero. Hence the property of mean i.e. sum of the differences of observations from their mean is zero is proved.

? How can you find the variance of the above data?

We know that the formula of variance is  $S^2 = \Sigma(x - \bar{x})^2 / n - 1$ , so you will make another column which will be the square of the 2nd column i.e. column-III.

Column-I $x$	Column-II $x - \bar{x}$	Column-III $(x - \bar{x})^2$
36	4	16
40	8	64
25	-7	49
18	-14	196
24	-8	64
49	17	289
32	0	0

$$\Sigma x = 224 \quad \Sigma(x - \bar{x}) = 0 \quad \Sigma(x - \bar{x})^2 = 678$$

Put the values in the formula you will get  $s^2 = 678/6 = 113 \text{ Kg}^2$ .

Hence the variance of the data is  $113 \text{ kg}^2$ .

? Marks of a student in different subjects are as follows:

25, 35, 45, 35, 20, 50, 13, 57

Find the variance of the data.

If you denote marks by a variable  $x$ , for finding the variance, you will proceed as follows:

Column-I $x$	Column-II $x - \bar{x}$	Column-III $(x - \bar{x})^2$
25	-10	100
35	0	0
45	10	100
35	0	0
20	-15	225
50	15	225
13	-22	484
57	15	484

$$\Sigma x = 280 \quad \Sigma(x - \bar{x}) = 0 \quad \Sigma(x - \bar{x})^2 = 1618$$



Step-1: Find the mean of the data  
 $\bar{x} = \Sigma x/n = 280/8 = 35$  mark

Step-2: Find the difference of the observations from their mean (see the 2nd column).

Step-3: Take the square of these differences i.e. square of the 2nd column (see the 3rd column).

Step-4: Divide the sum of squared difference (Column-III) by degree of freedom (n-1) i.e. put the values in the formula of variance.

$$s^2 = \frac{\Sigma(x-\bar{x})^2}{n-1}$$

$$= 1618/7 = 231.14 \text{ (marks)}^2$$

(b) **Standard Deviation:**

Standard deviation is the positive square root of variance. Here we use the word positive square root because when we take the square root of any number the answer comes with positive and negative signs e.g. when we take the square root of 16 the answer will be  $\pm 4$ . But for the standard deviation, we will take only the positive value because sum of square for a data can never be negative.

Standard deviation is usually denoted by s. In Mathematical form it can be written as:

$$s = + \sqrt{s^2}$$

$$s = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n-1}}$$

? The variance of the above example is 231.14. Now can you find the standard deviation of this data.

As you know that the standard deviation is the positive square root of variance so,

$$s = + \sqrt{\text{variance}}$$

$$= + \sqrt{231.14}$$

$$= 15.20 \text{ marks}$$

? In the previous example of sheep's weight the variance is  $113 \text{ kg}^2$ . What will be the value of standard deviation.

The value of standard deviation can be found by taking the positive square root of variance. Hence the standard deviation

$$s = + \sqrt{113} = 10.63 \text{ kg.}$$

**Self-Assessment Questions-5**

2. Standard deviation is the positive square root of.....

1. The sum of differences of the observations from their mean is always.  
 (i) 1 (ii) 0 (iii) -1  
 (iv) none of them

3. The value of the variance may be positive or negative True False

4. The variance of a constant is always zero True False

5. 42, 38, 53, 33, 45, 58, 50, 44 are the number of students in different classes of a school,. Find the standard deviation of the data.

6. Find the variance of the data given in the above question.

7. The range and the variance; the standard deviation are measures of spread.

True False

### Activity-6

Take some potatoes, ask about their weight from your 10 friends without weighing them, note these figures (numbers) then find the variance of these figures.

## 8. ANSWERS TO SELF-ASSESSMENT QUESTIONS

### Self-Assessment Questions-1

- |         |           |
|---------|-----------|
| 1. mode | 2. (ii)   |
| 4. True | 5. 13, 17 |

### Self-Assessment Questions-2

- |               |              |
|---------------|--------------|
| 1. 25.5, 25.5 | 2. 14.29, 14 |
| 3. True       |              |

### Self-Assessment Questions-4

- |                     |          |
|---------------------|----------|
| 1. True             | 2. (iii) |
| 3. qualitative data | 4. 20    |

### Self-Assessment Questions-5

- |             |           |
|-------------|-----------|
| 1. variance | 2. (ii)   |
| 3. False    | 4. True   |
| 5. 8.11     | 6. 65.696 |
| 7. True     |           |

# INTRODUCING COMPUTERS

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## INTRODUCTION

We are living in the age of computers where all tasks of human activities are supported by computers. Due to the importance of computers in our lives, we are presenting three units on computer in this course. You might have your first exposure to computers in this unit.

Although we are unable to provide you the facility of using computers but we have tried our best to present the material with the help of illustrations. In this unit the very basic concepts of computers are introduced to you which are essential to learn computers. These concepts will help you to understand the processing system of computers and also the computers components.

## OBJECTIVES

After reading this unit, you will be able to:

- understand the importance of computers in everyday life.
- distinguish between different types of computers.
- list the process of computers functioning.
- familiar with various input and output devices of a computer.

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## 1. WHY WE NEED COMPUTERS?

It is usually said that we are living in the age of computers. You might have seen computers in various government and non-government organizations. Computer is a device such as shown in Fig 7.1.

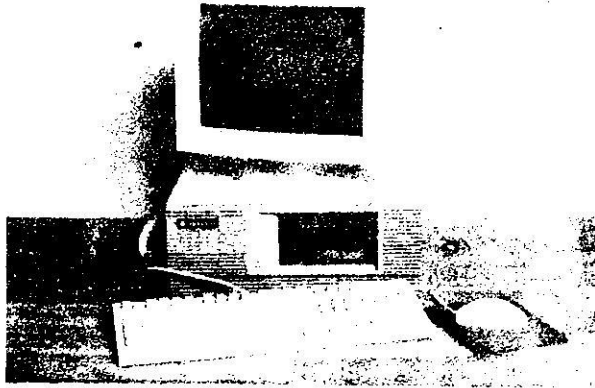


Fig. 7.1 - Personal Computer

Look around, you will observe that in our day-to-day work routine how much we depends on computers.

☞ Consider the following examples:

Look at your electricity bill, you will find it computerized. Almost all over the world the utility bills (i.e. gas, electricity and telephone bills) are prepared by computers. All necessary information are given to computer with some instructions and as a result it gives you the prepared bill. This process is completed in a very very short time as compare to the ones done manually i.e. without using computer.

Suppose you are doing shopping, suddenly you need money but all your money is kept in a bank which is far away from that market.

The question is how you will manage to get money from the bank. Some years back it was impossible to get money from bank account without going to the bank. But now computers make it possible. You might have seen a cash machine, see Fig 7.2. This machine provide you the facility of doing banking yourself without going to the bank. Just by simply inserting a special bank card (commonly known as credit card) into cash machine and typing a code number alongwith the money required immediately you can get the money. Actually the cash machine is linked to a computer in the bank, might be many kilometers away. Just by pressing the button of the machine the computer receives the signal and tells the machine to pay out the required money. The cash machine is also known as Automated Teller Machine (ATM).



Fig 7.2 - Cash Machine: 24 hours Banking

You might have seen cartoon films on television. Few years back, making of cartoon films was considered very difficult. At that time one had to make hundreds of drawing cards just to show one movement of cartoon. Now this process is done on computers with a greater speed and accuracy.



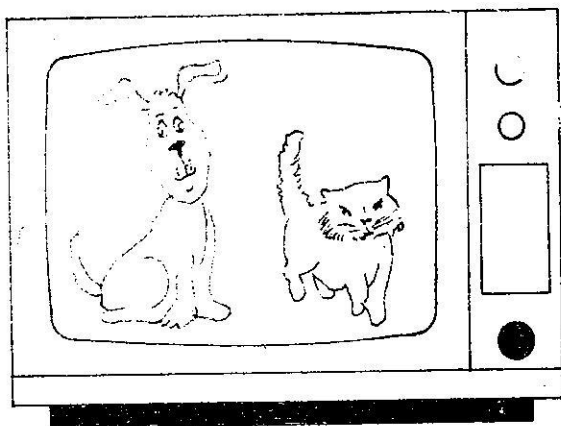


Fig 7.3

During watching a cricket match on television, the T.V. screen shows different graphs. Just by looking at these graphs you can immediately analyze the situation of the match. It is possible only because of computers. After receiving the data the computer immediately displays the graphs on the screen.

? It seems that every human activity is supported by computers. Imagine if there were no computers then what kind of problems you might be facing? Think for a while by keeping in mind the examples stated earlier write your answer in the space below:

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☞ Most people think computer is a very fast calculator, Infact a computer can do more than it. It can also perform non arithmetic operations. In simple words computer is an electronic device which can perform the required task by following the step-by-step instructions. The set of step-by-

step instructions which is given to computers is known as **program**. It should be remembered that for the subject of computer the word program is not written like programme. A person who writes the program for computer is known as **programmer**.

? Generally speaking a computer can do work 24 hours a day without asking any break for rest and for lunch. The most important thing is that it always gives you accurate results. Now you are in a position to write down some of the merits of using computers. Please write below:

---



---



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---

☞ Some of the merits of using computer are listed below:

(i) *Speed:*

The processing speed of a computer is very very fast as compared to humans. Suppose you want to calculate the standard deviation of a very large data set, consisting of hundred observations. If you do it by hand it will take hours. On the other hand by using computers, you can get the result in just a few minutes. The speed of computers is measured in Mega Hertz (MHZ). In microcomputers the speed ranges from 4MHZ to 120MHZ.

(ii) *Reliability*

Usually you rely on the electricity bill which you receive every month because you are aware that the bill is computerized. But one thing should kept in mind that a computer cannot make decision on its own.

it follows the instructions given by human. You might have heard that somebody was complaining about her gas bill. Of course it is not the error made by the computer. It might be a mistake of the computer operator while entering the data into the computer.

### (iii) *Storage Capability*

The storage capacity of a computer is large. You can store in it a big amount of data which can be retrieved quickly.

### Self-Assessment Questions - 1

Observe the use of computers in various organizations. Give three such examples.

## 2. TYPES OF COMPUTERS

☞ The computers come in different sizes. A computer is big enough to occupy a hall or so small that it can fit in your pocket. The computers are divided into four types according to their size, speed and storage capacity.

### (i) *Mainframe Computers*

As is evident from the name, mainframe computers are the largest computers in the world, first developed in 1954, see fig. 7.4.

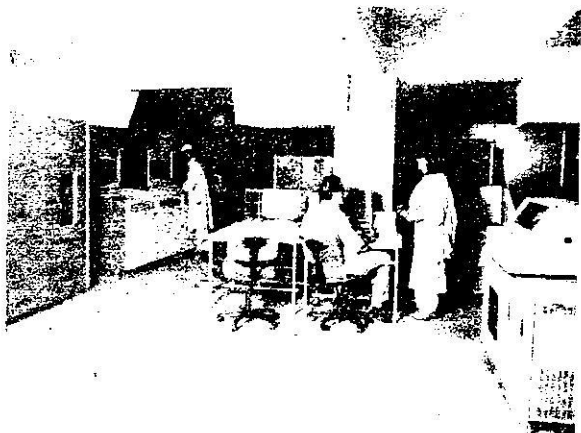


Fig. 7.4 Mainframe

They are usually installed in big rooms with controlled environment which should be dust free and air conditioned. Their processing speed is very fast and they have a very large storage capacity. They are used by big government and non-government organizations, like Agricultural Development Bank of Pakistan (ADBP). All kind of utility bill are prepared by mainframes. In AIOU mainframe computers are used to process the admission forms and your results.

### (ii) *Mini-computers*

Minicomputers were introduced in 1961. They are smaller than mainframes and have a size of standard cupboard see fig 7.5 Unlike mainframes, they do not required special care. they are usually used in research organization and in factories to monitor the manufacturing process.

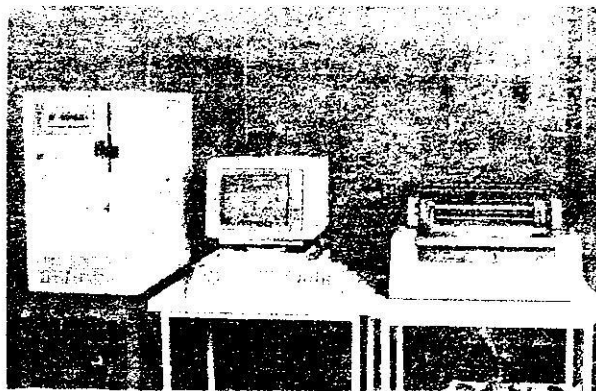


Fig. 7.5 Mini Computer

### (iii) *Micro-computers*

Micro-computers are also known as personal computers (P.C.) These were developed in 1971. They are smaller than minicomputers and can fit on <sup>1</sup> writing table, see fig 7.6. Their use in homes, offices, hospitals, shops has been increasing rapidly. You can use it to write essays, letters and to solve mathematical and statistical problems.

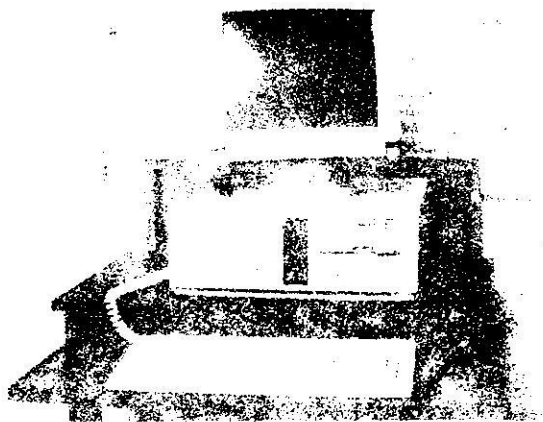


Fig. 7.6 - PC on writing table.

Three types of microcomputers have been introduced. These are desktop, laptop and palmtop. You might have seen desktop computers in various offices see fig 7.6 given above. It is the most common P.C. which is easy to use and monitor. Laptop computer is smaller than desktop, see fig 7.7. It is so small that it can be carried in a briefcase from one place to another. Even you can use it during travelling.

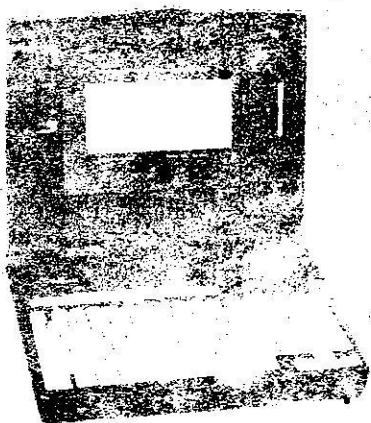


Fig. 7.7 - Laptop

The smallest of the three is a palmtop computers. It is also known as pocket size computer. It can be used ideally by field workers on field locations especially during survey work.

It should be noted that in unit 7 and 8 we will concentrate only on microcomputers and their systems.

#### (iv) *Super Computers*

Super Computers came into market in the mid 1970,s. They are very expensive computers. Their processing speed is the fastest among all the computers they are mainly used by research institutes like National Aeronautics & Space Agency in America (NASA). They are also used for forecasting the weather worldwide.

#### **Self-Assessment Questions - 2**

Which types of computer do you think would be most suitable for each of these jobs:

- (i) Maintaining data for a large bank.
- (ii) Playing computer games.
- (iii) Working in a nuclear lab.
- (iv) A designer working on a computer seeking its help in graphics.
- (v) An editor working on a computer to compose his/her book.
- (vi) A computer operator feeding data about admissions to the computer.

### 3. WHAT IS A COMPUTER?

It is believed that man designed aeroplane by observing birds fly. Therefore the basic principles of flying aeroplanes are same as that of birds. If you observe some other machines, you will note that we take most of the basic principles of their functioning from nature. It is true that computer is not a human. However, the computer has been engineered to imitate some of the basic functions human performs. You may ask, "what are the human like behaviors which a computer possess?". To answer this question consider the following example:

? Suppose your teacher asks you which is the capital of Egypt?" You will answer this question after going through some steps. Think for a while what are these steps. Write your answer in the space below:

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

☞ The following three steps are involved in answering this questions.

**Step-I:** Hearing the question is the first step. it is known as **INPUT**.

**Step-II:** You try to recall your memory which activates your brain. It is called **Processing**.

**Step-III:** Finally you say "Cairo is the capital of Egypt." It is the answer or result of the question known as **OUTPUT**.

? From the above discussion it has been cleared that we use our senses to input

the facts into brain for processing. Therefore the senses play the role of input devices. Can you name these input devices.

\_\_\_\_\_

\_\_\_\_\_

Our five senses do the function of input devices, these are touch, sight, hearing, smell and taste. We express ourselves by writing, speaking, or by our gestures, these are output devices.

Like the functioning of a human brain, the process of computers also involve the three steps, which are:

Input → Processing → Output

Before discussing these steps in detail it is important for you to have some idea about the major components of a microcomputer.

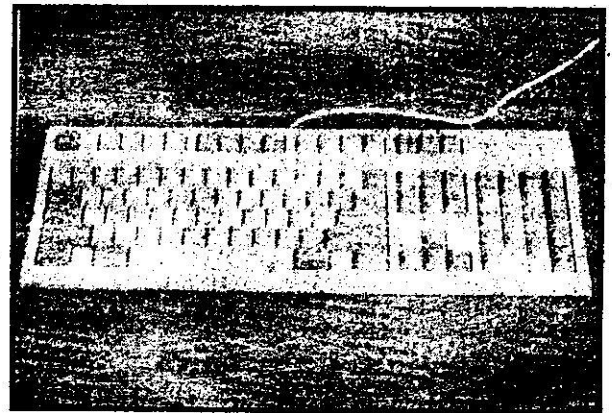


Fig. 7.8 (a) Keyboard

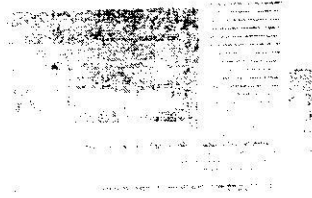


Fig. 7.8 (b) System Unit.

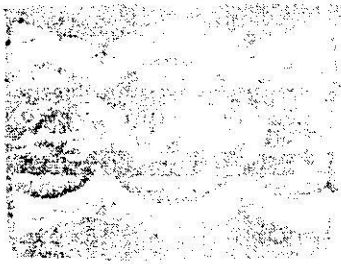


Fig. 7.8 (c) Monitor

Look at Fig 7.8(a), it is a device like a typewriter, known as a **keyboard**. It is an input device. Through a keyboard you type the data in to the brain of a computer for processing. The brain of a computer is known as **Central Processing Unit (CPU)**, which is situated in a box like device known as system cabinet or more technically, system unit chassis see Fig 7.8(b). While the other important component of system unit is computer's memory. A system cabinet may also house the monitor and the disk drives, which will be discussed further. Consider fig 7.8(c), it is a device like T.V. screen, known as a **Monitor**. Whatever you type appear on the screen of the computer. It is considered

as output device as it also shows the processed data.

It should be remembered that the figures or the raw facts which we feed to the computer are known as **data**. For example you might input the name of your relatives and program the computer to give you the alphabetically arranged names. Thus the processed data is known as **information**. Write below one more example of data and information.

Data: \_\_\_\_\_

Information: \_\_\_\_\_

#### 4. HARDWARE AND SOFTWARE

Try to find the meanings of the word hardware from the dictionary. What did you find? Write below:

\_\_\_\_\_  
\_\_\_\_\_

Hardware means physical equipment, therefore hardware consists of the machinery which makes up the computer. At this stage you are familiar with some of the hardware components, write down their names.

\_\_\_\_\_  
\_\_\_\_\_

Yes- keyboard, the computer cabinet and monitor are some of the typical hardware components. As you have been told earlier that computer cannot think itself. For its working we have to give it a program or step-by-step instructions, known as **software**. For example a game program is a software. We will discuss in detail the software in unit 8.

### Self-Assessment Questions - 3

Which of the followings are hardware and which are software:

- (i) Monitor
- (ii) Program for solving the quadratic equation.
- (iii) Keyboard
- (iv) A game program
- (v) System unit

### 5. HOW THE HARDWARE COMPONENTS OF COMPUTER WORK TOGETHER?

? Suppose a computer in a company is programmed to accept data about employees rate of pay and hours worked. The computer is directed to process it to produce the employees paycheck. In this case write down what is input, processing and output?

Input: \_\_\_\_\_

Processing: \_\_\_\_\_

Output: \_\_\_\_\_

In this example data about hours worked and rate of pay is input. Then the data is processed according to the program given. Finally the computer gives the paycheck which is the output. Suppose the computer operator wants to store the data in some external device but not in computer's memory. Such storage devices are known as **secondary storage devices**. A computer can easily retrieve data stored on such devices.

➡ A system hardware components of typical microcomputers can be shown diagrammatically as below.

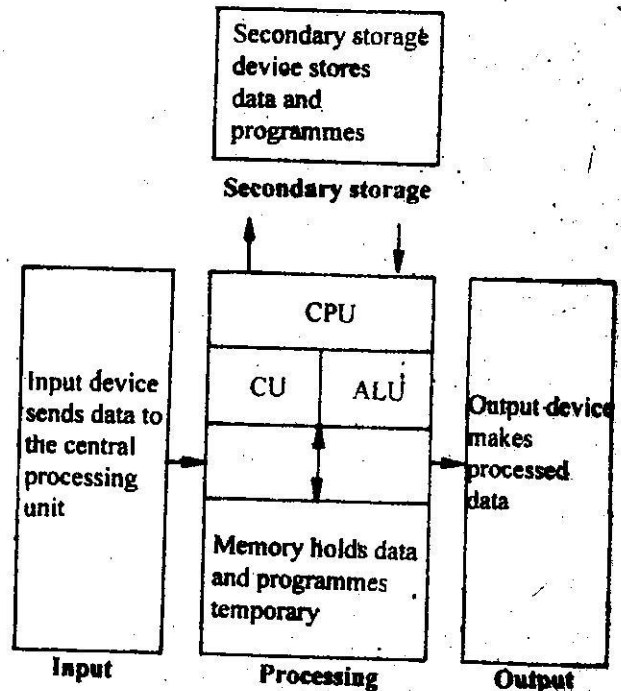


Fig 7.9: Hardware Components of Microcomputers

The input, output and secondary storage devices are known as **peripherals**. A peripheral device is anything outside the CPU. Now we will discuss the hardware system in detail.

#### (i) Input Devices

? Input devices are those parts of computers which are used to: (please tick the right answer)

- A put the data into the CPU.
- B get the final results
- C process the data

The correct answer is A As you know keyboard is one of the input devices. It is a device just like typewriter with some additional keys. You can input the data simply by using the keys on the keyboard. A



normal keyboard has the following keys:  
(Also see fig 7.10)

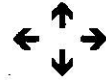
**Combination Keys:** Keys like shift, alt, are used in combination with other keys. To type the uppercase character of a button you have to press the shift key and the required key together.

**Numeric Keys:** Ranging from 0 to 9

**Typewriter Keys:** See Fig 7.10

**Functional Keys:** Like F1, F2, ....F12. The choice depends on the software you are using.

**Cursor Keys:** Like



**Enter Key:** ↵

**Functional Keys**

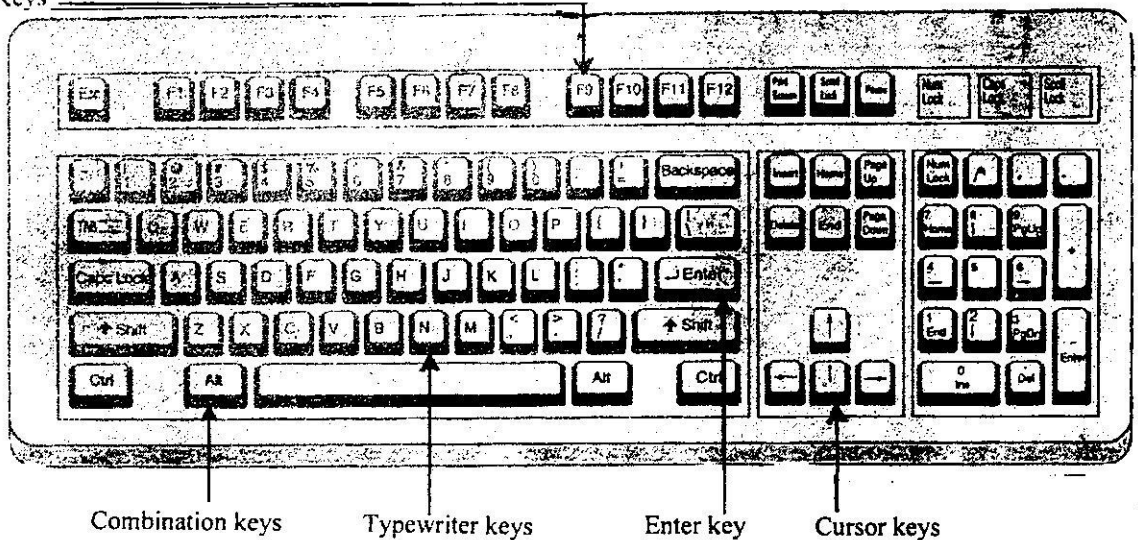


Fig 7.10: Keyboard

**Mouse:** Another important input device is known as mouse, see Fig 7.11. You can use it for moving freely the cursor in circular motion. Such movement is not possible by using only the keyboard. As you can see it is a hand held device with button on it. Moving the mouse around usually cause an arrow or some other symbol on the computer screen to move.

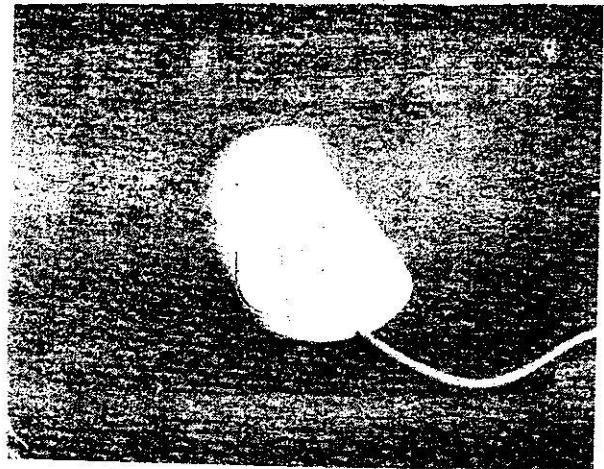


Fig 7.11: Mouse

### (ii) **Processing**

You have been told earlier that in humans, processing is done in brain and the time spent on processing is known as thinking. In computer the device which is used for processing is known as CPU. So CPU is a brain of a computer and it is on a microchip, see Fig 7.12.

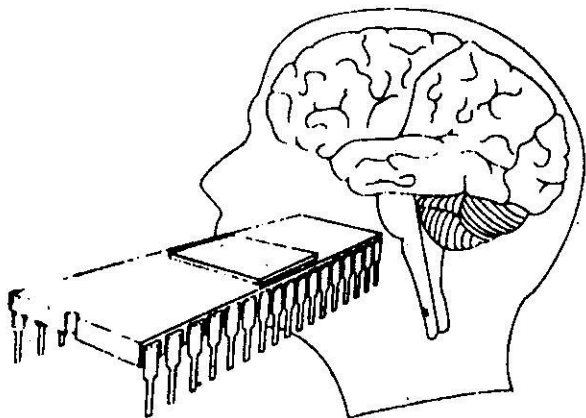


Fig 7.12: The CPU The brain of the computer

Like humans computers also have memory which is associated with CPU in the system unit, see fig 7.9. The purpose of processing is to convert the input into output. Like human brain the CPU has different parts, responsible to monitor the various activities of data processing see Fig 7.9. These activities are done by the following parts of CPU.

(a) The Control Unit (CU)

(b) The Arithmetic Logic Unit (ALU).

(a) *The Control Unit (CU)*

? You might have seen the orchestra on a television. Usually a man stands in front of the orchestra and he gives instruction to the orchestra. He also controls their

activities, this man is known as conductor. The role of a control unit is the same as that of conductor. Think over it that what is the role of CU and write your answer in the space below:

---

---

Yes-the control unit direct other parts of the system in carrying out the processing of the data. Although it does not execute the instructions itself rather it directs other parts of the system to do so. It contains signals that translate the data into a language acceptable to other parts of the computer. You can call it a gate through which the data goes to arithmetic logic unit and to the memory.

(b) *The Arithmetic Logic Unit (ALU)*

The arithmetic logic unit (ALU) is responsible to perform the tasks of dealing with arithmetic operations and logical decisions. As you know arithmetic operations include all types of calculations such as addition and subtraction of numbers. While computer is also able to decide which value is larger or smaller than the other, this is because of its power of logical decisions. It is very important function of ALU e.g., it enables you to know whether party A has more votes than party B in National Assembly elections.

As we have told you earlier like humans computer also has memory closely associated with CPU (see fig 7.9). Now you will learn about computers memory.

**Memory:** By memory we mean the computer's blackboard also known as main memory and primary storage. It is responsible to store the programs or software and it also keeps the data



which you input for processing. The larger the computers memory the more data can store. Like humans computer also has a long term memory and short term memory.

The short term memory is known as random access memory (RAM). It keeps the data temporary that is when you switch off the power the contents are lost. The major function is to keep the data which you input. On the other hand the long term memory is referred to read only memory or ROM. The contents of the memory are stored by the manufacturer (of that computer). These contents are actually the information about the computer, its system, the storage capacity and etc. etc. Thus information is built into computer memory and cannot be altered. Therefore, it is a long term or permanent memory by which you can only read the contents but cannot write. Further its contents do not disappear on switching off the power.

RAM and ROM, both build up the memory. The size of RAM is important because the computer can do the amount of work that its RAM has the storage capacity. You can also save your work on storage devices outside the RAM such devices are known as secondary storage devices.

**Secondary Storage:** As stated earlier the computer has a finite capacity to store data. To avoid this problem, one can store his/her work on some other computer devices known as secondary storage devices. These devices hold the data permanently and the computer can easily retrieve the data when needed. There are two types of such devices:

- (i) Magnetic Disk.
- (ii) Magnetic Tape.

Magnetic disk is further of two types:

- Hard disk
- Diskette or floppy disk.

A hard disk is fitted permanently inside the computer. It is inflexible i.e. you cannot remove or insert it into computer. In the next unit you will read what type of programs we usually store on a hard disk. The storing capacity of hard disk is much more greater than the floppy disk.

The diskette is more commonly known as a floppy disk. It looks like a small stereo record. A disk can store data and program in the form of magnetized spots. It usually comes in two sizes 5 1/4" and 3 1/2" also see fig 7.13 (a) and 7.13(b)

A floppy disk is inserted into a disk drive. The mechanism reads and writes the data from the disk. Many microcomputers system has one floppy disk drive referred to as drive A and one hard disk drive referred to as drive C. Sometimes microcomputers have two floppy disk drives, drive A and drive B. In case of two disk drives one drive takes 5 1/4" disk and the other drive takes 3 1/2" disk.

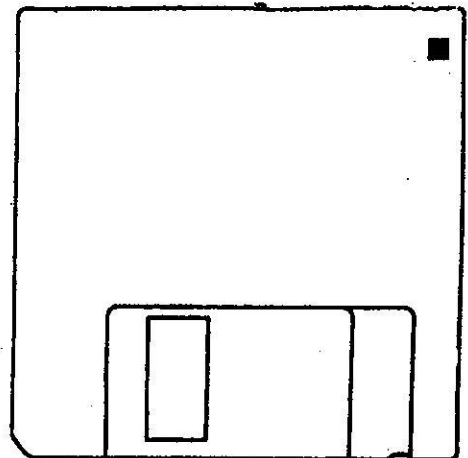


Fig. 7.13(a)- Floppy Disk. 5 1/4"

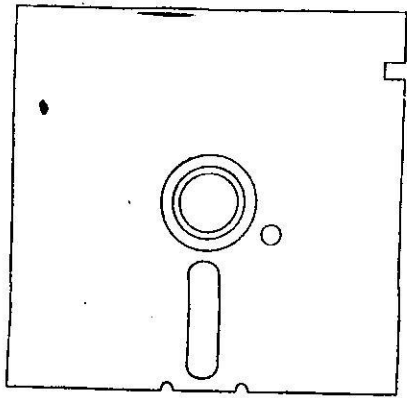


Fig. 7.13(b)- Floppy Disk. 3" 1/2

### (ii) Magnetic Tape

This is the same tape which you use for listening music in tape recorder see Fig. 7.14. Although it is inexpensive but now most of the computer users prefer to use floppy disk.

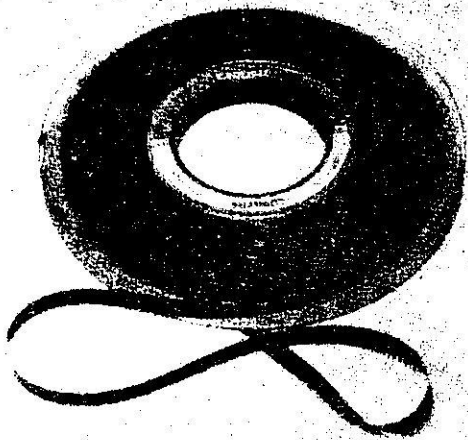


Fig. 7.14 - Tape

### (iii) Output Devices

Now you have come to the final stage which is output. You will learn about the output devices i.e. those devices by which you can obtain the result from the computer.

Some commonly used output devices are monitor and printer. Monitor is a device just like TV screen, usually, it is placed over a CPU box. There are two types of monitor;

- (i) A Monochrome Monitor
- (ii) A Colour Monitor

Monochrome monitors are those which produce only one colour as mono means one. The text usually comes in white, green or amber colours with a dark background. But in colour monitors there are various types which produce different number of colours. They are CGA (4 colours) EGA (16 colours) VGA (256 colours) Super VGA (2000 colours) and XGA (65,536 colours). As the number of colours increases the quality also improves. Super VGA and XGA are used by graphic designers and advertising agencies.

You might have seen a device attached with computer and used for printing on the paper, also see Fig 7.15:

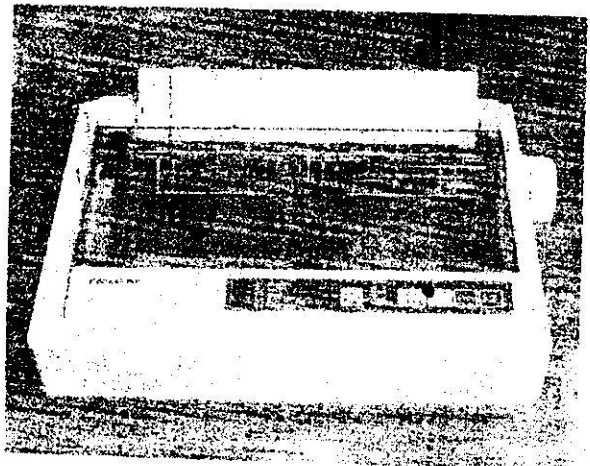


Fig. 7.15 - Printer

This device is known as **printer**. It is an output device used to print on paper whatever the information you need from the computer. There are four popular kinds of printers used with microcomputers, these are dot-matrix, laser, ink-jet and thermal.

**Dot-matrix Printer:** It can produce a page of text in less than 10 seconds. This printer is the most popular printer used now-a-days. It works on the same pattern as the typewriter. It produces print in a pattern of small dots. Because of this reason they are used for tasks where high quality work is not involved. The disadvantage of using dot-matrix printer is its noise. It can print numbers, characters, shapes and graphics.

**Laser Printer:** This is the most modern and advanced type of printers. Its print is of highest quality so it is used where high-quality output is required. These printers use laser beams to create print. The technology is same as that of photocopying machine. A laser printer can print 8 pages in just one minute. See Fig. 7.16.

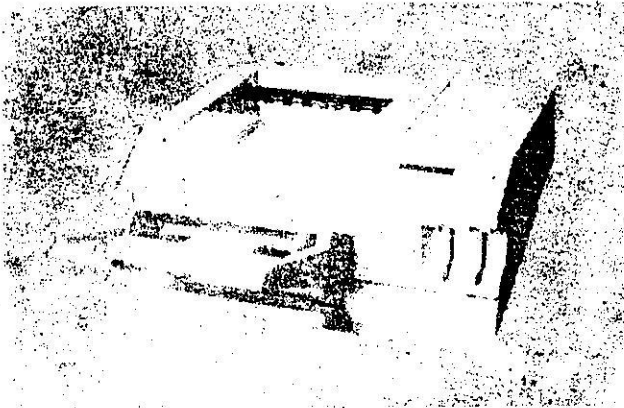


Fig. 7.16 - Laser Printer

**Ink-Jet Printer:** This printer not only produces a high-quality image but also permits printing to be done in a variety of colours. These printers are used whenever colour and appearance are important, as in advertising agencies. It is thought that these printers will become the most popular printers by 1996.

**Thermal Printers:** A thermal printer uses heat elements to produce images on heat sensitive paper. Originally these printers are used in science labs because of their low cost and high reliability.

**Other Printers:** There are some other types of printers e.g., daisy-wheel printer and plotter. Daisy-wheel printers produce very high-quality print. But they are slower and less reliable than the earlier mentioned printers. Therefore their sale has been decreasing since last few years. Plotter is a special kind of printer that produces graphic designs. They are used by art designers.

#### **Activity-1**

Whenever you have a chance to go to such organizations where the work is supported by computers. Try to do the following:

- (i) Observe the type of computer and in case of microcomputer observe its components.
- (ii) How the computers component link together? Study it.
- (iii) Ask the workers of the organisation for what purposes they are using computers in their organization.

### Self-Assessment Questions - 3

State whether the following statements are True or False.

- (i) Mouse is an output device.
- (ii) Memory is one of the secondary storage devices.
- (iii) CPU has two components, CU and ALU.
- (iv) The programme given to computer is known as peripheral device.
- (v) Processing is carried out in system unit.
- (vi) Memory is one of the components of system unit.
- (vii) The most commonly used printers are laser printers.

(ix) The monitor with one colour is known as monochrome monitor

(x) RAM stores the data temporarily.

### 6. ANSWERS TO SELF-ASSESSMENT QUESTIONS

#### Self-Assessment Questions - 2

mainframes (i, vi)  
minicomputer (vi)  
microcomputer (ii, iv, v)  
supercomputer (iii)

#### Self-Assessment Questions - 3

Hardware; i, iii, v  
Software; ii, iv

#### Self-Assessment Questions - 4

True; iii, v, vi, ix, x  
False; i, ii, iv, vii, viii.



# **COMPUTER SOFTWARE**

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# INTRODUCTION

The previous unit was about the basic concepts of computer hardware. A computer is just a machine without software. In this unit, you will study two major kinds of software. Some packages which are thought to be important and useful are briefly introduced to you. Although we are not providing you the facility of computer but this unit provides you the opportunity to learn some commands for starting a computer and also working with it.

DOS or Disk Operating System a well known and most widely used operating system will also be introduced to you.

## OBJECTIVES

After reading this unit, you will be able to:

- explain how various characters are represented inside the computer.
- describe the use of some important software packages.
- list various commands of DOS.
- boot up the computer.
- appreciate the importance of computer languages.




## 1. HOW COMPUTER UNDERSTANDS THE DATA

? When you type alphabet or numbers by keyboard for processing then how these alphabets or numbers are presented inside the computer? Spend few moments in thinking and tick your appropriate choice, given below:

A: The alphabets or numbers are presented inside the computer as they are e.g., A will be presented as A and 5 as 5.

B: The alphabets or numbers are presented inside by some other system acceptable to computer for processing.

 Yes, the correct answer is "B". Definitely you would be eager to know the name of this system. By using the **Binary System** the alphabets, numbers and special characters are represented in such a form which a computer can understand. You have already studied binary system during your schooling this is the time to recall it and answer the following question:


? The binary system consists of:

A: 2 digits (0 and 1)

B: 6 digits (1 to 6)

C: 9 digits (1 to 9)


Yes, the binary system consists of 2 digits 0 and 1. The question arises why this system is applicable to computers?

 As we said earlier a computer is an electronic device which consists of electric circuits. Like other electronic devices e.g., TV, the computer might be ON or OFF.

In other words the computer operates with electricity so there are only two possibilities, it is either ON or OFF.

We consider OFF condition as '0' and ON condition as '1'. Therefore we have to use two numbers system which is a binary system. Everything which goes into computer is converted into binary numbers.


? The question is how the binary system is used to convert the alphabets, numbers and different characters in 0's (Zero's) and 1's (one's)?

 Each 0 and 1 in a binary system is called a **bit** as bit is an abbreviation of Binary digit. A bit is the smallest unit of computer memory but the alphabets, numbers and characters are represented by a group of bits. The group of 8 bits is known as a **byte** i.e.

8 BITS = 1 BYTE
-----------------

It should be noted that the capacity of computer memory is represented in number of bytes. Further the number of bytes are expressed in **Kilobytes (K)**. A microcomputer typically has its memory between 512K and 4MB where Mb stands for **Megabytes** and one megabyte is around one million bytes.

? Next you can ask how a computer is able to store words, characters and numbers in a binary form?

 Actually the computer uses a special code, which allocates a group of bits to each letter, number and character. It would be interesting for you to know that the 8 bits of a byte can make 256 different

combinations of 0's and 1's. These combinations are enough to represent every key on the keyboard. For example the letter A can be represented inside the computer as follows: (See Fig. 8.1).

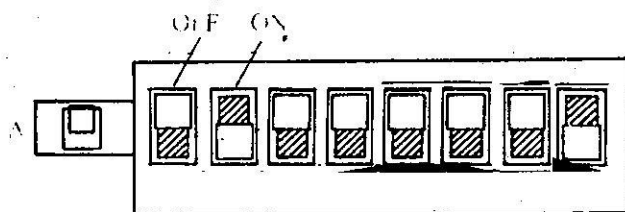


Fig. 8.1 - How the letter a is represented in on off 0 1 binary codes.

? Look carefully at Fig. 8.1, by assigning 0 to off condition and 1 to On condition, write below the binary digits for the letter A.

The binary digits for the letter A is 01000001. This process of assigning binary digits to letters, numbers and characters is known as **binary coding**. There are different codes for all the buttons on the keyboard.

☞ The more commonly used binary coding scheme for microcomputers is known as ASCII, pronounced as **as-key**. It stands for American Standard Code For Information Interchange. The above mentioned binary code for the letter A is also in ASCII.

### Self-Assessment Questions - 1

1. State whether the following statements are True or False.

- (i) Binary system consists of 5 digits.
- (ii) We assign 0 to Off condition and 1 to On condition.
- (iii) 8 Bits = 1 Byte
- (iv) The letter B is represented inside the computer as B.
- (v) Each letter is represented inside the computer in binary codes.

2. Look carefully at the following figure; this figure is suggesting a binary coding

scheme for the letter 'G'. Express G in binary codes.

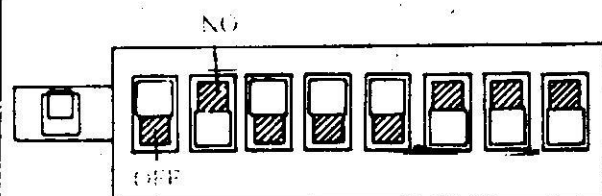


Fig. 8.2

## 2. COMPUTER SOFTWARE

In the previous unit, you have read about the hardware components of a microcomputer.

We need a software to run the physical machinery of computer. A computer is just like a body without a soul, otherwise. In unit-7 you have studied a brief introduction of software. By recalling it, answer the following question:

? Why do we need a software? Tick the appropriate choice, given below:

A: For the maintenance of CPU.

B: For converting data into information.

☞ Yes, the basic purpose of using software is to convert the data into **information**. In other words a software converts the unprocessed data into **processed facts**. So software is a set of instructions given to computer for its working. There are two major categories of software used in computers.

- (i) Applications Software
- (ii) Systems Software

### 3. APPLICATIONS SOFTWARE

It is a software which the computer user uses to solve problems on computer.

? Suppose you want to present a large set of data graphically by using the computer. To do it you need a software. Would you develop your own software or would you buy a ready made software from the market? Write below:

---

---

Definitely, you cannot develop or prepare the software by your own as this work requires a very special training in this field. Obviously you will prefer to buy a ready made software which is especially designed for drawing graphs.

This type of software is known as **packaged software** or sometimes called only **package**. It is usually stored on a diskette. There are thousands of different packages available for microcomputers. These packages are prepared by skilled programmers.

? Suppose you want to solve your course assignments on computer. What kind of packaged software do you expect to use? Write below:

---

---

---

As for typing assignment you need a package specially designed for typing, similarly, you might need software packages to solve mathematical and statistical problems or for drawing graphs and illustrations. As mentioned earlier there is a variety of packages available in market. Let us have a

quick look at some of the very important and more commonly used software packages.

#### (i) *Word Processing:*

An ordinary typewriter usually does not have the provision of editing, formatting, saving and composing the material which you are typing. Now this problem has been solved. Word Processing is such a package which enables you to perform all these tasks. The beauty of this package is that you can make changes easily at any stage.

You can use spell check to check the spelling of your work. Further, you can store your work on the diskette and you can get a beautifully composed print. A number of word processing packages are available.

Some of them are, WORD PERFECT, MS-WORD, WORDSTAR and many others. CHIWITER is a word processor suitable for mathematical, statistical and scientific work. Word processors are also available in Urdu, Arabic, Sindhi and Pushto. KATIB is one of the Urdu Nastaliq Word Processor.

#### (ii) *Spread Sheets:*

Have you ever had a chance to see the worksheet which accountants use? This sheet is organized in rows and columns. These sheets have been used for centuries as a tool of business communication. The manual preparation of such sheets was a difficult task. Now, computers has made the job considerably easier through the use of a software known as spread sheet. This software is used to organize, analyze and display data. Fig. 8.3 (a) displays a spreadsheet showing monthly expenses of a family for the months January to April. This spreadsheet shows months as columns and

different household expenses e.g., food, rent as rows. While the last row and the last column is showing the total of values. This data can also be represented graphically as pie chart, see Fig. 8.3 (b).

Expenses	Jan	Feb	Mar	Apr	Total
Rent	3000	3000	3000	3000	12000
Food	4000	3700	3500	3900	15100
Clothing	2000	1000	1700	1700	6400
Bills	1500	1500	1200	1000	5200
Transport	1000	1000	1100	1100	4200
Others	2000	1500	2000	2000	7500
<b>Total</b>	<b>13500</b>	<b>11700</b>	<b>12500</b>	<b>12700</b>	<b>50400</b>

Fig. 8.3 (a) Spread Sheet

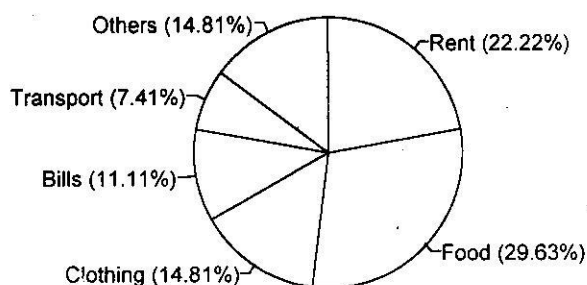


Fig. 8.3 (b) Pie Chart

Popular spreadsheet packages include LOTUS 1-2-3, EXCEL and QUOTTROPRO.

### (iii) Some Other Important Packages:

A variety of packages related to mathematics and statistics are also available. These packages are used to analyze given data, solving equations, matrices etc. For example some of the most commonly and effectively used statistical packages are SPSS, Statistical Package For Social Science, SAS (Statistical Analysis Software),

MINITAB, GENSTAT.... In these packages a variety of statistical methods and formulae are programmed, while the choice of method depends on the user. For solving the mathematical problems the following packages are usually used Eurica, Mathematica, IMSL,.....

## 4. SYSTEMS SOFTWARE

You have seen that a computer user interacts with computer by using the applications software. The question is how does the applications software interact with the computer? Systems software makes it possible. Systems software is also considered as background software which is responsible of managing the computer's internal affairs.

? What did you understand by systems software? Write below:

---



---



---

The most important system software programme is the **Operating System**. An operating system is the traffic coordinator, manager and operator for the transactions that occur between parts of the computer system and you. Therefore an operating system is a collection of specialized programmes that provide among other things support for input/output operations. Such support is often called an interface. As mentioned earlier the operating system is responsible of taking care of many of the computer tasks which you do not have to think about. These are transparent to you.

? Try to write down one such task.


---




---




---


 For instance, the operating system takes care of the - flow of characters between keyboard and the computer, between the computer and the screen, between the computer and the printer and between the disks and the internal memory (RAM). You cannot work on any applications programme without calling into action the operating system. Therefore as a computer user you must be able to interact with an operating system.

 A number of operating systems are available for personal computers. The most popular operating system is called DOS. Which is shorthand for Disk Operating System.


#### 4.1 *Booting Up The System*

As you have been told earlier that the computer's own memory has a limited storage capacity, so, only the main programme of the operating system is the permanent resident of the memory. We call it main programme as it is required for the working of computer with you. While the remaining programme of the operating system is usually stored on floppy disk or a hard disk, if available.

 As mentioned earlier an operating system enables the computer to interact with a software which further interacts with you. How the operating system is used to perform this job? Think for a while then go ahead.


 First you will have to load the operating system into the memory. This process is known as **booting up the system**. It means that your computer is ready for executing any other programme. Then you start to give some typical instructions to the


computer. Such instructions are known as **commands**. In this unit you will read some of the important commands of DOS.

 When you switch on your computer, you will see some information about your computer. You can ignore it. The information stops automatically then you will see the following on the screen:

C:\> -

This is called the **command prompt**. The flashing underscore next to the command prompt is called the cursor. The cursor shows where the command you are going to type will appear.

 The command prompt is describing the  
• DOS has been loaded. Where it is loaded, in hard disk or on floppy disk? In this case write down your answer.

 This command prompt will appear if the hard disk is loaded with DOS. If your hard disk is not loaded with DOS then the computer will not boot. You may hear a sound coming from the computer, known as a beep. A message on the computer screen may also appear asking you to insert a disk containing DOS, often referred to as **system disk**.

You will then insert the system disk in drive A and lock its door and then start the computer. You will see the following on the screen:

A:\> -

The command prompt has appeared but the active drive is A.



? When A:\> appears on the screen, what does it mean?

---

In fact it means that the computer is loaded with DOS and ready for executing the programmes while the floppy disk is in drive A.

? The question is how can we write various commands in DOS? Is there any specific method of writing? To get the answer to these questions, consider the following situations:

**Step-I:** Type the command **news** at the command prompt. (You can type the command in either uppercase or lowercase letters.)

C:\> news.

If you make a mistake in typing, press the BACKSPACE key to erase the mistake and then write again.

**Step-II:** Press ENTER Key (↵).

You will have to press ENTER Key after every command you type.

C:\> news ↵

**Step-III:** You will see the following message on the monitor.

Bad command or file name.

? Why this is so? Think for a while and then go ahead.

☞ This message appears whenever you type something which the DOS does not recognize. Actually news is not a valid

DOS command and so DOS displays the message 'Bad command or file name'. You might have got the answer of the question that for running the DOS, you need special commands.

? For further working on computer, you have to clear the screen, how will you do it?

Type the following command at the command prompt:

C:\> cls ↵

You will see that as soon as you enter the command, the computer screen is cleared.

☞ **Cls** is a DOS command that clears the screen.

Next, type the following command at the command prompt;

C:\> Ver ↵

On pressing the enter key the following message appears at the screen:

MS-DOS Version 6.0

Where MS-DOS is the name of the operating system and 6 is its version. What is meant by a version? Version is somewhat similar to the edition of a book or model of a car.

## 4.2 File and Directory

☞ Till now you have learnt some basic and starting commands of DOS. In the previous unit, we also said that the computer is also used to store information. For instance - you have a big collection of books at home. You want to store in computer the

information related with books of your personal library. As we said earlier computer uses its own language so it is important for you to learn some of the basic words used for storing the information. These words are listed below:

**Character:** A character may be a letter A through Z, a number 0 through 9 or a special character such as \*, \$, @, % etc. First you will have to provide the letters comprising the title of the book. These letters are the individual characters in the title of the book.

**Field:** A field contains a set of related characters. Thus for each book there are various fields. For example, a title field, author field, publisher field, editor field, number of pages field, year of publication field and a price field.

**Record:** A record is a collection of related fields. Therefore in your personal library, various information related to one book is a record. Here the record includes book's title, its author's name, publisher, edition, number of pages, year of publication and the price of that book.


**File:** A file is a collection of related records. In the example of personal library, how will you define a file? Write below:

---


---


---


Yes- if you manage to collect record of every book in your personal library then this collection constitutes a file.


 A file is the primary unit of storage in a computer. In your computer you might have different pieces of information.

For example one file might consist of information of your personal library the other might consist of the name of your friends alongwith telephone numbers. Thus a file enables DOS to distinguish one collection of information from another.

 In due course of time, there will be a large number of files in your computer. How will you locate a specific file?

 Consider the example of a kitchen where each item is stored or put in various cabinets and boxes. For example if you need tea cups then you straight away go to that cabinet where cups are put. Suppose if you put all the kitchen items in one large box then how difficult it would be for you to locate a specific item. Therefore classification is very important in our life. The same principle of classification is applied in storing files.

 By keeping in mind the example of kitchen, try to think how the principle of classification works in storing files in a computer.


 You might have noticed that we prefer to put kitchen items in their relevant boxes just because we do not have to waste our time for locating them. In other words just to shorten the "processing" time. Similarly a computer can effectively be used only by arranging large number of files in an organized way. It can be done if similar files are grouped together. In DOS one of these groups is called a **directory**. Storing groups of files in different directories makes files easier to find for example all the files that come with DOS are stored in a single directory that is usually named DOS.

Everyday you have one or more programmes on TV on cooking. You might be interested in storing on your computer the files that contain receipts of dishes shown on the TV. You can create a directory called DISHES in order to easily locate these files.

? There might be a number of directories on your hard disk or on your floppy disk. The question is how the directories are created on computer?

? You can create a directory by typing at the DOS prompt MD followed by the name of the directory, where MD means, 'make directory'. How you can type this command for creating a directory? Try to write below:

---

 Suppose you are interested in creating a directory with the name DISHES, then you will type at command prompt as under:

```
C:\> md DISHES ↵
```

The directory DISHES is created and the screen is again showing the DOS prompt.

```
C:\>
```


You can put your files in the directory you created but first you will have to move to that directory. To do this you type the command **cd** (change directory) followed by directory name:

```
C:\> Cd DISHES ↵
```

You are now in DISHES director and the screen shows

```
C:\> DISHES >
```

? Suppose you want to move from the directory DISHES to the RESULT directory then how you will move?

 Look at your computer screen, it is showing the following command:

```
C:\ DISHES >
```

To change directory we use again the special Command **cd** and this command is written as under:

```
C:\ DISHES > cd\RESULTS ↵
```

After pressing the ENTER Key, you are in RESULTS directory. Write below what should be written on your computer screen which shows that you are now in RESULTS directory?


---

Yes- the following will be displayed on your screen when you move to RESULTS directory.

```
C:\RESULT >
```

Where the sign (\) is known as backslash and you can find this key on your keyboard.

? Suppose you want to see what has been stored on your hard disk or on floppy disk then how you will proceed?

 As stated earlier, when you boot up the computer, the following command prompt will be on your screen (in case of using hard disk)

```
C:\>
```

to see the detail of files on your disk, simply type **dir.** abbreviation for directory and enter it.

```
C:\> dir. ↵
```

Just after pressing enter key, your computer screen shows the list of files and directories on your hard disk. See Fig. 8.4. You can see the information include the file/directory names, when they are created (day and month) and how much space they have occupied this is known as file list. From that list you can easily identify the directories as against the directory name <dir.> is written while against file name no such thing is written. See Fig. 8.4.

dir/p

Volume in drive C is MS-DOS\_6  
Volume Serial Number is 0021-BE5D  
Directory of C:\

DOS	<DIR>	01-01-80	5:51p
WINDOWS	<DIR>	01-01-80	6:01p
WPAO	<DIR>	01-01-80	6:26p
PSFONTS	<DIR>	01-01-80	6:27p
DTFONTS	<DIR>	01-01-80	6:27p
WPC60DOS	<DIR>	01-01-80	6:28p
123R3	<DIR>	01-01-80	6:29p
TOOLKIT	<DIR>	01-01-80	6:29p
SCAN	<DIR>	01-01-80	6:30p
NU	<DIR>	01-01-80	7:21p
MOUSE	<DIR>	07-26-95	5:43p
CW	<DIR>	07-26-95	5:16p
BIS	<DIR>	07-26-95	5:30p
RIKE	<DIR>	07-26-95	5:32p
DAVE	<DIR>	07-26-95	5:32p
CDMAN	<DIR>	07-26-95	5:33p
WPDOS	<DIR>	07-26-95	5:40p
COMMAND	COM	54,645 05-31-94	6:22a
WINA20	386	9,349 05-31-94	6:22a

Press any key to continue . . .

(continuing C:\)

CONFIG	SYS	119 01-01-80	5:20p
AUTOEXEC	BAT	172 01-07-80	2:35a
RRBFARDB		4,096 07-26-95	5:21p
TPFFINFO	NCD	411 01-01-80	9:40p
WP(WPC)	TRE	491 01-09-80	8:58p
CDDBASE		1,081 01-10-80	11:39p
FILE0000	_DD	8,192 10-30-95	1:59p
FILE0001	_DD	8,192 10-30-95	1:59p
FILE0002	_DD	8,192 10-30-95	1:59p
103W	<DIR>	09-27-95	11:41a
FILE0003	_DD	8,192 10-30-95	1:59p
FILE0004	_DD	8,192 10-30-95	1:59p
FILE0005	_DD	8,192 10-30-95	1:59p
FILE0006	_DD	8,192 10-30-95	1:59p
FILE0007	_DD	8,192 10-30-95	1:59p
FILE0008	_DD	8,192 10-30-95	1:59p
FILE0009	_DD	8,192 10-30-95	1:59p
FILE0010	_DD	8,192 10-31-95	11:58a
WINWORD	<DIR>	10-31-95	9:02a
FILE0011	_DD	24,576 10-31-95	11:58a
FILE0012	_DD	8,192 10-31-95	11:58a

40 files(s) 193,244 bytes  
Press any key to continue . . .

(continuing C:\)

181,764,096 bytes free

Fig 8.4 File List

Suppose you are interested to see the files in RESULTS directory then how you will proceed?

While you are in RESULTS directory the following command will display the files:

C:\RESULTS>dir

#### 4.3 File and Directory Names

In Fig 8.4 you might have noticed that each file and directory has a name. The question arises do we have to follow some rules in assigning the name to files and directories? The answer is yes. First the name can be upto eight characters long. Most file names have two parts: the name and the extension. These parts are separated by a period. For example RESULTS.WK1 is a valid file name.

In the file name RESULTS.WK1, identify the following:

Name: \_\_\_\_\_

Extension: \_\_\_\_\_

Yes- in this example RESULTS is the file name and WK1 is the extension. It should be noted that the file name should not exceed eight letters while the extension can be upto three characters. Further the name should indicate the contents of the file as in this case the name RESULTS is indicating that this file is about the marks obtained in various examinations. The extension WK1 is used for Lotus 1-2-3 (spreadsheet), which means that the application software used is Lotus 1-2-3. In other words the results which are stored in the file are entered by using Lotus 1-2-3.

#### 4.4 Disk Drives

You have seen that a directory is a group of files. In the same manner a drive is a group of directories. A drive is always

represented by a drive letter. Drives are associated with a piece of hardware known as disk. You have already seen in unit 7 that a disk is a flat piece of metal or plastic on which data is stored. The most commonly disks are hard disk which is inside your computer and the floppy disk which you insert into a slot in the computer.

A drive is represented by a single letter. Your first floppy disk drive is A, your second floppy disk drive, if you have one is drive B and your hard disk is named drive C.

As you have studied that disk drives placed in the system unit of computer. Because you use different computers, you may see several different types of disk drives combinations. The three combinations are more common, given in Fig. 8.5.

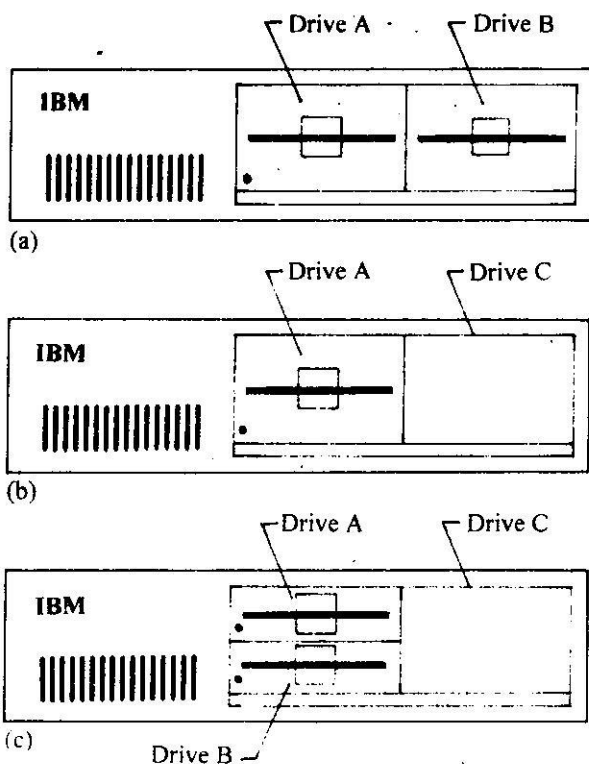


Fig 8.5: Disk drive configurations

When you are working on a computer, you may be working with files on different drives and it is useful to change drives.

Suppose you are in drive C and you want to change to drive A. To do this insert the floppy disk in drive A label side up and lock the drive door or make sure the disk clicks into the drive, see Fig. 8.6. At the command prompt type `a:` and enter, as below:

```
C:\> a:↵
```

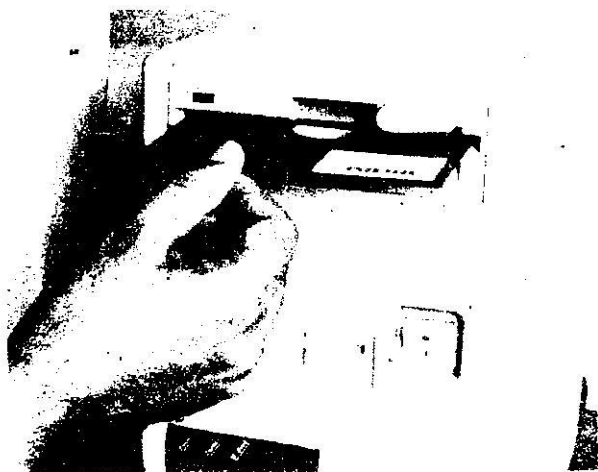


Fig. 8.6 - Picture showing how to insert a disk in drives

You will see that the command prompt changes to

```
a:\>
```

It means that now you are working on a diskette which is in drive A. Sometimes you may receive this message:

Not ready reading drive A

Abort, Retry, Fail?

Why do these messages appear on the screen? Spend some moments in

thinking and write below:

---

---

---



These messages have different meanings, for example you might not have properly inserted a disk in drive or you might not have closed properly the drive door. Insert again the disk in drive A properly and then type at the command prompt r for retry and enter it:

C:\> r ↵

If the above message again appears on the screen then type F for fail and enter it, as below:

C:\> F ↵



When you are in drive A then how will you change to drive C? Write below:

---

---



When you type a drive letter followed by a colon (:), you change to that drive. To move from A to C drive you type the letter C in the command prompt A i.e., A:\>C:↵ then C:\> will appear on the screen. Therefore the drive letter that appears in the command prompt shows which drive is the current drive. Any command you type is carried out on the current drive and the current directory. Similarly you can change to drive B by following the commands stated earlier.



Suppose you are in directory PROJECTS in drive C, the command prompt looks like C:\ PROJECTS> and you want to change

to drive B then how you will proceed? Write below:

---

---

---

Yes-you will type b: and enter the key then you will be in drive B.

### Self-Assessment Questions-2:

1. State whether the following statements are True or False.
  - (i) File is a collection of related records.
  - (ii) "C>" on the screen means that the current drive is A.
  - (iii) Loading the operating system is called booting.
  - (iv) The DOS command to list files is DIR.
  - (v) If you want to change drive A to drive B then you use the command cd.
2. Write the answers of the following questions in the space given.
  - (i) Write down the DOS command to list files.  

---

---
  - (ii) Write down the DOS command to move from one directory to another directory.  

---

---
  - (iii) What is the DOS command for creating a directory?  

---

---
  - (iv) What is the DOS command for clearing the screen?  

---

---

## 5. LANGUAGES AND PROGRAMMING

? While working on computer, why cannot we use our ordinary language? Write below:

---

---

☞ The answer is very simple as you already have read that computer can only understand in binary codes. Therefore for communicating with computer, we use very special languages known as **programming languages**.

These languages are described under two categories listed below:

- (i) Low level Languages
- (ii) High Level Languages.

The description of these two categories is given below:

### (i) *Low Level Languages*

Low Level Languages are those languages which computer can understand easily but difficult for humans. These languages are written in binary coding scheme (0 and 1) and are also known as **machine languages**.

As these languages are difficult to learn for humans so a need was felt to introduce such a language which should be very near to human languages (e.g., English). This category of languages are known as high level languages.

### (ii) *High Level Languages*

Machine languages usually written in this pattern:

001000110001000001110001001

Can you understand it easily? Definitely it is very difficult for you to understand. Also it is

a fact that humans do not always like to deal only with numbers, we mostly use letters and words to convey messages. Therefore the high level languages are introduced. These languages are very near to the languages which we speak. The vocabulary of words used in high level languages are very limited and special.

? Of Course you can ask that if the computer can understand only the binary codes then how can the computer accept the high level languages?

☞ The computer is unable to understand the letters and words unless they have been first converted into binary codes. So we need a tool which can convert the words into binary codes. You can understand it in another way, suppose you got a piece of document written in German language. But you do not know German language. To solve your problem you may ask a person who knows both German and Urdu languages for translating the document into Urdu language. That person is known as Translator. Similar is the case with computers. To translate the high level languages into machine languages the computer uses a translator. This translator is technically known as a **compiler**.

☞ You must be knowing by now that programming in computers is done by using programming languages. The software packages are also produced by using these languages. There are over 200 programming languages. In this unit we are just introducing to you the applications of some commonly used programming languages. See Table 8.1.



**Table 8.1. Applications of Some Important Programming Languages**

Languages	Applications
1. FORTRAN stands for Formula Translator, year of invention 1954.	Scientific specially in mathematics
2. COBOL stands for Common Business-Oriented Language (1959)	Business e.g., preparing the pay checks of an organization.
3. BASIC stands for Beginners All purpose Symbolic Instruction Code (1965)	Education, Business.
4. Pascal named after French Mathematician Blaise Pascal (1971)	Education, system programming and scientific.
5. C (1972)	General Use

## 6. HOW TO BOOT YOUR COMPUTER

In this Unit, you have read about booting up of a computer. Let us review it with the help of some photographs. The process is given step by step so do not miss any of the step and follow the instructions carefully.

**Step-I:** For a dual floppy-disk system, insert a disk containing the DOS-files for your computer system in drive A and lock the drive door.



Fig. 8.7 - Picture showing how to insert a disk in drives

**Step-II:** Turn on the printers power.



Fig. 8.8 - Printer Power



*Step-III:* Turn on the monitors power, if it is separate from the computer.



Fig. 8.9 - Monitor Power.

*Step-IV:* Turn on the computers power.



Fig. 8.10 - Computer Power.

*Step-V:* Wait for a while. If computer asks for a date, type the current date in the month-day-year format (MM-DD-YY) and press enter.

```
date
Current date is Mon 12-04-1995
Enter new date (mm-dd-yy):

C:\>date
Current date is Mon 12-04-1995
Enter new date (mm-dd-yy):
```

Fig. 8.11 - Computer screen showing date

*Step-VI:* If computer asks for the time, type the current time in the hour: minute format (HH:MM) and press the enter key.

```
Current time is 1:28:53.04p
Enter new time:

C:\>time
Current time is 1:29:08.86p
Enter new time: 12:50:30
```

Fig. 8.12 - Computer screen showing time.

*Step-VII:* Look at the last line on your computer screen. It displays the command prompt A:\>. It shows that DOS has been loaded in the memory.

*Step-VIII:* If you want to see the file list, give the directory command A:\> dir

```
dir/p

Volume in drive C is MS-DOS_6
Volume Serial Number is 0021-BF5D
Directory of C:\

DOS             <DIR>          01-01-80    5:51p
WINDOWS         <DIR>          01-01-80    6:01p
WP60            <DIR>          01-01-80    6:06p
PSFONTS         <DIR>          01-01-80    6:07p
BTFONTS         <DIR>          01-01-80    6:07p
WPC60DOS        <DIR>          01-01-80    6:08p
I23R3           <DIR>          01-01-80    6:09p
TOOLKIT         <DIR>          01-01-80    6:09p
SCAN           <DIR>          01-01-80    6:09p
NUJ            <DIR>          01-01-80    6:01p
MOUSE          <DIR>          07-26-95    5:43p
CW             <DIR>          07-26-95    5:15p
BIS            <DIR>          07-26-95    5:30p
BIKE           <DIR>          07-26-95    5:33p
DAVE           <DIR>          07-26-95    5:33p
CDMAN          <DIR>          07-26-95    5:33p
WPDOS          <DIR>          07-26-95    5:40p
COMMAND.COM    54,645 05-31-94    6:22a
WINAZO        386      9,349 05-31-94    6:22a
```

Fig. 8.13 - Computer screen showing list of files.

*Step-IX:* Suppose you want to see the files in the directory DISHES. First you will move to the directory DISHES by typing at the command prompt

A:\>cd DISHES ↵

Your screen now shows

A:\ DISHES >

Now type the command dir and the screen will show the files in DISHES.



You might have noted, whenever we give commands in DOS to computer, we give a space of one letter between two different words or letters while typing the command. Whenever you sit on computer always remember this point.

## 7. ANSWERS TO SELF-ASSESSMENT QUESTIONS

### Self-Assessment Questions -1

1. True statements: ii, iii, v  
False statements: i, iv
2. 01000111

### Self-Assessment Questions - 2

1. True statements: i, iii, iv  
False statements: ii, v.
2. Read carefully the section 4.



## **Unit - 9**

# **APPLICATIONS OF COMPUTERS**

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*Reviewed by:*  
**Shahid Afzal**



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# INTRODUCTION

A computer is such a machine which can work around the clock without getting tired. Computer can be vigilant all the time. Computer can response immediately. If kept under favourable conditions, a computer will be a very fast, very accurate and time saving machine. Because of these and some other characteristics of computer, it is becoming more and more popular in almost every field of life. There is hardly any corner which has not been interrupted by the usefulness of the computer.

In this unit we have just introduced some of the important applications of computer. We have also briefly explained the fast growing application of computer i.e. artificial intelligence.

## OBJECTIVES

After reading this unit, you will be able to:

- state the application of computers in different walks of life.
- give your suggestions to introduce computers to teach handicapped children.
- examine the use of computer packages for educational purposes.
- explain the purpose and use of artificial intelligence.





In the previous two units, you have learnt what is a computer? What are the parts of a computer? How it works? Due to the speed and accuracy of the computer, it is now becoming more and more popular. Almost in every field of life, the computer is ready to help. From simple situation to very complicated and risky situations, the computers are serving human beings. We will choose only a few important areas where computers are in use because it is very difficult to cover all walks of life.

Computers of all types are widely used in education. In primary and secondary schools Microcomputers are used. Students can learn different subjects and can do their homework on the computers. A computer acts as a teacher and guide for the students. The students can get answers of their problems. By using computers at school, students can learn about the latest techniques and development in their respective fields.



**Fig. 9.1 - Students in computer centre.**

Different science subjects are being taught using computer animation which has increased its interest in the respective

concerns keeping oneself abreast of the ever-increasing human knowledge. The computer data bank is becoming a very important part of today's education. Of major significance has been computer's use in the designing and implementing of academic curricula. Computers are also becoming an integral part of such scientific courses as engineering and advance courses in the field of Chemistry, Biology, Physics, Mathematics, etc. What is more, since much of certain type of work can be done by the computer more accurately than by the students themselves, many of the courses have been redesigned to leave for students only those tasks which add to their knowledge rather than repetitions. For instance the students would do well to concentrate on the nature and qualities of mathematical operations and arithmetical facts instead of becoming expert in the addition, subtraction, division and other simple mathematical operations. The students will be more creative and bring about innovative ideas rather than cramming conventional ideas.

The explosion in the use of personal computers has made it possible for many many more schools to install their own computers. The Government of Pakistan is encouraging the educational institutions to install more and more computers for students in their institutions. Some big organisations have established computer centres to popularize computer education or awareness about computers.

**Name some of such organizations.**

- |     |
|-----|
| (1) |
| (2) |
| (3) |

The computers that are in the schools today are not just being used as teaching tools. In addition to learning from computers, many children are learning about them and how to use them. It is predicted that within a very few years basic computer skills will be one of those things that everybody learns in elementary school. Programmes that can be used in teaching various subjects are very rapidly becoming popular.

These programmes will be improved and be more widely used as students and teachers become more familiar with computers.

? Can computers help the handicapped students? If yes, then how?



Yes, they can, in a variety of ways. Computer operation rarely requires much more physical activities than sitting at a keyboard punching in letters and numbers. There can be computer "home-work" for those handicapped persons for whom physically leaving home is difficult. Computers can be specially fitted up for use by severely handicapped persons. There are, for example, computers that can be operated by blowing into a tube, for people who have lost the use of their hands.

There are talking computers for the blind, and computers that send written messages on telephone lines for the deaf. The computer may be considered as blessing for the handicapped persons.

### Self-Assessment Questions-1:

1. Why computer is becoming popular?
2. What type of computer is useful for secondary school children?
3. Have you ever seen application of computer animation on TV? Explain it.
4. How can a computer improve the creative attitude of a student?
5. Think for a while and give your own opinion to teach handicapped children through computers.

## 2. COMPUTER IN BUSINESS

Business applications such as payroll and stock control were among the earliest to be computerized. Although increasing use in being made of computers in manufacturing industry, science and medicine, business applications still constitute the greatest usage. A number of categories of computer applications can be identified in accounting system as follows:

### 2.1 Payroll

Payroll systems are concerned with the production of payslips for employees and the maintenance of records required for taxation and other deductions. In a manual system, the preparation of payroll figures and the maintenance of payroll records is a labour intensive task. Although tedious and repetitive, but still very important. Most of the workers naturally regard pay as being the main reason for work. To get computerized payroll or payslips are useful especially with organizations which employ large numbers of

people. The automatic production of reports for taxation purposes also provide a valuable benefit. Smaller organizations with only several employees probably do not regard payroll as a high priority application for computerization, because the benefits are not as great if the payroll can be processed by one or two employees who also carry out a number of other tasks.

## 2.2 Inventory Control

What do you mean by inventory control?



Any organization which keeps stocks of raw material or finished goods and demand of raw material is said to have inventory control system. For small business it can be done manually. But if an organization has many items, then the company must keep sufficient quantities of items to satisfy customer demand or manufacturing requirements. To maintain this balance, an inventory control system should provide up-to-date information on quantities, prices, minimum stock levels, re-order quantities, as well as warning of excessively high, or dangerously low levels of stock. In the latter case, orders may be produced automatically i.e. the computer will issue a warning message that the balance of such items is below danger mark. The incharge of store will take necessary actions to purchase such items. An inventory control system can also generate valuable management reports on sales patterns, slow-moving items and overdue orders.

## 2.3 Sales and Purchase

You can also see the application of computers in the form of sales accounting and purchase accounting systems to keep the manager update regarding payments. You can see in some big organizations the general ledger keeps control of financial summaries, including those originating from payroll, sales and purchase accounting and acts as a balance in a double entry system. Reports are generally produced at the end of financial period, including a trading and profit and loss account and balance sheet. Now packaged software are available to computerize all such activities.

## 2.4 Electronic Office Systems

Now computers are becoming popular day by day. The Electronic Office is a concept which views the office as an integrated whole, with many automated procedures and much of the communication by electronic and much of the communication by electronic means. The main components of the Electronic Office are as follows:

- (i) *Word processing:* Computers are replacing manual typewriters.
- (ii) *Electronic messaging and electronic mail:* Messages are being sent by computers from one computer to another within one organization, between two cities and between different countries.
- (iii) *Electronic projectors:* Computers can be used for presenting lectures. Beautiful coloured transparencies can be obtained from computers.
- (iv) *Telecommuting:* It has the potential to improve working habits. It

requires the use of a terminal or microcomputer work station linked to a company's computer at another location. For workers and executive staff, this removes the need for regular attendance at the traditional office. Such a system has the provision of employee's supervision and security of records.

## Assessment Questions-2:

Explain how accounting system can be improved by using computer.

What do you know about Electronic Office System?

How can we improve efficiency by office automation?

## COMPUTER IN SCIENCE AND TECHNOLOGY

The idea of computer was conceived to meet the need of science and technology. Computers are becoming an integrated part of research in science and technology. Highly complicated scientific problems are solved using frame computers. For working also main frame or mini computer is used at the central place. You can send message locally or globally through different networks as follows:

LAN (Local Area Network)

WAN (Wide Area Network)

LAN is defined as a system (network) for transmitting data from one point to two or more points at the same time, within a relatively small area.

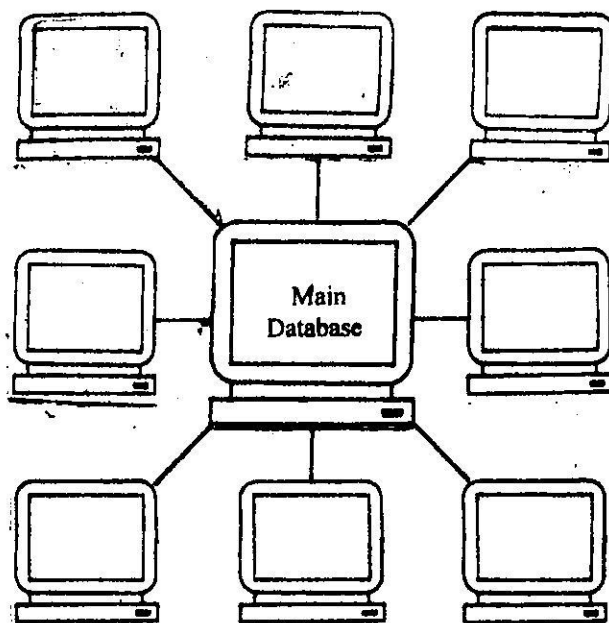


Fig. 9.2 - Local area network

If you want to computerize an organization independently within one building, then you can use LAN model.

### (ii) WAN:

It can be defined as a computer network covering a wide area. It means that communication between computers is not only within a short area but you can extend it between city to city and also between different countries. This system is very useful for airlines and railways, all kinds of informations. All informations for newspapers and military operations are obtained through this WAN.

(b) To predict weather conditions accurately requires vast amount of data regarding past conditions. Super computers allow such volumes of data to be stored, recurred, updated and analysed on a national

and sometimes international basis. Computer graphics and computer enhanced satellite pictures are also used to provide interesting and informative weather forecasts for television viewers.



Fig. 9.3 - A computer enhanced picture of hurricane alicia.

#### 4. COMPUTER - AIDED INSTRUMENT

Computer-aided instrumentation is now a firmly established, and in some cases essential part of many scientific disciplines. Techniques for data collection and analysis used in experimental situations have progressed dramatically over the past many years and now analogue-to-digital conversion rate, precision and accuracy no longer form major system limitations.

For example a mass spectrometer in its commercial form is a machine for rapid chemical analysis. Mass spectrometers can provide information on the composition, and

often structure of chemical compounds as well as the amount of particular compounds present in a mixture. In these respects the instrument is one of the most powerful and versatile tools available to the chemist. These days in many hospitals such type of instruments are used for blood analysis, urine analysis and stool analysis.

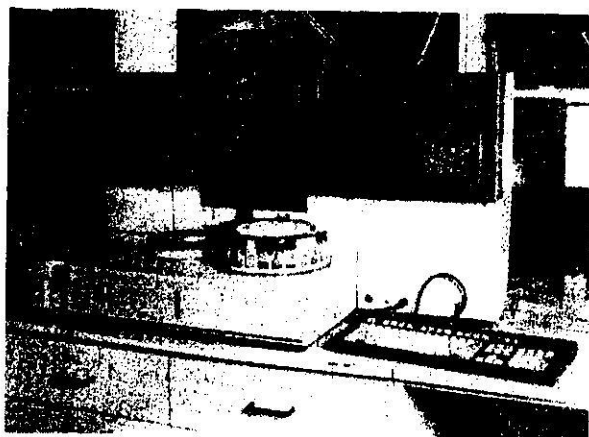


Fig. 9.4

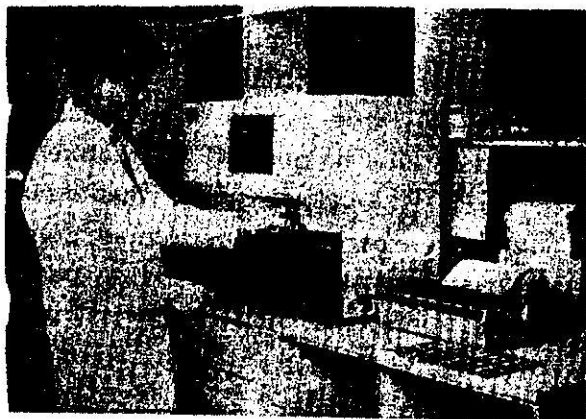


Fig. 9.5

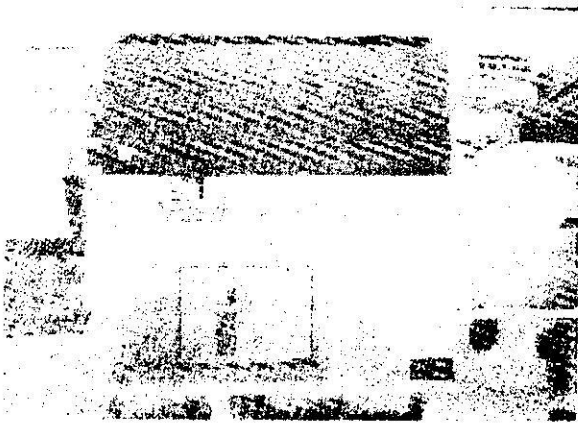


Fig. 9.6

You can also see computer applications in intensive therapy units. It is particularly important that such systems should be suitable for use by the nurses and doctors concerned with the clinical management of patients. The nurses are good at recording the types of fluid administered and they also measure the urinary output and other types of fluid loss but sometimes due to a small negligence a true picture of the case of the patient can not be possible so treatment may be wrong. The calculations of fluid input and output are not always performed correctly, however, and the automated system has gained immediate acceptance as well as providing the medical staff with an up-to-date picture of fluid balance at all times.

## 5. COMPUTER IN DESIGNING

These days computer is giving assistance in designing as well. With the use of a graphics terminal and mouse, or similar device, a designer can produce and modify designs more rapidly than is possible with a conventional drawing board. Ideas can be sketched on the screen, stored, recalled and modified.

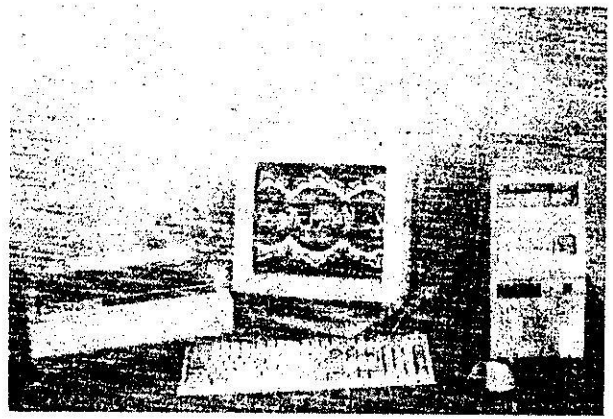


Fig. 9.7

The computer can also be instructed to analyse a design for comparison with some specified criteria. Drawing can be rotated and tilted on the screen to reveal different three-dimensional views. This branch of computer science is termed as CAD i.e. computer-aided design. CAD is used in the design of ships, cars, buildings, microprocessor circuits, clothing and many other products.

## 6. ARTIFICIAL INTELLIGENCE

The greatest creature i.e. human being has made science fiction as scientific fact. Scientists are now looking for methods to make computers solve unstructured problems. These are the types of problems that people solve by trying various approaches and learning from their mistakes. Until recently only a human intelligence could do this but intelligent computer systems are beginning to compete with human beings. Efforts to design computer systems that show the features we associate with human intelligence are classified under the heading of Artificial Intelligence. This idea was first



given in 1956. Since then researchers have used concepts from disciplines such as psychology, linguistics and computer science in an attempt to learn how to prepare programmes or construct systems to do tasks that no machine has ever done automatically before. Artificial intelligence is the development of expert systems and during the last 30 years many researchers have been working on the application of these systems to specific problems.

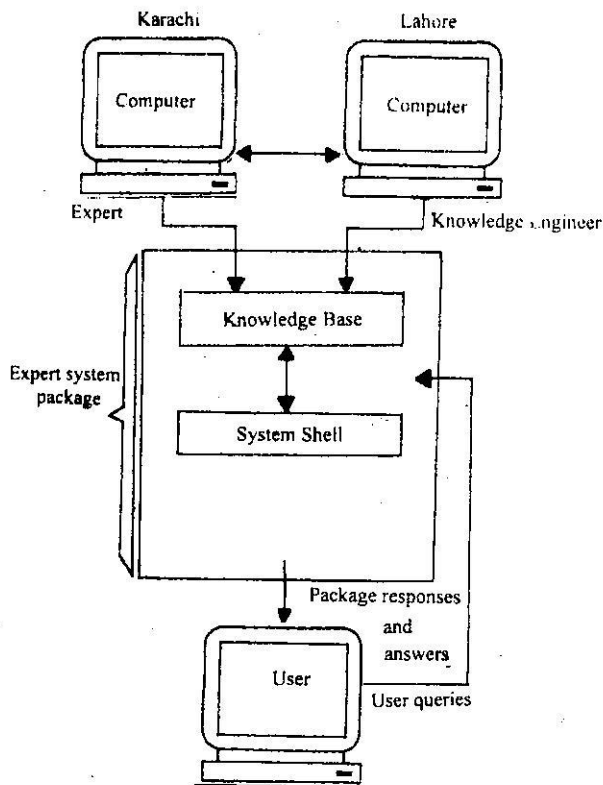


Fig. 9.8 Expert system

of making human like decisions by representing the human expertise in the form of explicit rules. You can play chess with the computer. In traditional expert systems knowledge is represented in the form of fixed IF... THEN..... rules, but researchers are now realizing that the human experts do not always make decisions in such rigid fashion. They also learn from experience by way of analyzing the consequences of previous decisions. Their responses may also be based on what is often described as "Intuitive Understanding". Therefore, recent years have seen a growing interest in development of computer programmes that are capable of learning and commenting their own knowledge from previous experience. With Artificial intelligence advancing so rapidly, it is necessary for us to know about it and its application in different walks of life. Artificial intelligence has its application in space science, agriculture, Chemistry and complicated engineering organizations. In developed countries its application is increasing day by day. Although this technology is expensive but still it is very useful.

Computer usage contributes to personal safety in many ways. For example, computer controlled anti lock breaking system in aircraft and cars help prevent dangerous accidents during turning, landing and taking off and produce optimum stopping distances in all weather conditions. Wheel-speed detect if a wheel is stopping too quickly. A microcomputer then automatically reduces hydraulic brake pressure at the wheel until the danger has passed. Computers can also permit gas utility companies to do a better job of managing and controlling the pipeline leaks that can seriously put public safety in danger.

In general, an expert system is a highly sophisticated computer programme capable



A personal computer can entertain you with hundreds of challenging games. On the personal computer you can compose music, paint pictures, store and maintain scores and coin collection records and polish foreign language skills.

In spite of all these benefits, the society has also potential dangers and problems like employment problems, data gathering problems, the system security issue, the privacy issue, etc. These issues will be discussed in some other course of computer literacy programme.

### **Self-Assessment Questions-3:**

1. Explain LAN and WAN
2. Explain briefly how computers help in weather forecasting.
3. Give an example of a modern hospital where different medical tests are undergoing with the help of a computer aided machine. Give your comments.
4. How CAD be preferred over manual drawings?
5. Explain briefly expert system and artificial intelligence.

## **7. ANSWERS TO SAQ's**

### **Self-Assessment Questions-1:**

1. Computer is becoming popular because

of its application in many fields of life.

2. Personal computer with coloured monitor.
3. Yes.
4. By using self-learning packages of different subjects.

### **Self-Assessment Questions-2:**

1. A large amount of data can be stored, we can compare the data which will give us comprehensive information.
3. We can retrieve files immediately and can update information in the computer without wasting time to look for files.

### **Self-Assessment Questions-3:**

1. LAN means local area network and WAN means wide area network.
2. Computers which are linked with satellites collect data, process the data according to programme and can give us information immediately about weather forecasting.
3. SHIFA International Hospital Islamabad, Sheikh Zaid Hospital, Lahore, Agha Khan Hospital/University, Karachi, are the main examples.
4. CAD is very fast, many possibilities are available and is better to use it than manual drawings.

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