4th SEM BTTM
CALICUT UNIVERSITY

BUSINESS STATISTICS AND IT-II

2019 ADMISSION

Prepared by

Aliga Rose Mony
Rahsina P
Muhammed Nishad. C P
Reeja Varghese
(Department of Tourism)

CPA College of Global of Studies, Puthanathani

Syllabus

TTM4C04: Business Statistics and Information Technology II

Lecture Hours per Week: 5 Credits: 4

Objective:

This course has been devised to give an idea about the use of computer and information technology in the field of tourism and travel industry management. Also, the student should be able to apply various statistical tools in business functions. Pedagogy: A combination of Lecture, Case Analysis, Group Discussion, Seminars, Assignments, Practical's and assigned readings.

Module I Meaning and Definitions of Statistics Scope and Limitations. Statistical enquiries Scope of the problem Methods to be employed types of enquiries Presentation of data by Diagrammatic and Graphical Method Formation of Frequency Distribution. Measures of Central tendency Arithmetic Mean, Median, Mode, Geometric and Harmonic mean, Measures of variation and standard, mean and quartile deviations Skew ness and Kurtosis and Lorenz curve.

Module II Regression and correlation: Simple Correlation Scatter diagram – Karl Pearson's Co efficient of correlation – Rank correlation Regression lines. Analysis of Time Series: Methods of measuring Trend and Seasonal variations Index number Unweighted indices Consumers price and cost of living indices.

Module III MIS and Networking – Management Information System, Types of networks, Different topologies, Concept of DBMS- Database, Characteristics of a Database system, Components of DBMS, Database Users, Database Languages, Database Models.

Module IV IT Systems used in Airlines: Introduction and functions of GDSs-Airline reservation systems, inflight systems, crew scheduling systems, airline scheduling systems, point of sale systems Airport Systems, check in systems, gate scheduling systems, baggage handling and cargo systems-travel distribution systems, online travel agency, other online intermediaries in travel distribution-Disintermediation and reinter mediation : Definition and Concept.

Module V ICT in Destination and Hospitality Management: Introduction-Property Management System Functions and Modules-Guest room systems-F and B Systems- CRSs-Sales and Marketing Systems-Accounting Systems-Guest Information and Entertainment Systems-Destination 64 Management System: Application, uses and functions-Destination Marketing Information Systems-GIS in Destination Management. (Note: About quarter of the hours may be used for practical sessions to demonstrate the use of MS Office applications such as Word, Excel and PowerPoint). Activity: Develop an Amortization Table for Loan Amount – EMI Calculation. Prepare an Overhead Machine / Labour hour rate through matrices. Prepare a Bank Statement using Simple interest and Compound interest. Prepare a Case study. Recommended Practical Study A one /two-week GDS training to the students.

Reference Books:

1. Dileep M.R., 2011, Information Systems in Tourism, Excel Books, New Delhi. ISBN 978-81744-69090

2. Demetrius Buhalis, 2003. eTourism, Prentice Hall: Essex:UK

3.. Sundaresan and Jayaseelan An Introduction to Business Mathematics and Statistical Methods

4. Levine. M. David, Timothy C Krehbiel, Berensen. L. Mark and Viswanathan. P. K, (2011), Business Statistics, A First Course. Pearson Publication, (fifth

5. V. Rajaraman, Introduction to Information Technology, Prentice Hall.

6 Poon A. (1998), Tourism, Technology and Competitive Strategies, CABI.

7 Rayport J.F. & Jaworski B.J. (2002), Introduction to Ecommerce, McGraw-Hill.

8. Management information Systems, (2003). Kenneth C. Laudon and Jane P. Laudon, Pearson Education, New Delhi.

9. Using Microsoft Office, Ed Bott and Woody Leonhard, Prentice Hall of India, New Delhi 1999.

10. Fundamental of Database Systems, Elmasri and Navathe, Addison Wesley, New Delhi.

Module 1

BUSINESS STATISTICS AND INFORMATION TECHNOLOGY II

DEFINITIONS OF STATISTICS

The word statistics is derived from the Latin word 'Status' or Italian word 'Statista' or German word 'Statistik' which means a Political State. It is termed as political state, since in early years, statics indicates a collection of facts about the people in the state for administration or political purpose.

Statistics has been defined either as a singular non or as a plural noun.
Definition of Statistics as Plural noun or as numerical facts:- According to Horace Secrist, 'Statistics are aggregates of facts affected to a marked extent by multiplicity of causes numerically expressed, enumerated or estimated according to a reasonable standard of accuracy, collected in a systematic manner for a predetermined purpose and placed in relation to each other'.

Characteristics of Statistics

(1) Statistics show be aggregates of facts
(2) They should be affected to a marked extent by multiplicity of causes.
(3) They must be numerically expressed.
(4) They should be enumerated or estimated according to a reasonable standard of accuracy.
(5) They should be collected in a systematic manner.
(6) They should be collected for a predetermined purpose.
(7) They should be placed in relation to each other.

Function of Statistics

The following are the important functions of statistics:
1. It simplifies complexity:- Statistical methods make facts and figures easily understandable form. For this purpose Graphs and Diagrams, classification, averages etc are used.
2. It presents facts in a proper form:- Statistics presents facts in a precise and definite form.
3. It facilitates for comparison:- When date are presented in a simplified form, it is easy to compare date.
4. It facilitates for formulating policies:- Statistics helps for formulating policies for the companies, individuals, Govt. etc. it is possible only with the help of date presented in a suitable form.
4. It tests hypothesis:- Hypothesis is an important concept in research studies. Statistics provides various methods for testing the hypothesis. The important tests are Chi – square, Z-test, T-test and F-test.
5. It helps prediction or forecasting:- Statistical methods provide helpful means of forecasting future events.
6. It enlarges individual's knowledge:-When data are presented in a form of comparison, the individuals try to find out the reasons for the variations of two or more figures. It thereby helps to enlarge the individual's knowledge.
7. It measures the trend behavior:- Statistics helps for predicting the future with the help of

present and past data. Hence plans, programs, and policies are formulated in advance with the help of statistical techniques.

Scope of Statistics or importance or utility of statistics.

The Scope of Statistics in various field are:
(1) Statistics in Business:- Statistics is most commonly used in business. It helps to take decision making of the business. The statistical data regarding the demand and supply of product can be collected and analyzed to take decisions. The company can also calculate the cost of production and then the selling price. The existing firms can also make a comparative study about their performance with the performance of others through statistical analysis.
(2) Statistics in Management:- Most of the managerial decisions are taken with the help of statistics. The important managerial activities like planning, directing and controlling are properly executed with the help of statistical data and statistical analysis. Statistical techniques can also be used for the payment of wages to the employees of the organization.
(3) Statistics in economics:- Statistical data and methods of statistical analysis render valuable assistance in the proper understanding of the economic problems and the formulation of economic policy.
(4) Statistics in banking and finance:- Banking and financial activities use statistics most commonly.
(5) Statistics in Administration:- The govt. frames polices on the basis of statistical information.
(6) Statistics in research:ı Research work are undertaken with the help of statistics.

Limitation of statistics
(1) Statistics studies only numerical data
(2) Statistics does not study individual cases
(3) Statistics does not reveal the entire story of the problem.
(4) Statistics in only one of the methods of study a problem.
(5) Statistics can be misused. Statistical result are true only an average

Statistical Enquires or Investigation
Statistical Investigation is concerned with investigation of some problem with the help of statistical methods. It implies search for knowledge about some problems through statistical device.
Different stages in statistical enquiry are:
(1) Planning the enquiry
(2) Collection of data.
(3) Organization of data.
(4) Presentation of data.
(5) Analysis of data.
(6) Interpretation of data.

Graphs and Diagrams
Graphs and diagrams is one of the statistical methods which simplifies the complexity of quantitative data and make them easily understandable.
Importance of Diagrams & Graphs
1. Attract common people
2. Presenting quantitative facts in simple.
3. They have a great memorizing effect.
4. They facilitate comparison of data.

5. Save time in understanding data.
6. Facts can be a understood without mathematical calculations.

General rules for constructing Diagrams

1. TItle
2. Proportion between width and height.
3. Selection of scale
4. Foot note
5. Index
6. Neatness and cleanliness
7. Simplicity
8. Attractiveness

Types of Diagrams

1. Dimensional Diagrams
2. Cartograms
3. Pictograms

Dimensional Diagrams

Dimensional Diagrams are those diagrams which show information in terms of length, height, area or volume. They are one dimensional two dimensional or three dimensional.

One Dimensional Diagram

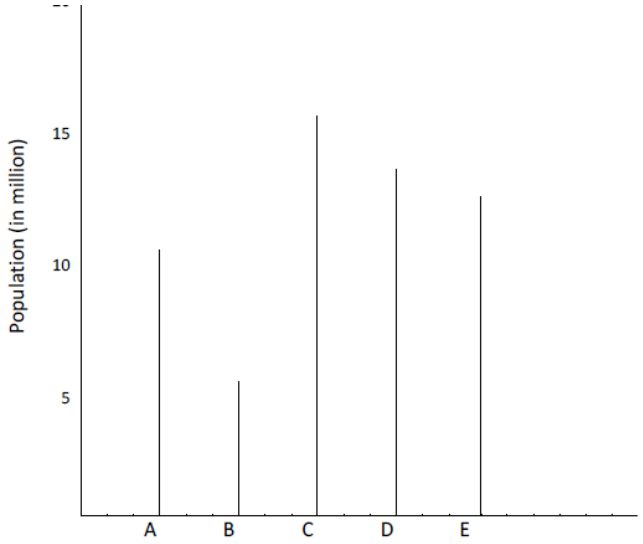
In one dimensional diagram the height will represent the magnitude of observations. Must commonly used one dimensional diagrams are line diagram and Bar diagram.

Line Diagram

Line diagrams are one dimensional diagrams. They are drawn to represent values of a variable.

Ex. Draw a line diagram to the following data.

Country:	A	B	C	D	E
Population: (in million)	10	5	15	13	12



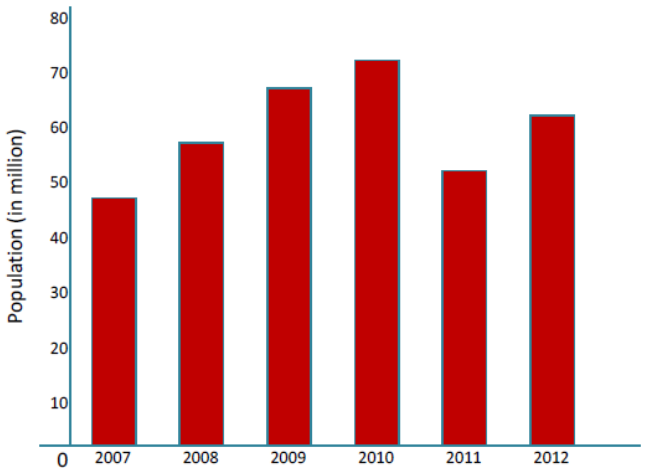
Bar Diagram

In a bar diagram only the length is considered. The width of the bar is not given any importance. Following are the important types of bar diagrams

(1) Simple bar diagram

Simple bar diagram represents only one variable. For example, height, weight, etc.

Year	2007	2008	2009	2010	2011	2012
Sales (In '0000'	45	55	65	70	50	60

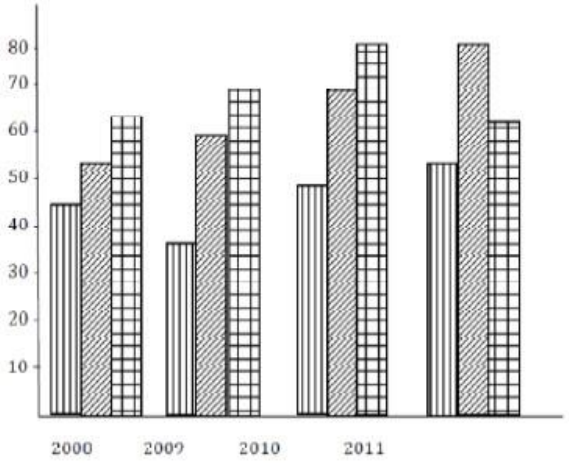


2) Multiple Bar Diagram

Two or more interrelated data are represented in a multiple bar diagram. In order to identity the data, the bars should be differentiated with colors or shades.

Eg:- From the following data draw a suitable diagram.

Year	Production (in units)		
	A	B	C
2008	45	55	65
2009	35	60	70
2010	50	70	80
2011	55	80	60

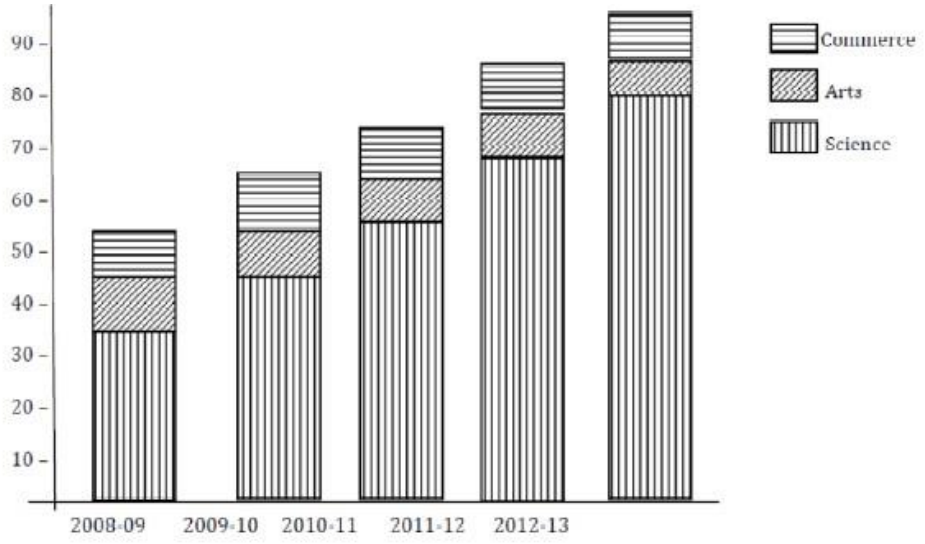


3) Sub Divided Bar Diagram

In the sub divided bar diagram each bar is subdivided into two or more parts. Each part may explain different characters.

Eg:- The number of students in Calicut University are as follows: Represent the date by suitable diagram

Year	Commerce	Arts	Science	Total
2008-09	35000	10000	9000	54000
2009-10	45000	9000	90000	64000
2010-11	55000	7000	8000	69000
2011-12	70000	5000	7000	82000
2012-13	80000	4000	6000	90000



4) Percentage Bar Diagrams

In percentage bar diagram the length of all the base are equal ie each bar represent 100 percent. The component parts are expressed as percentage to the whole.

Eg:- Prepare a subdivided bar diagram on the percentage basis.

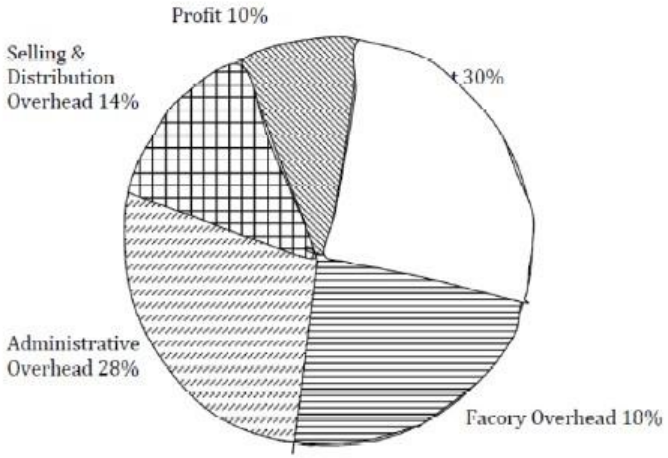
Year	Direct Cost Rs	Indirect Cost Rs	Profit Rs	Sales Rs
2009	35	15	10	60
2010	40	20	12	72
2011	32	22	8	62
2012	25	35	15	75

Answer

Year	Direct Cost in %	Indirect Cost in %	Profit in %	Sales
2009	58	25	17	100
2010	55	28	17	100
2011	52	35	13	100
2012	33	47	20	100

Ans:

Prime Cost	30	108°
Factory over Head	18	65°
Administrative overhead	28	101°
Selling & Distribution overhead	14	50°
Profit	10	36°
	100	360



Three Dimensional Diagrams

Three dimensional diagrams are prepared in the form of cubes, spheres, cylinders etc. In these diagrams width, length and breadth are important.

Cartograms

Cartograms means the presentation of data in a geographical basis. It is otherwise called as statistical maps. The quantities on the map may be shown through shades, dots or colours etc.

Pictograms

Under the pictograms, data are represented in the form of a appropriate pictures most suited for the data.

GRAPHS

Types of Graphs

(1) Graphs of Frequency Distribution

(2) Graphs of Time Series

Graphs of Frequency Distribution

A frequency distribution can be presented graphically in any of the following ways:

(1) Histogram

(2) Frequency Polygon

(3) Frequency Curves

(4) Ogive or cumulative frequency curves.

Histogram

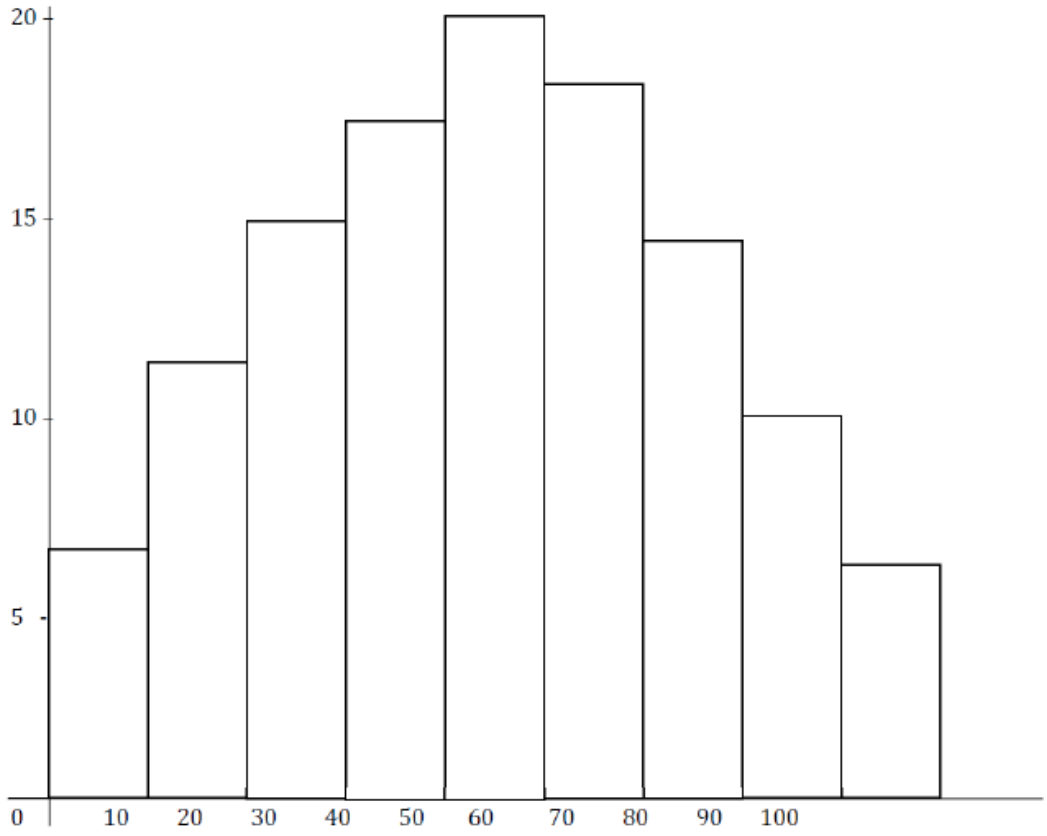
A histogram is a graph of frequency distributions. A histogram consists of bars erected upon the class interval columns.

While constructing histogram, the variable is always taken on the x-axis and the frequency on the y-axis. The width of the bars in the histogram will be proportional to the class interval.

Histogram for frequency Distribution having equal Class interval

1) Draw a histogram from the following information

Marks	No. of Students
0-10	7
10-20	12
20-30	15
30-40	17
40-50	20
60-70	14
70-80	10
80-90	4



Histogram for unequal Class Interval

Unequal class intervals must be corrected.

$$\text{Unequal class intervals} = \frac{\text{Frequency unequal class intervals}}{\text{width of the unequal class intervals}} \times \text{width of the lowest class interval}$$

Draw a histogram from the following data

Daily wages	No. of workers
15-20	4
20-25	9
25-30	12
30-40	20
40-50	16
50-55	7
55-60	6
60-75	15
75-80	4
80-95	9
95-100	2

Frequency Polygon

It is a curve instead of bars. There are two methods for constructing frequency polygon. First, histogram should be drawn and mark mid point of upper side of each bar and join such joints by a curve.

In the second method, first of all plot the frequencies corresponding to midpoints of various class intervals. Then join all the plotted points to get the frequency polygon curve.

3) Ogive or Cumulative Frequency Curve

A frequency distribution when cumulated, we get cumulative frequency distribution and curve drawn is known as ogive. An ogive can either less than ogive or more than ogive. Less than ogive curve is drawn on the basis of less than cumulative frequency distribution and more than ogive is drawn on the basis of more than cumulative frequency distribution.

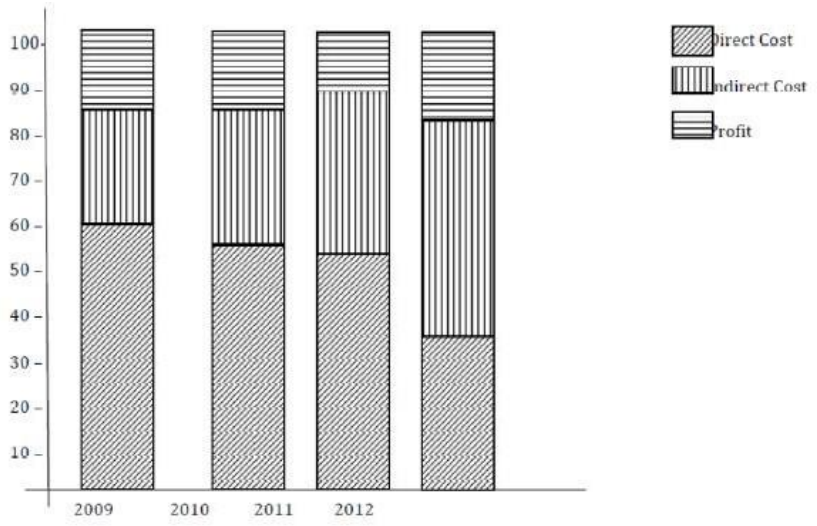
Example :-

From the following data drawn less than and more than ogives

Marks :	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80
No. of Students	10	20	35	30	20	15	10	10

Answer :

Less than CF	F	More than CF	F
Less than 0	0	More than 0	150
Less than 10	10	More than 10	140
Less than 20	30	More than 20	120
Less than 30	65	More than 30	95
Less than 40	95	More than 40	55
Less than 50	125	More than 50	35
Less than 60	130	More than 60	20
Less than 70	140	More than 70	10
Less than 80	150	More than 80	0



Two Dimensional Diagram

In two dimensional diagram the length as well as width have to be considered. The most commonly used two dimensional diagrams is pie diagram, Rectangles, Squares, Circles etc are also two dimensional diagrams.

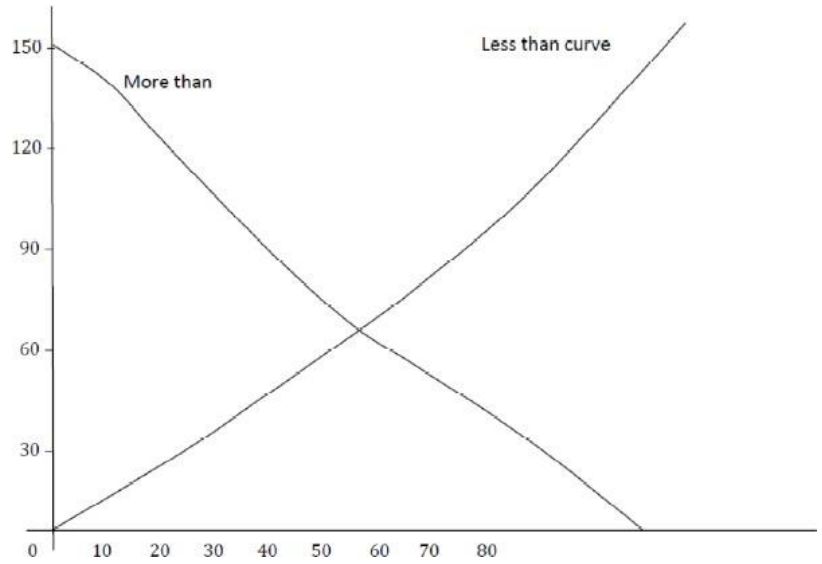
Pie Diagrams

Pie diagrams are used when the aggregate and their divisions are to be shown together. The aggregate is shown by means of a circle and divisions by the sectors of the circle. For example, the selling price of a product can be divided into various segments like factory cost, administrative cost, selling cost and profit. These segments are converted into percentage in order to represent in the pie diagram.

In order to prepare the pie diagram, each percentage outlay must be multiplied by 3.6, since the pie diagram contain 360° scale.

Eg:- Draw a pie diagram from the following data

Prime Cost	30%
Factory over Head	18%
Administrative overhead	28%
Selling & Distribution overhead	14%
Profit	10%



Limitations

1. They can present only approximate values.
2. They can represent only limited amount of information.
3. They can be misused very easily.
4. They are not capable of further mathematical treatment.
5. They are generally useful for comparison purpose only

Various Statistical Techniques

A brief comment on certain standard techniques of statistics which can be helpful to a decision- maker in solving problems is given below.

i) **Measures of Central Tendency**: Obviously for proper understanding of quantitative data, they should be classified and converted into a frequency distribution (number of times or frequency with which a particular data occurs in the given mass of data.). This type of condensation of data reduces their bulk and gives a clear picture of their structure. If you want to know any specific characteristics of the given data or if frequency distribution of one set of data is to be compared with another, then it is necessary that the frequency distribution help us to make useful inferences about the data and also provide yardstick for comparing different sets of data. Measures of average or central tendency provide one such yardstick. Different methods of measuring central tendency, provide us with different kinds of averages. The main three types of averages commonly used are:

a) **Mean**: the mean is the common arithmetic average. It is computed by dividing the sum of the values of the observations by the number of items observed.

b)**Median**: the median is that item which lies exactly half-way between the lowest and highest value when the data is arranged in an ascending or descending order. It is not affected by the value of the observation but by the number of observations. Suppose you

have the data on monthly income of households in a particular area. The median value would give you that monthly income which divides the number of households into two equal parts. Fifty per cent of all the households have a monthly income above the median value and fifty per cent of households have a monthly income below the median income.
c) **Mode**: the mode is the central value (or item) that occurs most frequently. When the data organised as a frequency distribution the mode is that category which has the maximum number of observations. For example, a shopkeeper ordering fresh stock of shoes for the season would make use of the mode to determine the size which is most frequently sold. The advantages of mode are that (a) it is easy to compute, (b) is not affected by extreme values in the frequency distribution, and (c) is representative if the observations are clustered at one particular value or class.

ii) **Measures of Dispersion:** the measures of central tendency measure the most typical value around which most values in the distribution tend to coverage. However, there are always extreme values in each distribution. These extreme values indicate the spread or the dispersion of the distribution. The measures of this spread are called 'measures of dispersion' or 'variation' or 'spread'. Measures of dispersion would tell you the number of values which are substantially different from the mean, median or mode. The commonly used measures of dispersion are range, mean deviation and standard deviation. The data may spread around the central tendency in a symmetrical or an asymmetrical pattern. The measures of the direction and degree of symmetry are called measures of the skewness. Another characteristic of the frequency distribution is the shape of the peak, when it is plotted on a graph paper. The measures of the peakedness are called measures of Kurtosis.
iii) **Correlation:** Correlation coefficient measures the degree to which the charge in one variable (the dependent variable) is associated with change in the other variable (independent one). For example, as a marketing manager, you would like to know if there is any relation between the amount of money you spend on advertising and the sales you achieve. Here, sales is the dependent variable and advertising budget is the independent variable. Correlation coefficient, in this case, would tell you the extent or relationship between these two variables,' whether the relationship is directly proportional (i.e. increase or decrease in advertising is associated with decrease in sales) or it is an inverse relationship (i.e. increasing advertising is associated with decrease in sales and vice- versa) or there is no relationship between the two variables. However, it is important to note that correlation coefficient does not indicate a casual relationship, Sales is not a direct result of advertising alone, there are many other factors which affect sales. Correlation only indicates that there is some kind of association-whether it is casual or causal can be determined only after further investigation. Your may find a correlation between the height of your salesmen and the sales, but obviously it is of no significance.

iv) **Regression Analysis**: For determining causal relationship between two variables you may use regression analysis. Using this technique you can predict the dependent variables on the basis of the independent variables. In 1970, NCAER (National Council of Applied and Economic Research) predicted the annual stock of scooters using a regression model in which real personal disposable income and relative weighted price index of scooters were used as independent variable. The correlation and regression analysis are suitable techniques to find relationship between two variables only. But in reality you would rarely find a one-to-one causal relationship, rather you would find that the dependent variables are affected by a number of independent variables. For example, sales affected by the advertising budget, the media plan, the content of the advertisements, number of salesmen, price of the product, efficiency of the distribution network and a host of other variables. For determining causal relationship involving two or more variables, multi- variable statistical techniques are applicable. The most important of these are the multiple regression analysis deiscriminant analysis and factor analysis.
v) **Time Series Analysis** : A time series consists of a set of data (arranged in some desired

manner) recorded either at successive points in time or over successive periods of time. The changes in such type of data from time to time are considered as the resultant of the combined impact of a force that is constantly at work. This force has four components: (i) Editing time series data, (ii) secular trend, (iii) periodic changes, cyclical changes and seasonal variations, and (iv) irregular or random variations. With time series analysis, you can isolate and measure the separate effects of these forces on the variables. Examples of these changes can be seen, if you start measuring increase in cost of living, increase of population over a period of time, growth of agricultural food production in India over the last fifteen years, seasonal requirement of items, impact of floods, strikes, wars and so on

vi) **Index Numbers**: Index number is a relative number that is used to represent the net result of change in a group of related variables that has some over a period of time. Index numbers are stated in the form of percentages. For example, if we say that the index of prices is 105, it means that prices have gone up by 5% as compared to a point of reference, called the base year. If the prices of the year 1985 are compared with those of 1975, the year 1985 would be called "given or current year" and the year 1975 would be termed as the "base year". Index numbers are also used in comparing production, sales price, volume employment, etc. changes over period of time, relative to a base

.

vii) **Sampling and Statistical Inference**: In many cases due to shortage of time, cost or nonavailability of data, only limited part or section of the universe (or population) is examined to (i)get information about the universe as clearly and precisely as possible, and (ii) determine the reliability of the estimates. This small part or section selected from the universe is called the sample, and the process of selection such a section (or past) is called sampling.

Schemes of drawing samples from the population can be classified into two broad categories:

1 .Random sampling schemes: In these schemes drawing of elements from the population is random and selection of an element is made in such a way that every element has equal change (probability) of being selected.

2 Non-random sampling schemes: in these schemes, drawing of elements for the population is based on the choice or purpose of selector

Measures of central tendency are also usually called as the averages

. • They give us an idea about the concentration of the values in the central part of the distribution.

• The following are the five measures of central tendency that are in common use: • (i) Arithmetic mean, (ii) Median, (iii) Mode, (iv) Geometric mean, and (v) Harmonic mean (vi) weighted mean

measures of variation and dispersion

1. Dispersion measures the extent to which the items vary from some central value. It may be noted that the measures of dispersion measure only the degree (the amount of variation) but not the direction of variation. The various measures of central value give us one single figure that represents the entire data. But the average alone cannot adequately describe a set of observations, unless all the observations are the same. It is necessary to describe the variability or dispersion of the observations.
2. 3. A good measure of dispersion should possess the following properties } It should be simple to understand. } It should be easy to compute. } It should be rigidly defined. } It should be based on each and every item of the distribution. } It should be amenable to further algebraic treatment. } It should have sampling stability. } Extreme items should not unduly affect it.
3. 4. } Range } Inter-quartile range or Quartile Deviation } Mean deviation or Average Deviation } Standard Deviation } Lorenz curve

MEASURES OF CENTRAL TENDENCY

It is generally located at the center or middle of the distribution.

a) Arithmetic Mean

Mean is the mathematical average. It is a method of representing the whole data by one figure

- In individual series = $\frac{\sum x}{n}$
- In discrete frequency distribution = $\frac{\sum fx}{N}$
- In continuous frequency distribution = $\frac{\sum fx}{N}$

b) Median

It is the value of that item which occupies the central positions when the items are arranged in the ascending or descending order of their magnitude.

- In individual series = $\frac{(n+1)}{2}$
- in discrete frequency distribution = $\frac{(N+1)}{2}$
- in continuous frequency distribution = $L1 + \frac{N/2 - cf}{f} * C$

where **L1** = lower limit of median class, **cf** = cumulative frequency of the class just proceeding the median class, **f** = frequency of median class

c) Mode

It is the value of item of a series which occurs most frequently.

Mode = 3 median – 2 mean

- In individual series = the value which occurs more number of times
- In discrete frequency distribution = the value having highest frequency
- In continuous frequency distribution = $L1 + \frac{(f_1 - f_0)}{2f_1 - f_0 - f_2} * C$

Where, **f1** = frequency of model class, **f0** = frequency of class just proceeding model class,

f2 = frequency of class just succeeding model class

d) Geometric mean

If there are 'n' values in a series, then their geometric mean is defined as the n^{th} root of the product of those n values.

- In individual series = $\frac{\text{Antilog } [\sum \log x]}{n}$
- In frequency distribution = $\frac{\text{Antilog } [\sum f \log x]}{N}$

e) Harmonic mean

It is a set of 'n' values is defined as the reciprocal of the mean of the reciprocals of those values.

- In individual series = $\dfrac{n}{\frac{\Sigma 1}{x}}$
- In frequency distribution = $\dfrac{N}{\Sigma f \frac{1}{x}}$

MEASURES OF DISPERSION

Dispersion refers to the variability in the size of items. It speaks about the spread or scatter of the values in a series. It tells the extent to which the values of a series differ between each other or from their average. It can be classified into;

1) Absolute measures: - expressed in the same units in which the data are collected. It includes,
   a) Range
   b) Quartile deviation
   c) Mean deviation
   d) Standard deviation
2) Relative measures: - it is the ratio of measure of dispersion to an appropriate average from which deviations are measured.it is also called coefficient of dispersion. These are used to comparing two series for their variability. It includes,
   a) Coefficient of range
   b) Coefficient of quartile deviation
   c) Coefficient of mean deviation
   d) Coefficient of variation

a) Range

It is the difference between the highest and the lowest values in a series.

Range = H – L

H= highest value

L = lowest value

Coefficient = $\dfrac{H-L}{H+L}$

b) Quartile deviation = $\dfrac{Q_3 - Q_1}{2}$

Coefficient – $\dfrac{Q_3 - Q_1}{Q_3 + Q_1}$

- In individual series

  Q_1 = size of (n+1) / 4 th item

  Q_3= size of $\frac{(n+1)}{4}$ *3 th item

- In discrete frequency distribution

  Q_1 = (N+1) / 4 th item

  Q_3 = $\frac{(N+1)}{4}$ * 3 th item

- In continuous frequency distribution

  Q_1 = size of N/4 th item

  Q_3 = size N/4 *3 th item

  $$Q_1 = L1 + \frac{N/4 - cf}{f} * c$$

  $$Q_3 = L1 + \frac{3N/4 - cf}{f} * c$$

c) Mean deviation

It is the arithmetic mean of deviations of all the values in a series from their average, counting all such deviations as positive.

Coefficient = mean deviation / mean

- In individual series = $\sum \frac{|d|}{n}$

  |d| = deviation from an average without sign 'n' being number of items.

- In discrete frequency distribution = $\sum \frac{f|d|}{n}$

d) Standard deviation

it is the square root of the mean of the squares of the deviations of all values of a series from their arithmetic mean

coefficient = Standard deviation/ mean *100

- In individual series = $\frac{\sum x2}{n} - [\frac{\sum x}{n}]^2$
- In discrete frequency distribution = $\sqrt{\frac{\sum x2}{N} - [\frac{\sum x}{N}]2}$

MEASURES OF SKEWNESS

Skewness is a measure of symmetry, or more precisely, the lack of symmetry. If a frequency distribution is skewed, there will be more items on one side of the mode than the other side. In a skewed distribution, the mean and the median are pulled away from the mode. For a skewed distribution mean, median and mode are equal.

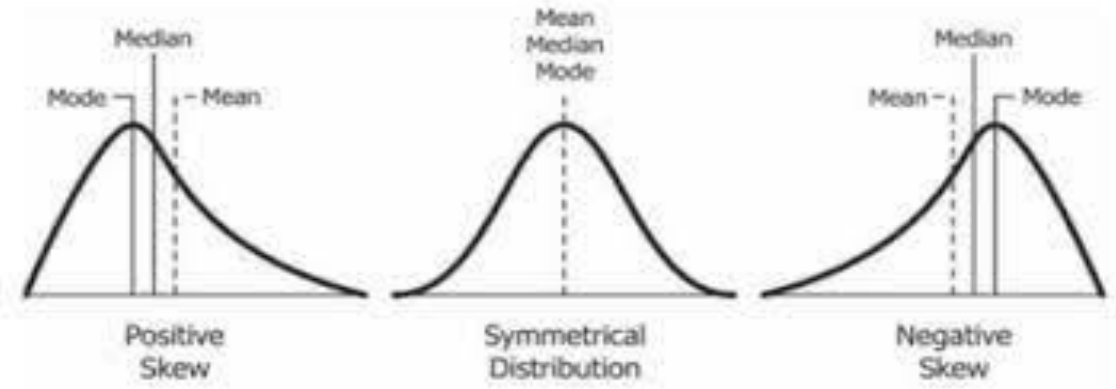
Positive skewness

Where the mean is greater than median and median is greater than mode. In this case the curve is skewed to the right. more than half the areas fall at the right side of the highest ordinate.

Negative skewness

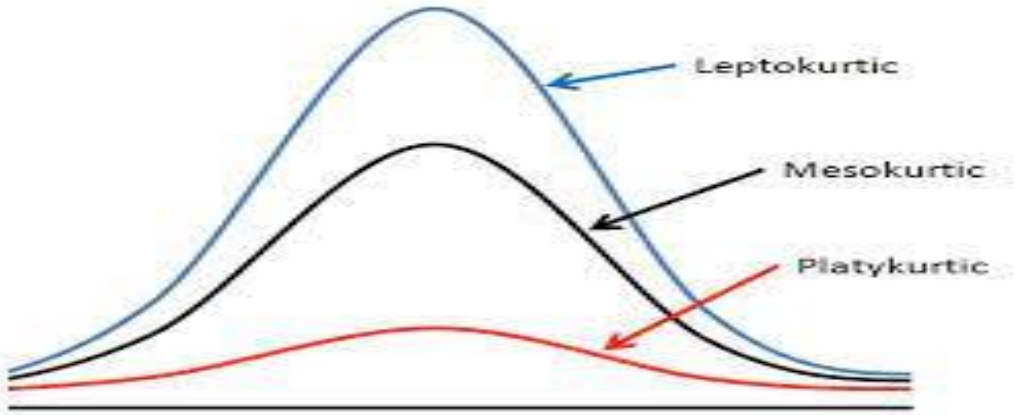
Where mean is less than median and median is less than mode. In this case the curve is skewed to the left. more than half the area fall at the left of the highest ordinate.

For a positively skewed curve, there is longer tail at the right and for a negatively skewed curve, there is longer tail at the left.



MEASURES OF KURTOSIS

It indicates whether a distribution is flat topped or peaked. It is the measure of peakedeness. When a frequency curve is more peaked than the normal curve it is called **lapto kurtic** and when it is more flat topped than the normal curve it is called **platy kurtic.** When a curve is neither peaked nor flat topped, it is called **mesokurtic** (normal)



MOMENTS

Measures of kurtosis derived from moments.

a) For individual series

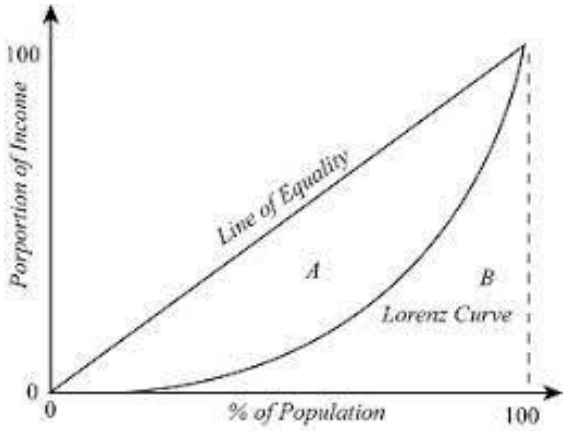
- $\mu 1 = \dfrac{\sum(x - \bar{\chi})}{n}$
- $\mu 2 = \dfrac{\sum(x - \bar{\chi}^2)}{n}$
- $\mu 3 = \dfrac{\sum(x - \bar{\chi}^3)}{n}$
- $\mu 4 = \dfrac{\sum(x - \bar{\chi}^4)}{n}$

b) For frequency distribution

- $\mu 1 = \dfrac{\sum f(x - \bar{\chi})}{N}$
- $\mu 2 = \dfrac{\sum f(x - \bar{\chi}^2)}{N}$
- $\mu 3 = \dfrac{\sum fx - \bar{\chi}^3)}{N}$
- $\mu 4 = \dfrac{\sum fx - \bar{\chi}^4)}{N}$

LORENZ CURVE

A Lorenz curve is a graphical representation of income inequality or wealth inequality developed by American economist Max Lorenz in 1905. The graph plots percentiles of the population on the horizontal axis according to income or wealth. It plots cumulative income or wealth on the vertical axis. In practice, a Lorenz curve is usually a mathematical function estimated from an incomplete set of observations of income or wealth.



It is graphic method of studying dispersion in a seried. It is used in business to study the disparties of the distribution of wages, turnover, production, population etc. in economies it is useful to measure inequalities in the distribution of income between different countries or between periods of time.

If there is no ineqaulity in the distribution, the lorenz curve will coincide with the line of equal distribution. The more the lorenz curve is away from the line of equal distribution, the greater is the inequality.

It is useful to ;

- Study the varibility in a distribution
- Compare the variability relating to a phenomenon for two regions
- Study the changes in variability over a period.

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Module 2

CORRELEATION ANALYSIS

Introduction:

- In practice, we may come across with lot of situations which need statistical analysis of either one or more variables. The data concerned with one variable only is called univariate data. For Example: Price, income, demand, production, weight, height marks etc are concerned with one variable only. The analysis of such data is called univariate analysis.
- The data concerned with two variables are called bivariate data. For example: rainfall and agriculture; income and consumption; price and demand; height and weight etc. The analysis of these two sets of data is called bivariate analysis.
- The date concerned with three or more variables are called multivariate date. For example: agricultural production is influenced by rainfall, quality of soil, fertilizer etc.

Definition:

Two or more variables are said to be correlated if the change in one variable results in a corresponding change in the other variable.

According to Simpson and Kafka, "Correlation analysis deals with the association between two or more variables".

Lun chou defines, "Correlation analysis attempts to determine the degree of relationship between variables".

Boddington states that "Whenever some definite connection exists between two or more groups or classes of series of data, there is said to be correlation."

Correlation Coefficient:

Correlation analysis is actually an attempt to find a numerical value to express the extent of relationship exists between two or more variables. The numerical measurement showing the degree of correlation between two or more variables is called correlation coefficient. Correlation coefficient ranges between -1 and +1.

SIGNIFICANCE OF CORRELATION ANALYSIS

Correlation analysis is of immense use in practical life because of the following reasons:

1. Correlation analysis helps us to find a single figure to measure the degree of relationship exists between the variables.
2. Correlation analysis helps to understand the economic behavior
3. Correlation analysis enables the business executives to estimate cost, price and other variables.
4. Correlation analysis can be used as a basis for the study of regression. Once we know that two variables are closely related, we can estimate the value of one variable if the value of other is known.
5. Correlation analysis helps to reduce the range of uncertainty associated with decision making. The prediction based on correlation analysis is always near to reality.
6. It helps to know whether the correlation is significant or not. This is possible by comparing the correlation co-efficient with 6PE. It 'r' is more than 6 PE, the correlation is significant.

Classification of Correlation

Correlation can be classified in different ways. The following are the most important classifications

1. Positive and Negative correlation
2. Simple, partial and multiple correlation
3. Linear and Non-linear correlation

Positive and Negative Correlation

Positive Correlation

When the variables are varying in the same direction, it is called positive correlation. In other words, if an increase in the value of one variable is accompanied by an increase in the value of other variable or if a decrease in the value of one variable is accompanied by a decree se in the value of other variable, it is called positive correlation.

Eg: 1)	A: 10	20	30	40	50
	B: 80	100	150	170	200

When the variables are moving in opposite direction, it is called negative correlation. In other words, if an increase in the value of one variable is accompanied by a decrease in the value of other variable or if a decrease in the value of one variable is accompanied by an increase in the

value of other variable, it is called negative correlation.

Simple, Partial and Multiple correlation

Simple Correlation

In a correlation analysis, if only two variables are studied it is called simple correlation. Eg. the study of the relationship between price & demand, of a product or price and supply of a product is a problem of simple correlation.

Multiple correlation

In a correlation analysis, if three or more variables are studied simultaneously, it is called multiple correlations. For example, when we study the relationship between the yield of rice with both rainfall and fertilizer together, it is a problem of multiple correlation.

Partial correlation

In a correlation analysis, we recognize more than two variable, but consider one dependent variable and one independent variable and keeping the other Independent variables as constant. For example yield of rice is influenced b the amount of rainfall and the amount of fertilizer used. But if we study the correlation between yield of rice and the amount of rainfall by keeping the amount of fertilizers used as constant, it is a problem of partial correlation.

Linear and Non-linear correlation

Linear Correlation

In a correlation analysis, if the ratio of change between the two sets of variables is same, then it is called linear correlation.

For example when 10% increase in one variable is accompanied by 10% increase in the other variable, it is the problem of linear correlation.

X:	10	15	30	60
Y:	50	75	150	300

Here the ratio of change between X and Y is the same. When we plot the data in graph paper, all the plotted points would fall on a straight line.

Non-linear correlation

In a correlation analysis if the amount of change in one variable does not bring the same ratio of change in the other variable, it is called nonlinear correlation.

X:	2	4	6	10	15
Y:	8	10	18	22	26

Here the change in the value of X does not being the same proportionate change in the value of Y

Degrees of correlation:

Correlation exists in various degrees

1. **Perfect positive correlation**

If an increase in the value of one variable is followed by the same proportion of increase in other related variable or if a decrease in the value of one variable is followed by the same proportion of decrease in other related variable, it is perfect positive correlation. eg: if 10% rise in price of a commodity results in 10% rise in its supply, the correlation is perfectly positive. Similarly, if 5% full in price results in 5% fall in supply, the correlation is perfectly positive.

2. **Perfect Negative correlation**

If an increase in the value of one variable is followed by the same proportion of decrease in other related variable or if a decrease in the value of one variable is followed by the same proportion of increase in other related variably it is Perfect Negative Correlation. For example if 10% rise in price results in 10% fall in its demand the correlation is perfectly negative. Similarly if 5% fall in price results in 5% increase in demand, the correlation is perfectly negative.

3. **Limited Degree of Positive correlation**:

When an increase in the value of one variable is followed by a non-proportional increase in other related variable, or when a decrease in the value of one variable is followed by a non-proportional decrease in other related variable, it is called limited degree of positive correlation.

For example, if 10% rise in price of a commodity results in 5% rise in its supply, it is limited degree of positive correlation. Similarly if 10% fall in price of a commodity results in 5% fall in its supply, it is limited degree of positive correlation.

4. **Limited degree of Negative correlation**

When an increase in the value of one variable is followed by a non-proportional decrease in other related variable, or when a decrease in the value of one variable is followed by a non-proportional increase in other related variable, it is called limited degree of negative correlation.

For example, if 10% rise in price results in 5% fall in its demand, it is limited degree of negative correlation. Similarly, if 5% fall in price results in 10% increase in demand, it is limited degree of negative correlation.

5. **Zero Correlation (Zero Degree correlation)**

If there is no correlation between variables it is called zero correlation. In other words, if the values of one variable cannot be associated with the values of the other variable, it is zero

correlation.

Methods of measuring correlation

Correlation between 2 variables can be measured by graphic methods and algebraic methods.

I Graphic Methods

1) Scatter Diagram

2) Correlation graph

II Algebraic methods (Mathematical methods or statistical methods or Co-efficient of correlation methods):

1) Karl Pearson's Co-efficient of correlation

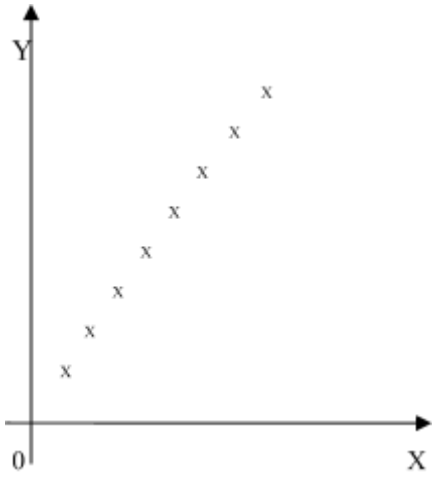
2) Spear man's Rank correlation method

3) Concurrent deviation method

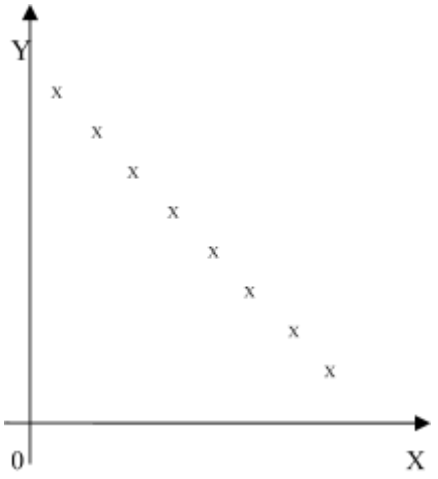
Scatter Diagram

This is the simplest method for ascertaining the correlation between variables. Under this method all the values of the two variable are plotted in a chart in the form of dots. Therefore, it is also known as dot chart. By observing the scatter of the various dots, we can form an idea that whether the variables are related or not.

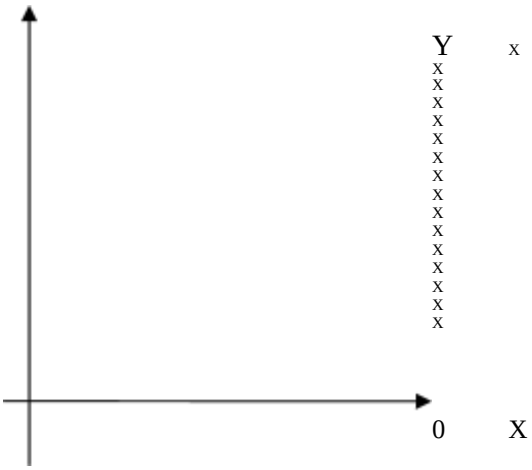
A scatter diagram indicates the direction of correlation and tells us how closely the two variables under study are related. The greater the scatter of the dots, the lower is the relationship



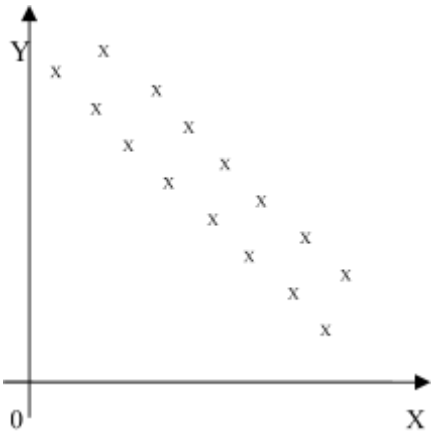
Perfect Positive Correlation



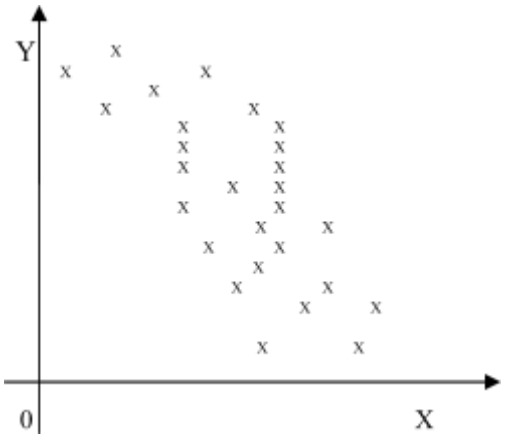
Perfect Negative Correlation



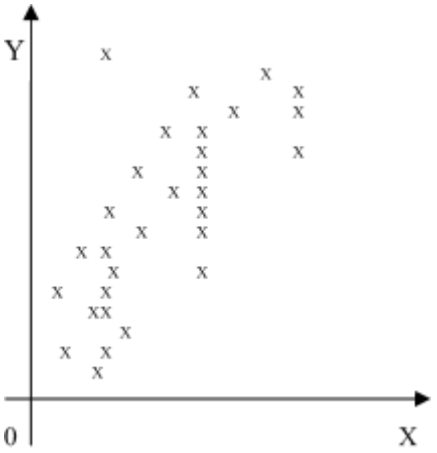
High Degree of Positive Correlation



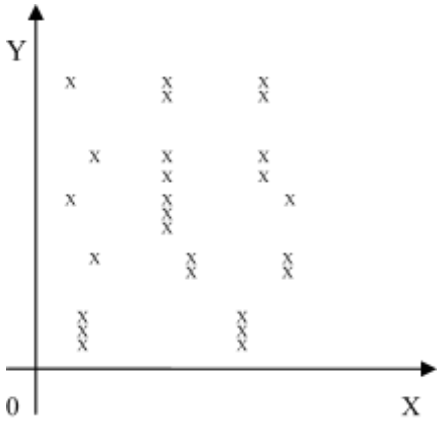
High Degree of Negative Correlation



Low Degree of Positive Correlation



Low Degree of Negative Correlation



No Correlation (r = 0)

Merits of Scatter Diagram method

1. It is a simple method of studying correlation between variables.
2. It is a non-mathematical method of studying correlation between the variables. It does not require any mathematical calculations.
3. It is very easy to understand. It gives an idea about the correlation between variables even to a layman.
4. It is not influenced by the size of extreme items.
5. Making a scatter diagram is, usually, the first step in investigating the relationship between two variables.

Demerits of Scatter diagram method

1. It gives only a rough idea about the correlation between variables.
2. The numerical measurement of correlation co-efficient cannot be calculated under this method.
3. It is not possible to establish the exact degree of relationship between the variables.

Correlation graph Method

Under correlation graph method the individual values of the two variables are plotted on a graph paper. Then dots relating to these variables are joined separately so as to get two curves. By examining the direction and closeness of the two curves, we can infer whether the variables are related or not. If both the curves are moving in the same direction(either upward or downward) correlation is said to be positive. If the curves are moving in the opposite directions, correlation is said to be negative.

Merits of Correlation Graph Method

1. This is a simple method of studying relationship between the variable
2. This does not require mathematical calculations.
3. This method is very easy to understand

Demerits of correlation graph method:

1. A numerical value of correlation cannot be calculated.
2. It is only a pictorial presentation of the relationship between variables.
3. It is not possible to establish the exact degree of relationship between the variables.

Karl Pearson's Co-efficient of Correlation

Karl Pearson's Coefficient of Correlation is the most popular method among the algebraic methods for measuring correlation. This method was developed by Prof. Karl Pearson in 1896. It is also called product moment correlation coefficient.

$$r = \frac{\Sigma(s-\bar{s})(y-\bar{y})}{\sqrt{\Sigma(x-\bar{x})^2\Sigma(y-\bar{y})}}$$

Interpretation of Co-efficient of Correlation

Pearson's Co-efficient of correlation always lies between +1 and -1. The following general rules will help to interpret the Co-efficient of correlation:

1. When r - +1, It means there is perfect positive relationship between variables.
2. When r = -1, it means there is perfect negative relationship between variables.
3. When r = 0, it means there is no relationship between the variables.
4. When 'r' is closer to +1, it means there is high degree of positive correlation between variables.
5. When 'r' is closer to – 1, it means there is high degree of negative correlation between variables.
6. When 'r' is closer to 'O', it means there is less relationship between variables.

Properties of Pearson's Co-efficient of Correlation

1. If there is correlation between variables, the Co-efficient of correlation lies between +1 and -1.
2. If there is no correlation, the coefficient of correlation is denoted by zero (ie r=0)
3. It measures the degree and direction of change
4. If simply measures the correlation and does not help to predict cansation.
5. It is the geometric mean of two regressions co-efficient.

i.e $r = \sqrt{b_{sy} \cdot b_{yx}}$

Probable Error and Coefficient of Correlation

Probable error (PE) of the Co-efficient of correlation is a statistical device which measures the reliability and dependability of the value of co-efficient of correlation.

$$¤\ PE = 0.6745 \times \frac{1-r2}{\sqrt{n}}$$

If the value of coefficient of correlation (r) is less than the PE, then there is no evidence of correlation.

If the value of 'r' is more than 6 times of PE, the correlation is certain and significant.

By adding and submitting PE from coefficient of correlation, we can find out the upper and lower limits within which the population coefficient of correlation may be expected to lie.

Uses of PE:

1) PE is used to determine the limits within which the population coefficient of correlation may be expected to lie.
2) It can be used to test whether the value of correlation coefficient of a sample is significant with that of the population

If r = 0.6 and N = 64, find out the PE and SE of the correlation coefficient. Also determine the limits of population correlation coefficient.

Merits of Pearson's Coefficient of Correlation:-

1. This is the most widely used algebraic method to measure coefficient of correlation.
2. It gives a numerical value to express the relationship between variables
3. It gives both direction and degree of relationship between variables
4. It can be used for further algebraic treatment such as coefficient of determination coefficient of non-determination etc.
5. It gives a single figure to explain the accurate degree of correlation between two variables

Demerits of Pearson's Coefficient of correlation

1. It is very difficult to compute the value of coefficient of correlation.
2. It is very difficult to understand

Spearman's Rank Correlation Method

Pearson's coefficient of correlation method is applicable when variables are measured in quantitative form. But there were many cases where measurement is not possible because of the qualitative nature of the variable. For example, we cannot measure the beauty, morality, intelligence, honesty etc in quantitative terms. However it is possible to rank these qualitative characteristics in some order.

$$(R) = 1 - \frac{6XD2}{N3—N}$$

Merits of Rank Correlation method

1. Rank correlation coefficient is only an approximate measure as the actual values are not used for calculations
2. It is very simple to understand the method.
3. It can be applied to any type of data, ie quantitative and qualitative
4. It is the only way of studying correlation between qualitative data such as honesty, beauty etc.
5. As the sum of rank differences of the two qualitative data is always equal to zero, this method facilitates a cross check on the calculation.

Demerits of Rank Correlation method

1. Rank correlation coefficient is only an approximate measure as the actual values are not used for calculations.
2. It is not convenient when number of pairs (ie. N) is large
3. Further algebraic treatment is not possible.
4. Combined correlation coefficient of different series cannot be obtained as in the case of mean and standard deviation. In case of mean and standard deviation, it is possible to compute combine arithmetic mean standard deviation.

Concurrent Deviation Method:

Concurrent deviation method is a very simple method of measuring correlation. Under this method, we consider only the directions of deviations. The magnitudes of the values are completely ignored. Therefore, this method is useful when we are interested in studying correlation between two variables in a casual manner and not interested in degree (or precision).

Under this method, the nature of correlation is known from the direction of deviation in the values of variables. If deviations of 2 variables are concurrent, then they move in the same direction, otherwise in the opposite direction.

The formula for computing the coefficient of concurrent deviation is: -

$$r = \pm\sqrt{\pm\frac{(2c-N)}{N}}$$

Where N = No. of pairs of symbol

C = No. of concurrent deviations (ie, No. of + signs in 'dx dy' column)

Steps:

1. Every value of 'X' series is compared with its proceeding value. Increase is shown by '+' symbol and decrease is shown by '-'
2. The above step is repeated for 'Y' series and we get 'dy'
3. Multiply 'dx' by 'dy' and the product is shown in the next column. The column heading is 'dxdy'.
4. Take the total number of '+' signs in 'dxdy' column. '+' signs in 'dxdy' column denotes the concurrent deviations, and it is indicated by 'C'.
5. Apply the formula:

$$r = \pm\sqrt{\pm\frac{(2c-N)}{N}}$$

If $2c \Sigma N$, then r = +ve and if $2c \in N$, then r = −ve.

REGRESSION ANALYSIS

Introduction:

Correlation analysis analyses whether two variables are correlated or not. After having established the fact that two variables are closely related, we may be interested in estimating the value of one variable, given the value of another. Hence, regression analysis means to analyses the average relationship between two variables and thereby provides a mechanism for estimation or predication or forecasting.

The term 'Regression" was firstly used by Sir Francis Galton in 1877. The dictionary meaning of the term 'regression" is "stepping back" to the average.

Definition:

"Regression is the measure of the average relationship between two or more variables in terms of the original units of the date".

"Regression analysis is an attempt to establish the nature of the relationship between variables-that is to study the functional relationship between the variables and thereby provides a mechanism for prediction or forecasting".

Types of Regression:-

There are two types of regression. They are linear regression and multiple regressions.

Linear Regression:

It is a type of regression which uses one independent variable to explain and/or predict the dependent variable.

Multiple Regression:

It is a type of regression which uses two or more independent variable to explain and/or predict the dependent variable.

Regression Lines:

Regression line is a graphic technique to show the functional relationship between the two variables X and Y. It is a line which shows the average relationship between two variables X and Y.

If there is perfect positive correlation between 2 variables, then the two regression lines are winding each other and to give one line. There would be two regression lines when there is no perfect correlation between two variables. The nearer the two regression lines to each other, the higher is the degree of correlation and the farther the regression lines from each other, the lesser is the degree of correlation.

Properties of Regression lines:-

1. The two regression lines cut each other at the point of average of X and average of Y (i.e $\bar{X}$ and $\bar{Y}$)
2. When r = 1, the two regression lines coincide each other and give one line.
3. When r = 0, the two regression lines are mutually perpendicular.

Regression Equations (Estimating Equations)

Regression equations are algebraic expressions of the regression lines. Since there are two regression lines, therefore two regression equations. They are :-

1. Regression Equation of X on Y:- This is used to describe the variations in the values of X for given changes in Y.
2. Regression Equation of Y on X :- This is used to describe the variations in the value of Y for given changes in X.

Regression Equation of Y on X:-

$$Y = a + bx$$

The normal equations to compute 'a' and 'b' are: -

$$\Sigma y = Na + b\Sigma x$$

$$\Sigma xy = a\Sigma x + b\Sigma x^2$$

Regression Equation of X on Y:-

$$X = a + by$$

The normal equations to compute 'a' and 'b' are:-

$$\Sigma x = Na + n\Sigma y$$

$$\Sigma xy = a\Sigma y + b\Sigma y^2$$

Properties of Regression Coefficient:

1. There are two regression coefficients. They are b_{xy} and b_{yx}
2. Both the regression coefficients must have the same signs. If one is +ve, the other will also be a +ve value.
3. The geometric mean of regression coefficients will be the coefficient of correlation. $r = \pm \sqrt{b_{sy.} \, b_{ys.}}$
4. If x $\tilde{x}$ and y $\tilde{y}$ are the same, then the regression coefficient and correlation coefficient will be the same.

Computation of Regression Co-efficient

Regression co-efficient can be calculated in 3 different ways:

1. Actual mean method

- Regression coefficient x on y (b_{xy}) = $\frac{\Sigma sy}{\Sigma y^2}$

- Regression coefficient y on x (b_{yx}) = $\frac{\Sigma sy}{\Sigma s^2}$

Correlation	**Regression**
It studies degree of relationship between variables	It studies the nature of relationship between variables
It is not used for prediction purposes	It is basically used for prediction purposes
It is basically used as a tool for determining the degree of relationship	It is basically used as a tool for studying cause and effect relationship
There may be nonsense correlation between two variables	There is no such nonsense regression
There is no question of dependent and independent variables	There must be dependent and independent variables

ANALYSIS OF TIME SERIES

Time series

It refers to the values of a variable chronologically or over a successive period of time. Through the analysis of time series, we try to examine the effect of time on various variables. It discloses the relationship between two variables, one of which being time. Examples of time series are yearly national income data, quarterly inventories in an industry etc.

Analysis of time – series

Analysis of time series is a statistical device which can be used to understand, interpret and evaluate changes in economic phenomena over time with the hope of more correctly anticipating the course of future events.

Importance of time series analysis

- It discloses changes in time and changes in the value of the variable.
- It helps in understanding past behaviour
- It helps in predicting, forecasting and planning
- It helps in evaluating current programmes
- It facilitates comparison

Components of time series

The value of a variable changes due to the interaction of certain forces like changes in the taste and habits of people, changes in population, reduction in cost of production etc.

These forces are interconnected and cannot be distinguished easily. The effects of these forces on a time series are called the components of a time series.

The components are:

1. Secular trend
2. Seasonal variations
3. Cyclic variations
4. Irregular variations

1. Secular Trend

it shows the definite and basic tendency of the statistical data with the passage of time. It is smooth, regular and long-term movement. It refers to general tendency of a statistical data to rise or to fall or to remain the same.

2. Seasonal variation

Those variations which occur with some degree of regularity within a specific period of one year or shorter. Climatic conditions, social customs, religious functions etc. are the factors responsible for seasonal variations.

3. Cyclic variations

These are period movements. These variations occur at intervals (or periods) of more than one year. They are visible in the case of most of the business and economic activities.

4. Irregular fluctuations

Those caused by unusual, unexpected and accidental events. Effects of earthquake, strike, flood etc. led to irregular variations. These are random in their nature.

SECULAR TREND

Trend, also called secular or long -term trend, is the basic or general tendency of a series to grow or decline over a period of time. Trend refers to long period changes. It is smooth, regular and long-term movement of statistical data. The movement can be upward, downward or constant. It should always be kept in mind that secular trend need not always be rising or falling. It may also fluctuate about a constant level that does not change with the passage of time. Trend may be linear or non-linear. Linear trend is one which gives the straight line when plotted on a graph paper while non linear trend is one which gives non linear curves like parabola, exponential curve, logistic curve etc.

Methods of measuring trend

a) **Free hand curve method**
   It is the easiest of all the methods for measuring trend. Here original data are plotted on a graph paper. Time is always taken along the horizontal axis, plotted points when joined gives a wave like curve. Draw a smooth and freehand line in such a way that the areas of the curve below and above the line are approximately equal. Such a line will describe the long period movement or the general tendency of the original data. The trend values can be measured from the line.

b) **Semi- average method**
   In this method original data are divided into equal parts. When the number of years is odd, the total number of years is divided into two groups, omitting the middle year. The figures from the two parts are averaged. The average of each part is plotted on the graph against the middle year of each part. a straight line then be drawn to pass through these two points plotted on the graph. The straight line shows the trend. The values can be measured from the line.

c) **Moving average method**
   It is an improvement over freehand curve method and semi average method. It is quite simple and is used for smoothing the fluctuations in curves. It is a new series obtained by finding out successive items chosen on the basis of periodicity of fluctuations, dropping off one item and adding the next item at each stage.

d) Methods of least squares
   The principle of least squares provides with a mathematical or analytical device to obtain a mathematical curve which will be fit to the given series. The technique of obtaining this mathematical curve by the principle of least squares is known as curve fitting.

SEASONAL VARIATIONS

These variations which occur, with some degree of regularity within a specific period of one year or shorter, these are quite regular and uniform and can be predicted with some amount of accuracy

Factors responsible for seasonal variations

1) climate and weather conditions 2) customs, tradition and habits.

Uses of studying seasonal variation

- To analyses seasonal pattern in a short period of time series.
- Once seasonal factor is known it can be eliminated and thus the effect of cyclic and irregular forces affecting the series can be studied.
- Once the effect of seasonal variations is studies, it can be adjusted to get correct idea of trend.
- Seasonal factor can be used to have proper scheduling in business and economic activities so as to adjust with the seasonal changes.

Measuring seasonal variations

a) **Method of averages**
   Her seasonal index is calculated by the average of each season. By season, mean a month or a quarter or any other period of time. This period is applied when trend is absent. Under this

method the data is arranged season wise for each year. Then average is calculated for each season. Then average of this average is calculated. Then seasonal index is for each season using the formula

$$\textbf{Seasonal index for any season} = \frac{\textbf{Average of that season}}{\textbf{Average of averages}}$$

b) Ratio to trend method

In this method first of all trend values are computed by the method of least squares and they are eliminated. Apply method of simple average method on these trends eliminated values and obtain seasonal indices.

c) Ratio to moving average method

Among all the methods of measuring seasonal variation this method is most satisfactory and widely used. In this method trend values are calculated by moving average method. Then trend effect is eliminated from the given values. Method of simple average is applied on these trend eliminated values to obtain the seasonal indices.

d) Link relative method

This method is most difficult one. It involves the following steps. We link relatives of the seasonal figures. From the link relatives we compute chain relatives and then apply method of simple average to arrive at seasonal indices.

INDEX NUMBERS

Definition

According to croxton and cowden, "Index numbers are devices for measuring differences in the magnitude of a group of related variables".

Meaning

It is statistical device for measuring changes in the magnitude of a group of related variables during a specific period in comparison to their level on some other period. That is, index numbers measure changes in group of related variables over time.

Characteristics/features of index numbers

- These are specialized averages. Index numbers are averages of relative changes in the price of different items given in different units.
- Index numbers are expressed in percentages of relative changes. But the sign (%) is never used.
- Index numbers measure changes not capable of indirect measurement. For instance, 'price level', 'economic activity', 'cost of living' etc. are not capable of direct measurement.
- Index numbers are meant for comparison.
- Index numbers have universal application.

Uses of Index numbers

- Index numbers measure changes in price level.
- Index numbers are indicators of inflationary or deflationary tendencies
- Index numbers can be used to make measuring adjustments in wages of employees.
- Many of the economic and business policies are guided by index numbers.

- Index numbers can be used to study trends and tendencies of various phenomena.

Limitations of index numbers

- Index numbers are based on samples.
- Index numbers are only approximately indicators of the relative level of a phenomenon.
- All index numbers are not good for all purposes.
- These are specialized type of average and as such they are subject to those limitations also within an average suffers
- There are different methods for calculations of index numbers. So if a suitable method is not selected the result obtained may not be accurate.
- Index numbers are liable to be misused by choosing abnormal base year or irrational weights.

Simple index numbers

Those index numbers in the calculations of which all the items are treated a equally important. No item has more importance than another.

Weighted index numbers

Those index numbers in the calculations of which each item is assigned a particular weight. The importance of each item differs. Here index numbers are obtained by taking into account the weight of each item.

Price index numbers

This measure change in the price of a commodity for a given period in comparison with another period. They are; whole sale price index numbers and cost of living index numbers.

Methods of constructing price index numbers

1) **Simple aggregative method**
   This is simplest method. The prices of base year and current year are only required. The aggregate of current year price id divided by aggregate base year price and multiple y 100.
2) Simple average relative method
   In this method price relative for each item is found. Price relative is current year price / Base year price *100. Then the average of these relatives is found out.
3) Weighted aggregative method
   In this method weights are assigned to each item. The two well known methods used for assigning weights are known as Laspeyer's method and Paasche's method. In the former method base year quantity is taken as weight while in the latter current year quantity is taken as weight.

Consumer Price Index Numbers/ Cost of Living Index Numbers/ Retail Price Index Numbers

These are generally intended to represent the average change over time in the prices paid by the ultimate consumer of a specified basket of goods and services. They measure changes in the cost of maintaining a certain standard of living from time to time.

Steps in the construction of consumer price index numbers

1) Decision about class of people, scope, area
2) Decision about the items to be selected
3) Conducting family budget enquiry
4) Obtaining price quotations
5) Selecting base period, proper weights
6) Selecting suitable methods for constructing index.

Module 3

MIS AND DBMS

MIS-Management Information System

- MIS provides for the identification of relevant information needs, the collection of relevant information, processing the same to become useable by the business managers, and timely dissemination of processed information to the users of information for properly managing the affairs of the enterprise.
- it is a system to convert data from internal and external into and to communicate that information, in an appropriate form, to mangers at all levels in all functions to enable them to make timely and effective decision for planning, directing and controlling the activities for which they are responsible.

Definition

Jerome Kanter defines MIS as "a system that aids management in making, carrying out and controlling decisions"

- user – machine system
- integrated system
- need for a database
- utilisation of models

Components of MIS

- data gathering
- data entry
- data transformation
- information utilisation

Characteristics of MIS

- management oriented
- management directed
- integrated concept
- common database
- avoids redundancy in data storage
- heavy planning
- subsystem concept
- common data flow
- flexibility and ease of use
- distributed data processing
- information as a resource

Importance of MIS in organization

- data processing
- decision making
- optimum use of resources
- effective communication
- planning and control
- decentralization
- coordination

Elements of MIS

- management
- information
- system

Need for MIS

- management oriented
- integrated system
- to make plans
- to achieve control
- latest information
- greater accuracy
- fulfilment of statutory obligations
- decision making
- strategic planning
- to practice management by exception

Limitations of MIS

- quality of output
- not a substitute for judgements
- lack of flexibility
- no tailor made packages
- ignoring of non-quantitative factors
- not suitable for non-programmed decisions
- costly affair
- greater chance for failures
- frequent changes in top management
- hoarding of information

NETWORKS

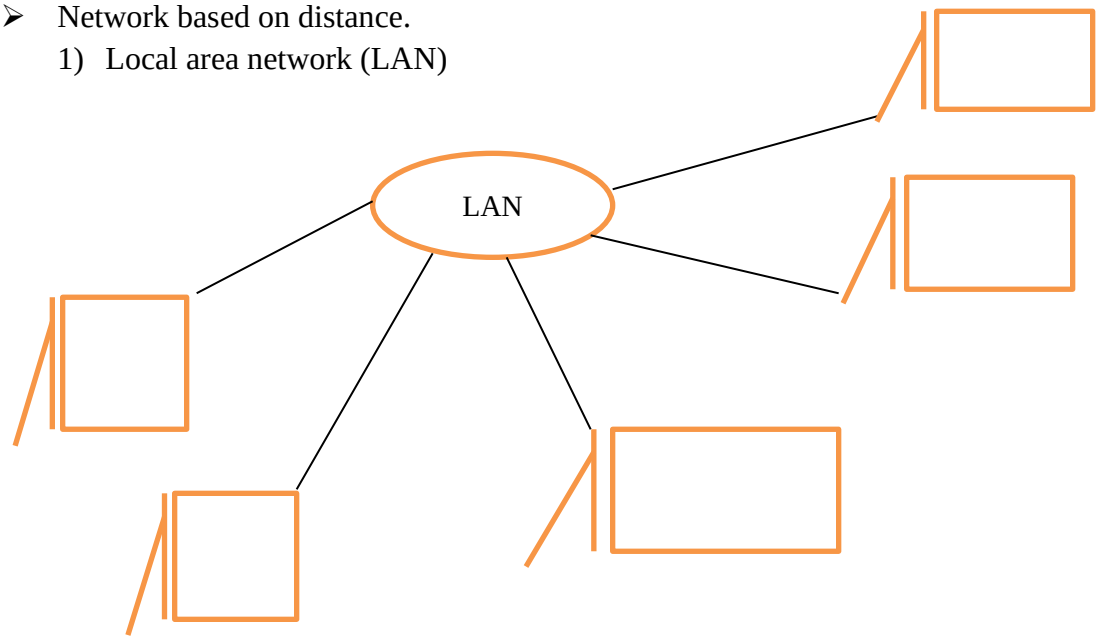
- A network is a collection of computers, servers, mainframes, network devices, peripherals, or other devices connected to one another to allow the sharing of data.
- An example of a network is the internet, which connects millions of people all over the world.

Types of network

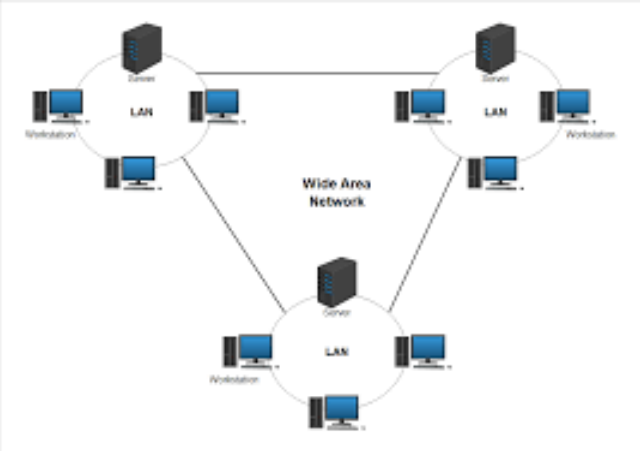
A computer network is a data communication system which interconnects computer system at various locations with the help of communication devices like hubs, routers, cables and NICs.

➢ Network based on distance.

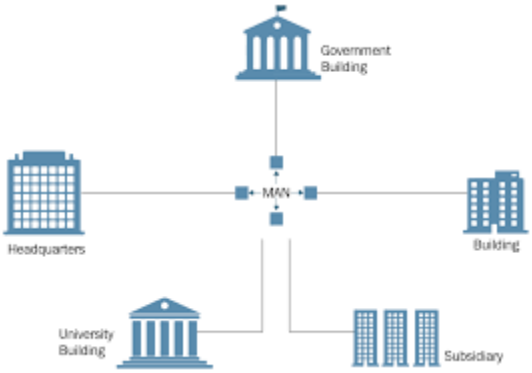
1) Local area network (LAN)



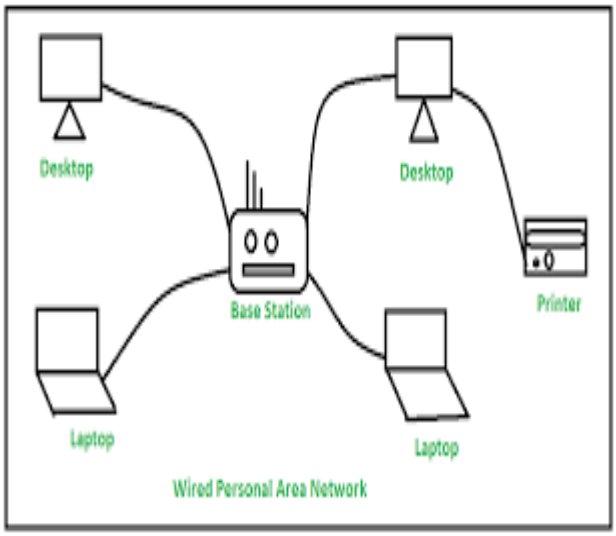
2) Wide area network (WAN)



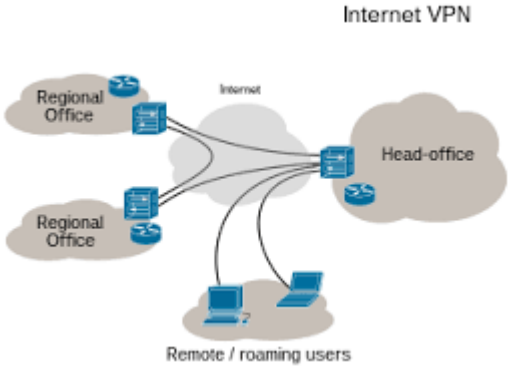
3) Metropolitan area network (MAN)



4) Personal area network (PAN)

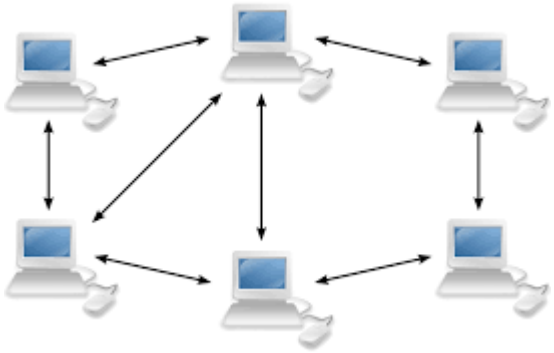


5) Virtual private network (VPN)



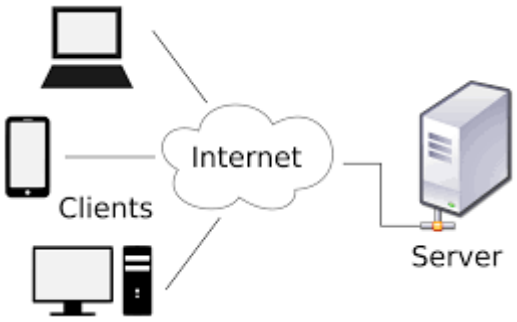
- Network based on Administration

1) peer-to-peer network



a) Wired Ethernet Networks
b) wireless Ethernet Networks
c) power line networks

2) client server network



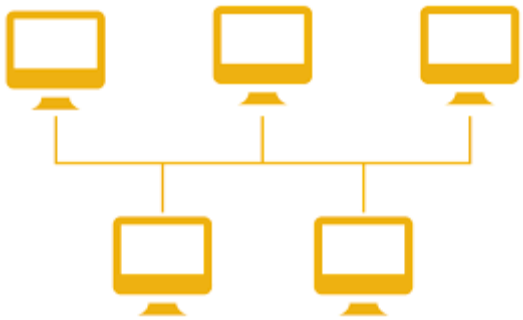
- **Uses of Computer Network**
  - Information sharing
  - sharing hardware
  - sharing software and application
  - centralized administration
  - Email
  - internet Relay Chat –IRC
  - audio/video conferencing
  - internet phone

Network Topologies

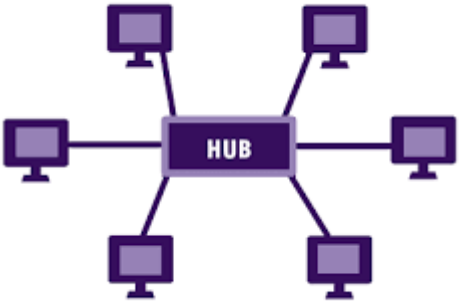
- The geometric arrangement of computer system is called Topology.
- It describes the method used to the physical configuration of cables, computer and network devices.
- the choice of topology is dependent upon:
  - type of number of equipment being used
  - planned applications and rate of data transfers
  - required response times
  - cost

Common network topologies are;

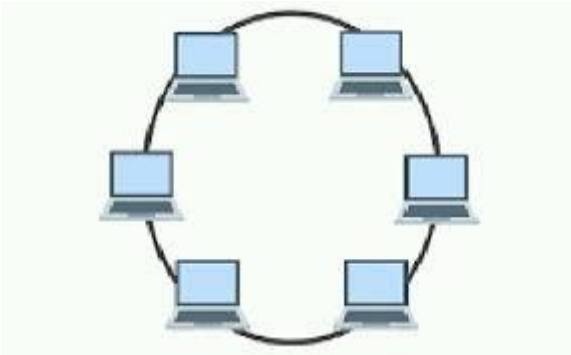
1) Bus Topology



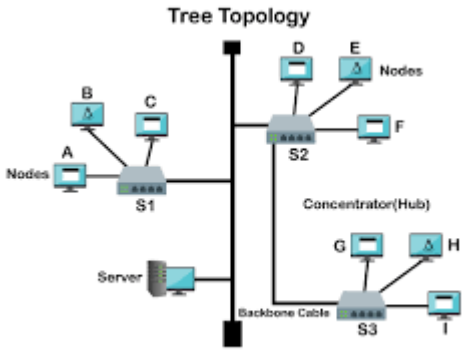
2) Star Topology



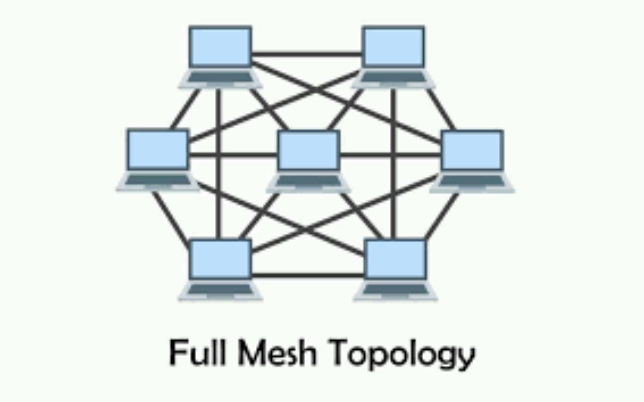
3) Ring Topology



4) Tree Topology



5) Mesh Topology



INTRODUCTION TO DBMS

Database concept

- A database is an integrated collection of logically related records and files. It is a collection of interrelated data items that can be processed by one or more application system.
- Database is a collection of data, integrated and organised into a single comprehensive file system.
- It is designed to minimise duplication of data within that system to satisfy a wide variety of user needs
- A centrally controlled and integrated collection data is called database.
- The database is either a flat file or relational. In a flat file system all data is arrange in a single table. Relational database split the data into several tables, with each table holding some portion of total data.

Necessity of database

- Reduced data redundancy
- Reduced programming effort
- Faster response time
- Data independence

- The ability to change
- Cost reductions
- Information protection
- Multi user support and distributed processing

Characteristics of database system

- Data abstraction
- Reliability
- Efficiency

Database management system –DBMS

- A database management system is also known as database system is a collection of prewritten, integrated programs. Its major function is to assist users in all aspects of data manipulation and utilization.
- A DBMS is a software that organize data into a database, providing information storage and retrievals. It helps to access multiple databases simultaneously.
- The DBMS stores and process data so that records can be accessed through their relationship to other records.

Components of Database

- The database file
- The users
- A host language interface system
- The application programs
- Natural language interface system
- The data dictionary
- Online access and update terminals
- The output system or report generator.

Functions of DBMS

- transaction processing
- concurrency management
- recovery
- security
- data dictionary

Database administrator

- the responsibility of database administration is assigned to an individual called a database administrator (DBA)
- he is the person who is responsible for defining, updating and controlling access to database

➢ functions of database administrator

- communicating with users
- establishing standards and procedures

- servicing end user requirements
- ensuring database security and integrity
- backup and recovery

Data Definition Language- DDL

A database management system contains two languages namely Data definition language (DDL) and Data manipulation language (DML)

- Data definition language is used to define the structure of the database.
- Structure of the database is called Schema of the database outlines the data to be included in the database. In the schema there are several fields.
- DDL establishes the connection between logical and physical structures of the database. Here logical refers to the way the user views data. On the other hand, physical refers to the way the data is physically stored.
- The DDL is used to define the physical characteristics of each record such as field name in the record, the length of each field and its data type.

➢ Functions of DDL

- Description of the schema and sub schemas
- Description of fields in each record and the logical name of the record
- Description of the data type and name of each field
- Description of the keys of record
- Provide protection to the data
- Provide physical and logical data independence

Data Manipulation Language –DML

- It is used to manipulate data in the database.
- It includes all the commands that enable the users to manipulate the data and the users can view the data, add new data, delete existing data and modify selected fields in a record.

➢ Functions of DML

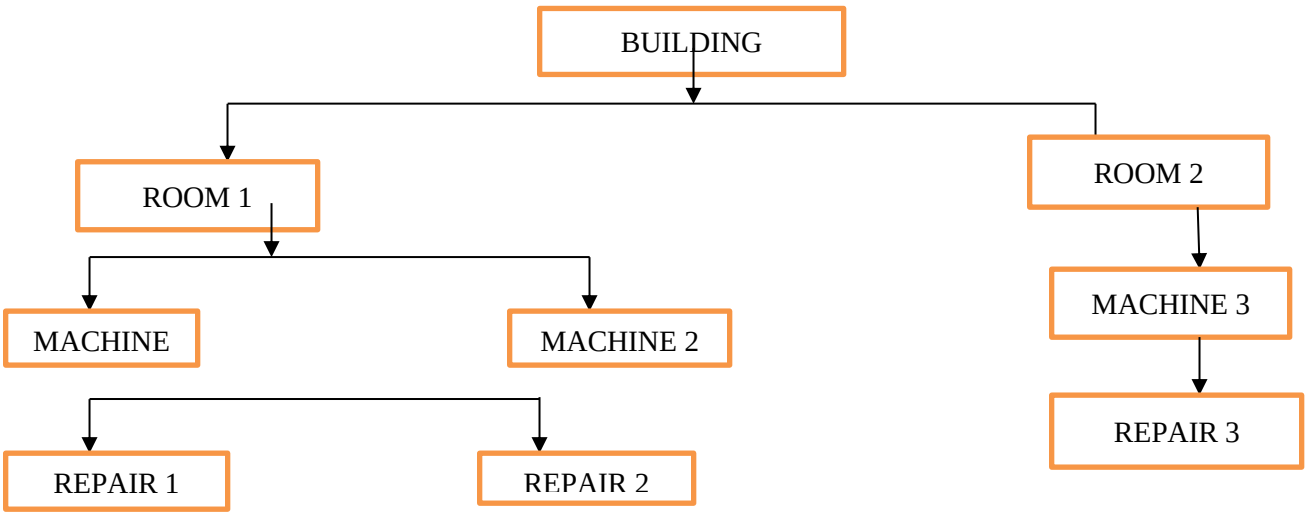
- Provide the techniques of data manipulation such as deletion, addition, retrieval of data records.
- It permits the users and application programs to process data on a symbolic logical basis rather than on physical location basis
- Provides for independence of programming languages
- Provide the relationship between different records
- It also allows the user and application programs to be independent of physical data structure and database structure maintenance.

Types of Databases

- Database models are also known as database structures or architecture.
- The structure of data refers to the view of data accessed by a user from the database.

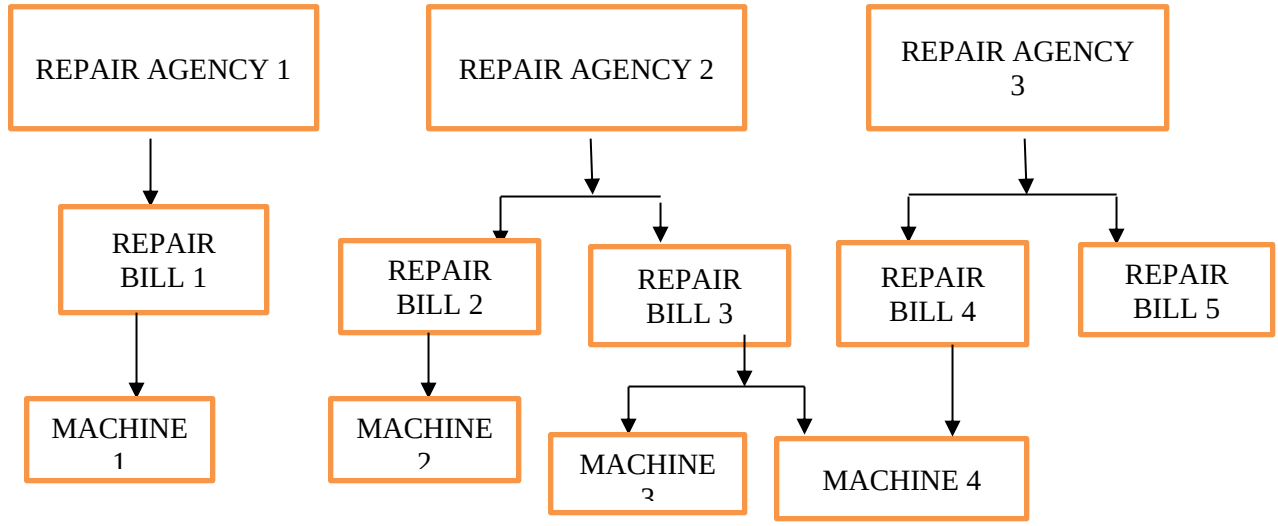
1. hierarchical database model
    - it employees a tree structure to represent relationship among data elements

- Here, the relationship between records is that of parent and child. One record is connected to only one record at the higher level. data at the lower level (child) can be accessed through a higher level record (parent)
- All records in hierarchy are called nodes. Each node is related to the others in a parent child relationship. Each parent record may have one or mode child records, but no child record may have more than one parent record. Thus the hierarchical database structure implements one-to-one and one-to-many relationship.



- Advantages
  - simplicity
  - data security
  - data integrity
  - efficiency
- Disadvantages
  - implementation complexity
  - database management problems
  - Lack of structural independence.

2. network database model
   - It allows more general connections among data elements.
   - A group of interconnected node is called a network.
   - This structure allows multiple relations between data items.
   - Here records are not confined to only one superior. a record may have many superior records and subordinate records.
   - A network model allows a record to be a member of more than one set at a time. namely it shows two types of relationship namely many-to-one and many-to-many relationship



- Advantages
  - capability to handle more relationship types
  - ease of data access
  - data independence
  - data integrity
- Disadvantages
  - system complexity
  - absence of structural independence

3. Relational database model
   - It is designed just like a two-dimensional table. Thus, the basic structure of relational database design is the table, known as relation.
   - This is highly beneficial to the managers of business organization because they often handle financial data in tabular forms.
   - In relational database system the table row is called a tuple. The columns of a table divide each record into different data fields. These columns in a table are called attributes.
   - Here the data stored in different tables can be related so long as these tables shares common data elements. Moreover, information in different files can be taken and combined into a new table.

Roll no	Name	Mark	Average
501	Soorya	534	90
502	John	456	75

- Advantages
  - structural independence
  - conceptual simplicity

- design, implementation, maintenance and usage ease

➢ Disadvantages

- hardware over heads
- Ease of design can lead to bad design.

Limitations of database

- concurrency problems
- ownership problems
- more resources required
- security problems

Module 4

IT SYSTEM IN AIRLINE

GLOBAL DISTRIBUTION SYSTEM (GDS)

A Global Distribution System, or GDS, is a computerized network that facilitates transactions between travel service providers and travel agents (both online travel agents like Expedia and human travel agents).
It allows agents, both human and technological, to review information, compare prices and schedules, and make purchases from multiple different vendors in real time to quickly and efficiently create an itinerary for their clients.

The first GDS, called the Semi-Automated Business Research Environment, or Sabre, was developed in collaboration between IBM and American Airlines with the express purpose of automating the airline's internal reservation system.

Before it came online in the early 1960s, all flights were booked and managed manually by airline reservationists, making for a time-consuming, labor-intensive, and easily bungled process.

Sabre revolutionized the industry and led to the creation of several additional GDS, each catering to different airlines or airline groups. By the 1970s, independent travel agencies were granted access and the concept eventually grew to encompass not just airline bookings, but also car rentals, cruises, hotels, trains, and other travel services.

How a GDS works for travel agents

Travel agents (again, both human and online) are the primary target for today's GDS networks. A GDS delivers data in real-time, so agents can determine which particular flights, accommodation, or other services best suit their client's needs in seconds. And because GDSs have expanded to other travel services, the entire combination (i.e. flight, car, hotel) can be purchased on one platform, eliminating the hassle of booking each component individually. GDSs also alert agents to limited-time sales, special rates, and promotional packages that further incentivize their use.

Example of a booking facilitation done by an airline GDS

A mirror image of the passenger name record (PNR) in the airline reservations system is maintained in the GDS system. If a passenger books an itinerary containing air segments of multiple airlines through a travel agency, the passenger name record in the GDS system would hold information on their entire itinerary, each airline they fly on would only have a portion of the itinerary that is relevant to them. This would contain flight segments on their own services and inbound and onward connecting flights (known as info segments) of other airlines in the itinerary. e.g. if a passenger books a journey from Amsterdam to London on KLM, London to New York on British Airways, New York to Frankfurt on Lufthansa through a travel agent and if the travel agent is connected to Amadeus GDS. The PNR in the Amadeus GDS would contain the full itinerary, the PNR in KLM would show the Amsterdam to London segment along with British Airways flight as an onward info segment. Like-wise the PNR in the Lufthansa system would show the New York to Frankfurt segment with the British Airways flight as an arrival information segment. The PNR in British Airways system would show all three segments. One as a live segment and the other two as arrival and onward info segments.

Some GDS systems (primarily Amadeus CRS and SABRE) also have a dual use capability for hosting multiple computer reservations system, in such situations functionally the computer reservations system and the GDS partition of the system behave as if they were separate systems

MAJOR GDSS

Sabre, Travelport (the majority owner of Galileo, Apollo, and World-span), and Amadeus represent the leading GDSs today.

Different corporation's partner with different GDSs, so each system connects agents to their own set of participating vendors. For example, Sabre can be used to book flights with American, JetBlue, Cathay Pacific, and China Air, among a host of major airlines, as well as hotel rooms from chains like Kimpton Hotels & Restaurants, Preferred Hotel Group, and others. Amadeus, on the other hand, works with British Airways, Southwest, Qantas, Lufthansa, and more. As the corporate landscape keeps shifting, however, some travel retailers have cut deals with several different GDSs simultaneously, allowing certain aspects of their services to be accessed through multiple channels.

There are several major global distribution systems that house and process the majority of data from

hotels, airlines, and other distributors. These include Amadeus, Sabre, Galileo, World-span, Apollo, and Pegasus. However there are many technology providers that help hotels tap into these GDSs and by extension the thousands of travel agents and travellers across the world.

Amadeus GDS

Amadeus has been operating for over 30 years, building critical solutions to help airlines, hotels, railways, travel agencies, tour operators and more to run their business and improve the travel experience. Amadeus has the biggest global footprint of any of the GDSs, with a potential reach to millions of guests. The company operates in over 190 markets and employs over 17,000 people.

Sabre GDS

Sabre is a leading technology and data-driven solutions provider helping airlines, hotels and travel agencies grow their businesses and transform the traveller experience.

Sabre is seen as a pioneer for online travel agencies, corporate booking tools, revenue management, and web and mobile itinerary tools, to name a few.

Sabre Travel Network is its global business-to-business travel marketplace and consists primarily of the GDS and a broad set of solutions that integrate with the GDS.

This marketplace is used by travel suppliers including 400 airlines, 175,000 hotels, 200 tour operators, 50 rail carriers, 40 car rental outlets and 17 cruise lines.

Galileo GDS

Galileo traces its roots back to 1971 when United Airlines created its first computerised central reservation system. Due to the high market penetration of the Sabre and Apollo systems, owned by American Airlines and United Airlines, respectively, Worldspan and Galileo were created by other airline groups in an attempt to gain market share in the computer reservation system market.

The Galileo system was moved from Denver, Colorado, to the Worldspan data centre in Atlanta, Georgia, in 2008, following the merger of Travelport and Worldspan (although they now share the same data centre, they continue to be run as separate systems).

Worldspan GDS

Worldspan is a Travelport platform, and is the technology leader in web-based travel eCommerce, offering solutions for all facets of travel business online. As a leading GDS, Worldspan provides travel

distribution, technologies and services for thousands of travel companies worldwide, including travel agencies, corporations, travel suppliers and travel websites. Worldspan transforms global travel distribution and transaction processing with industry-first fares, pricing, shopping and booking technologies, and a portfolio of interactive shopping tools that enable travel companies to reduce costs, increase productivity and build revenues.

Apollo GDS

As a leading GDS, Apollo provides travel distribution, technologies and services for thousands of travel companies worldwide, including travel agencies, corporations, travel suppliers and travel web sites.

The Apollo reservation system was used by United Airlines until 2012, when it switched to SHARES, a system used by its former Continental Airlines subsidiary. Apollo is still used by Galileo International (now part of Travelport GDS) travel agency customers in the United States, Canada, Mexico, and Japan.

Abacus GDS

Abacus was founded in 1988 and became a leading provider of travel solutions and services in the Asia Pacific region. The company is headquartered in Singapore and owned by Sabre Holdings, after Sabre acquired a full stake off 11 Asian airlines who were holding a majority share.

Abacus serves more than 100,000 travel agents across the Asia-Pacific region's 59 markets and has both global and uniquely local relationships with airlines and hotels, including the leading portfolio of low-cost content and Chinese airline content.

Pegasus GDS

Pegasus strives to remove friction and create simplicity amidst an otherwise complicated environment. Pegasus Solutions pioneered the hospitality reservations industry.

The company is a market leader in the electronic processing, management, distribution, sales and marketing of hotel inventory, rates and content across different sales channels to include direct bookings via hotels' branded websites, voice, travel agents (GDS), OTAs and metasearch partners.

AIRLINE RESERVATION SYSTEMS (ARS)

Airline reservation systems (ARS) are part of the so-called passenger service systems (PSS), which are applications supporting the direct contact with the passenger. ARS eventually evolved into the computer reservations system (CRS). A computer reservation system is used for the reservations of a particular airline and interfaces with a global distribution system (GDS) which supports travel agencies and other distribution channels in making reservations for most major airlines in a single system.

Airline reservation systems incorporate airline schedules, fare tariffs, passenger reservations and ticket records. An airline's direct distribution works within their own reservation system, as well as pushing out information to the GDS. The second type of direct distribution channel is consumers who use the internet or mobile applications to make their own reservations. Travel agencies and other indirect distribution channels access the same GDS as those accessed by the airline reservation systems, and all messaging is transmitted by a standardized messaging system that functions on two types of messaging that transmit on SITA's high level network (HLN). These messaging types are called Type A [usually EDIFACT format] for real time interactive communication and Type B [TTY] for informational and booking type of messages. Message construction standards set by IATA and ICAO, are global, and apply to more than air transportation. Since airline reservation systems are business critical applications, and they are functionally quite complex, the operation of an in-house airline reservation system is relatively expensive.

Prior to deregulation, airlines owned their own reservation systems with travel agents subscribing to them. Today, the GDS are run by independent companies with airlines and travel agencies being major subscribers.

As of February 2009, there are only four major GDS providers in the market: Amadeus, Travelport (which operates the Apollo, Worldspan and Galileo systems), Sabre and Shares. There is one major Regional GDS, Abacus, serving the Asian market and a number of regional players serving single countries, including Travelsky (China), Infini and Axess (both Japan) and Topas (South Korea). Of these, Infini is hosted within the Sabre complex, Axess is in the process of moving into a partition within the Worldspan complex, and Topas agencies will be migrating into Amadeus.

Reservation systems may host "ticket-less" airlines and "hybrid" airlines that use e-ticketing in addition to ticket-less to accommodate code-shares and interlines.

In addition to these "standardized" GDS, some airlines have proprietary versions which they use to

run their flight operations. A few examples are Delta's OSS and Deltamatic systems and EDS SHARES. SITA Reservations remains the largest neutral multi-host airline reservations system, with over 100 airlines currently managing inventory.

Under airline reservation system we have

- SCHEDULES AND AVAILABILITY
- FARE QUOTES
- PASSENGER INFORMATION
- TICKETING

FLIGHT BOOKING

Today, when a traveler or a travel agent books a flight, they have a choice: Use either an indirect or direct booking channel. The first one includes OTAs, like Expedia or Priceline, GDS, if an agent books for the traveler, or metasearch engines, like Kayak or Skyscanner. The second option is a direct booking from an airline website. The choice of booking channel – indirect or direct – determines the slight difference in the process.

1. Flight search

Indirect channel: OTA**, GDS, metasearch engine.** A user looks for the right flight via a flight booking engine on a third-party website or via a GDS terminal. As the flight is chosen, a third-party sends the request to the GDS, which accesses the airline's CRS.

Direct channel: Airline eCommerce website. If a traveler books directly from the provider, the process skips the whole GDS part and goes straight to the CRS.

2. Reservation management

CRS' basic functions are inventory and reservation management, passenger name record (PNR) generation, payment gateway integration, customer information management, booking and cancellation management, refund management, and email notification. While booking a flight, a customer can select a seat right away, but as a rule, airlines charge an additional price for this. Otherwise, the seat can be selected during online check-in or be randomly assigned. After a user pays for the ticket, the system generates a passenger name record (PNR).

What is PNR (Passenger Name Record)?

Passenger name record (PNR) is a personal code that contains a traveler's information and itinerary. Depending on the booking source, it's created either by an airline's CRS or a GDS. The PNR is generated based on a passenger's personal information, contact details, ticket number, and itinerary. An airline uses a PNR to easily track the passenger's record and exchange information between different airlines. We will discuss its use a little bit later.

Ancillary booking

Ancillary revenue reached $65 billion worldwide in 2018, remaining a major source of airline revenue, especially for low-cost carriers. Additional service booking and distribution are handled via Merchandising Systems that we mentioned earlier.

3. Choosing additional services

Ancillary services include an ability to reserve a particular seat, additional baggage, extra legroom, or in-flight meals. When a traveler adds ancillary services during the booking, a Merchandising System generates special service request number (SSR). It's a message to the supplier with a request for any ancillary service that's usually included in the ticket.

Besides selling extra services, Merchandising Systems are also responsible for dynamic pricing and discount offers. Some systems also include such services as changing the date and name on the ticket. An example of such a system is a Global Merchandising System by Amadeus. It can retrieve a traveler's PNR and amend it for a fee.

4. Using loyalty programs

Loyalty program operations are usually managed by airline merchandising systems, too. Being a member of a frequent-flyer or airline loyalty program, a passenger can use earned miles accumulated from each flight, or points for purchasing extra services from airlines. These points can be exchanged for discounts or benefits, like upgrading to business class. Depending on the airline, customers can either log in via their accounts while purchasing tickets directly from an airline website or get a loyalty program participant's number to use for booking from a third-party. Also, these systems keep a particular number of places for frequent flyers reserved in CRS.

Fares and payment

To receive a ticket with a PNR (sometimes called a booking confirmation number), a traveler must pay the fare. A fare is the amount of money a person must pay for the seat, taxes, and third-party service fee if any. The fare can also include a charge for ancillary services.

The allocation of fees between airlines, GDSs, OTAs, and customers works the following way:

1. Airlines pay GDSs for distribution
2. GDSs then pay OTAs to close the sale
3. Travel agents booking from the GDS terminal pay a fee for using its service
4. Customers booking via an OTA sometimes pay a service fee

If it's direct booking, a customer pays the airline's payment gateway directly and as soon as the payment is processed, a CRS is notified and generates a booking confirmation number. If the booking is made via OTA or metasearch website, they use their own payment gateway.

5. Payment processing

A payment gateway is a third-party service that not only processes all financial operations between customer and merchant, it also ensures data safety. The main operations of a payment gateway are authorization (checking that a user has enough money to pay), capture (sending the funds to the merchant's account), sale (regular payment for purchases), a refund (money return), and void (a refund for not-captured funds). The advantage of this service is that a customer can book and pay in one place, but a big disadvantage is that all the processes like cancelation and refund are completed through the OTA side, not through the CRS. And one more disadvantage for travelers: When booking via OTAs, they pay an additional fee.

As soon as the payment was processed by the payment gateway, the airline's CRS can generate a booking confirmation number and issue an electronic version of a ticket. Let's take a look at this process.

Ticketing

The flight ticket is an agreement between a traveler and a carrier. It makes ticketing a key part of this process. Obviously, there's no chance to get on a flight if there's something wrong with a ticket, like an incorrect name entered.

6. Personal name record (PNR) generation

Ticketing is a different concept from booking. Ticketing means that the seat is paid for, it won't be taken, and it belongs to a particular person. This is ensured by a PNR. It's a 6-digit code on an e-ticket that allows airlines to validate the booked seat. If it's a trip that consists of several flights by different airlines, an interline booking occurs. For such cases, airlines create an interline commercial agreement for code shared flights. Regarding this agreement, different airlines issue a single ticket with one PNR, which is issued by one of the airlines as defined by an agreement.

INFLIGHT SYSTEMS

INFLIGHT COMMUNICATION SYSTEM

There has to be continues communication not only inside the aircraft but also by the aircraft as well on ground staff, baggage handling staff, and engineering staff, etc….So it has to have complete communication and that's why aircraft is completely ready to take off when the communication system is clear and effective between all the different department working in aviation.

INFLIGHT ENTERTAINMENT SYSTEMs

AIRLINE CREW SCHEDULING SYSTEM

Flight Crew scheduling software streamlines the entire process of managing the Cockpit and Cabin Crew assignments. The solution covers support for:

- Manpower Planning
- Pairing Creation
- Automatic Rostering and Control
- Crew Tracking
- Crew Records Management
- Custom Reporting

Manpower Planning

A wealth of features ensures that the right Crew with the right qualifications is in the right place at the right time. This system assures that the schedules do not conflict with various kinds of constraints, and that they comply with laws and regulations.

Crew preferences and requests are handled and taken into consideration before publishing the schedules. The integration with software Flight Time enables the Scheduler to simulate different future scenarios.

Pairing Creation

Interactive pairing construction includes all flying and non-flying activities, legality checks, crew complement, pairing series days and date range, pairing qualifications and e.g. hotel requirements and booking information to show any crewmembers not staying at the default hotel. It is possible to create series throughout the entire season.

Automatic Rostering and Control

Automatic rostering is all about balancing block hours, duty hours, preferred destinations, standby etc., using pre-assigned credit (rostering) values to non-flying activities and vacation etc. as a balancing value.

This feature handles display of 'Requests' on roster display and a rostering 'Restart' capability, if required. There is a 'Pin Mode' for locking selected pairings and/or activities to rosters (training etc.) and a manual rostering, both methods of rostering use a 'fair and equal' assignment.

Automatic Rostering and Control handles user definable activity categories and activity types (ground duties, days off, vacation and deadheading, etc.) and define colors for all activities are user definable at the time of creation and amendable at any time later.

Crew Tracking

Crew tracking system makes the entire process of managing the cockpit and cabin crew assignment more efficient and much simpler The applications cover pairing creation, roster construction and control, crew tracking and crew records. The crew schedulers are ensured that the right crew with the right qualifications is in the right place at the right time. This system is able to handle simultaneously various kinds of constraints within the schedule assuring high efficacy and complying with laws and regulations.

Crew Portal

An additional web module provides all the desirable features to Crew Members to view their own Rosters, personal information, communicate with Planners and much more.

POINT OF SALE SYSTEM

Point of sale (POS) refers to the place where customers execute payments for goods or services.

Airline POS

In-Flight POS Framework is an automated framework for managing all on-board F&B, merchandise and duty-free sales. It automates the process of inventory management enabling quicker order processing and provides crew with real-time inventory and passenger updates.

POS software for airlines

Airlines use POS software on their website, at counters, and for third-party sellers, so that all the sales made can be integrated centrally and so that the available stock of flight seats are sold at optimal prices.

Airlines often also provide other value-added services like premium seat upgrades, on-flight shopping, payable food & beverages, extra baggage, etc. All this changes from one location to another and from one flyer to another.

POS software for airlines is versatile software, whose products, categories, sub-categories, etc. can be customized to make the software suit the services and business environment of an airline.

Best POS practices for airlines

Airlines face a lot of competition from other operators on the same routes, and hence they are always looking for ways to engage their customers effectively, so that they can earn healthy revenue and grow over time.Airline POS software are used to accomplish various operations and revenue-related goals. Here are a few best POS practices followed by airlines around the world:

1. Up sell to customers at point of sale and in flights
2. Offer rewards and premium services to loyal customers
3. Send valuable information and offers to registered customers
4. Manage revenue by assessing and forecasting demand for a defined time period
5. Centralizing selling of seats available between destinations
6. Allowing third-party sellers to use stock and price data
7. Record all customer data to support business analysis and marketing effort

LPOS billing software for airlines help managers achieve their business goals through various intuitive and sophisticated POS features:

1. Automatic addition of all customer and sales data to the system
2. Manage revenue by set prices as per demand
3. Manage inventory and allow access to available products and seats to all sales staff including agents and third-parties
4. Manage staff engagement in sales by studying their sales contribution
5. Product management by setting categories, sub-categories, prices, taxes, stock, etc.
6. Easy set up of POS with multiple points of sale across multiple outlets
7. Set up payment options—cash, debit/credit card, PayPal, and credit
8. Access to order and payment logs by managers and staff
9. Creation of promotions and discounts for registered or all customers
10. E-commerce add-on to sell services and products online
11. Loyalty add-on to run loyalty programs to retain customers and attract new ones

CHECK IN SYSTEM

The airport check-in is the first procedure that needs to be done in order to check the identity ofthe guest and make the guest to board the flight. Passenger submits the baggage that they don'twant to carry in the aircraft cabin and gets a boarding pass. Check-in time varies from 15minutesto 4hours depending upon the flight and the destination. Passenger can also ask for specialpreferenceslikeseatingpreference,changingoftheirseatsetc.duringcheckinprocess.

CHECKINPROCEDUR

a) Registration Process

This is done to identify passenger's identity and to check that the passenger has carried all necessary and valid documents for example passport, visa and travel tickets etc.

b) Registration of Baggage

Registration of baggage is very important in order to ensure the safety and security of the passenger, aircraft and airport. The baggage is scanned and tagged to ensure that it does not contain any dangerous or harmful items.

c) Self Service Bag Drop Procedure

Nowself-baggagedropserviceisalsoprovidesbyanumberofairlinesinordertosavepassengers time. In this type of service, the passenger has to reach the airport 25 minute prior to the departure time. Passengers come with their baggage and check-in at the self-service kiosks with baggage. Then passengers attach tag to the baggage and pass the baggage in the drop belt.

d) Registration of Seat

During the check-in the passengers can put their request for their choice i.e. the window or aisles eat as they wanted, unless these at is already selected.-

Online Check-In

Nowadays most of the passengers would like to check-in through online medium, they can print their own boarding passes with the help of using Internet online. Passenger can also set their meal preference, seating preference and baggage quantity online.

It also saves passengers time, otherwise passenger's need to check-in into the airport for Document at ionor verification of their documents, which is to be done at the airlines counter at the airport.

Online Check-in process open in some airlines before 24hours or before 15days, it depends upon the policies of airlines.

Mobile Check-in

Nowwiththeadvancementoftechnologyandincreasinguseofmobilesphonesandapplicationsairlines madeiteasyto check-in using passenger's mobile phone.

Airlines ends passengers boarding pass to passenger mobile device.

Somes end electronic confirmation with barcode, which needs to scan a the kiosk to continue check-in process at the airports.

Lounges Access and Premium Check-in

Lounge access and premium check-in is given to those passengers who carry a first or business class ticket or a member of frequent flier program.

For e.g. Air New Zealand Auckland International provides premium check-in lounge and gives direct access to check-in counter

BAGGAGE HANDLING SYSTEM

A baggage handling system (BHS) is a type of conveyor system installed in airports that transports checked luggage from ticket counters to areas where the bags can be loaded onto airplanes. A BHS also transports checked baggage coming from airplanes to baggage claims or to an area where the bag can be loaded onto another airplane.

A bag is entered into the baggage handling system when an airline agent, or self check system, assign the luggage a tag with a unique ten digit barcode. Airlines are also incorporating RFID chips into the tags to track bags in real time and to reduce the number of mishandled bags. The BHS will then scan and sort the bags by airline. Then a series of diverters along the conveyor belt will direct the bags into the baggage handling area.

Although the primary function of a BHS is the transportation of bags, a typical BHS will serve other functions involved in making sure that a bag gets to the correct location in the airport.

In addition to sortation, a BHS may also perform the following functions:

- Detection of bag jams
- Volume regulation (to ensure that input points are controlled to avoid overloading system)
- Load balancing (to evenly distribute bag volume between conveyor sub-systems)
- Bag counting
- Bag tracking
- Automatic Tag Reader (ATR) (Reads the tags on the luggage provided by the airlines)

After the bags are checked and tagged

They are usually put on a baggage belt conveyor system.

Bag belt systems take bags from skycap or ticket counters and transport them to the baggage makeup area(BMA).

Airline employees in a baggage make up area sort baggage by flight numbers and destinations and place them into carts or other conveyor systems to transport the baggage to the aircraft.

At the aircraft baggage is further sorted for loading and unloading purposes.

(bags going only to the aircrafts destination are loaded in one section, usually called local baggage)

(bags that are going to a connecting flight are loaded into another section, usually called connect bags).

Massages are send to the destination city after the plane takes off, telling where the different bags have been loaded

CARGO SYSTEM

Cargo

The items or goods carried by the aircraft from one place to another are termed as cargo. It can also include perishable goods for e.g., Food (Fish, Meat, Poultry, Curd, Milk, Fruits), flowers etc. It also includes precious goods like Diamond, Gold, Currency, Platinum and precious Stones etc. Other things that come under cargo are Mobiles, Computers, Electronics Goods and Live Animals like Cats, Dogs, Birds and Horses etc.

AIR CARGO OPERATIONS

Air cargo is any property carried or to be carried in an aircraft. It allows the transport of goods quickly by air.

Thereare2typesof air cargo, General and Special Cargo.

General Cargo

It includes high value goods, such as electronics, jewelry and pharmaceuticals.

Special Cargo

Special cargo requires special conditions for transporting goods, such as temperature control,

certain air conditions or protected casing (eg, if the goods are hazardous and live-stock).

ADVANTAGES;

Time, Reliable, Low Insurance Premium, Secure, Less Ware -Housing Requirements

Cargo Exporting Procedure

1. Pickup

Pick-up the cargo and send it into the airport.

2. Confirmation and Labeling

After being picked up the quantity and condition of the freight is confirmed. The freight is thenlabeledwiththosedetailsalongwithanairwaybillandisthentransportedtoabondedwarehouse.

3. Custom Clearance
4. Customs Approval

If there are no issues with the declaration, customs approval is granted.

If a customs inspection is deemed necessary, the cargo will undergo a sampling or complete inspection.

5. Stowage

Cargo granted export approval is stow Edina ULD container to be loaded onto an aircraft.

6. Loading and Departure

Cargo is passed to the airline, responsible for transportation then loaded on to the aircraft awaiting departure.

Cargo Importing Procedure

1. Arrival

Cargo is unloaded from the air-craft.

2. Confirmation

Unloaded cargo is confirmed for the quantity and condition.

3. Relocation

The confirmed cargo is transported to abounded warehouse.

4. Customs Clearance

5. Customs Approval

If there are no issues with the declaration, customs approval is granted.

If the custom inspection is deemed necessary the cargo will undergo a sampling or complete inspection.

6. Delivery

Cargo granted import approval is loaded and delivered to customers.

TRAVEL DISTRIBUTION SYSTEM

The travel distribution system is a complex, global network of independent businesses. This network includes a series of distributors or intermediaries, who play a specific role in the development, promotion and purchasing process of tourism experiences

a) Inbound tour operator (ITO)
b) Online travel agent (OTA)
c) Whole- salers
d) Retail travel agencies
e) Direct to consumer

INBOUND TOUR OPERATORS

An inbound tour operator (ITO), also known as a ground operator or destination management company (DMC), is an Australian based business that provides itinerary planning and product selection, and coordinates the reservation, confirmation and payment of travel arrangements on behalf of their overseas clients. They bring the components of accommodation, tours, transport and meals together to create a fully inclusive itinerary. ITOs are the link between Australian tourism products and the overseas travel distributors that buy them, including travel wholesalers, direct sellers, travel agents, meeting planners and event planners

ONLINE TRAVEL AGENTS

Online travel agents (OTAs) specialise in online distribution and have no intermediaries – they deal directly with consumers and tourism product. Consumers can purchase a product or an entire holiday package online. Online distribution is less structured than the traditional travel distribution system. Commission levels vary, depending on how the site is operated

MEETING & INCENTIVE PLANNERS

The business events sector is one of the highest yielding inbound tourism segments. Meeting and incentive planners organise and manage all aspects of meetings and events including conventions, conferences, incentives, seminars, workshops, symposiums, exhibitions and special events.

Meeting and incentive planners use a wide variety of venues, tour operators, accommodation, team building companies and restaurants. They look for unique travel experiences and require different support and facilities to leisure tourism. Meeting and incentive planners are also known as: Professional Conference Organisers (PCO); Destination Management Companies (DMC); Conference Managers; Event Managers; Incentive Houses; Travel Fulfillment Companies; and Special Project Managers.

WHOLESALERS

Wholesalers are located in overseas markets and have traditionally provided a link between travel agents and ITOs or tourism product. Wholesalers purchase programs developed by ITOs or develop their own packages and itineraries for travel agents and consumers. These packages will usually offer transport, accommodation, tours and attractions. In some markets, wholesalers are also ‘direct sellers’ who bypass travel agents to directly target consumers. In other markets, there are no wholesalers in the traditional sense and travel agents perform both roles. Traditionally, travel packages are published in brochures and promoted and distributed via retail travel networks. Wholesalers may operate their own retail outlets or work with an established network of travel agents in their own country. Many wholesalers specialized in specific market segments

such as adventure or the seniors' market and many also have an online presence.

RETAIL TRAVEL AGENTS

Retail travel agents offer wide distribution in prominent shop front locations and a convenient place for travelers to make bookings and buy holidays. Traditionally, retail travel agents have provided a link between the wholesaler and consumers. With the integration of distribution roles, the retailer may deal directly with ITOs or Australian based products, particularly in Asian markets. Many retail travel agents belong to a larger chain of travel agencies or consortiums that use their combined resources to market the agency brand. In some countries, retail agencies may be operated by travel wholesalers, or may concentrate on particular market segments such as special interest or family travel. Many retail travel agents also have an online presence.

ONLINE TRAVEL AGENCIEs

The role of an online travel agency (OTA) is becoming increasingly important in the accommodation industry as they provide a convenient way for travelers to arrange their stay. From the comfort of their home, travelers can compare hotel prices and book them over the internet.

How Do Online Travel Agencies Work?

OTAs generally work on two models. They are,

1. Merchant Model

In this model, hotels sell rooms to OTAs at a discounted or wholesale price. Then, the OTA sells them to the customer at a markup price

2. Agency Model

This is a commission-based model where OTAs acts as a distribution partner. OTAs receive full commission after the stay has taken place. The hotel directly receives the payment from the end customer and does not wait for the payment transfer from third-party distributors.

Advantages of Online Travel Agents

- Low-cost method of selling accommodation services

- Reduced online marketing spend as OTAs invest in advertising to attract potential customers
- Impartial reviews give customers the confidence to book
- Users can easily compare various accommodation costs at one place

Disadvantages of Online Travel Agents

- Commission rates are charged on every sale. It can range between 10-15% of the gross cost
- Restrictive cancellation terms
- Even if accommodation businesses use OTAs, the need for their own website and booking engine does not go away
- Investment in a balanced multi-channel strategy may be needed to boost sales

Online Travel Agents

1. Booking.com

Booking.com is one of the largest accommodations websites which has now expanded to smaller markets such as family-operated bed and breakfast, vacation rentals and self-catering apartments.

2. Expedia's Hotels.com

Expedia's Hotels.com is a popular brand which has a global audience and attracts diverse travelers. The company gained more power in the industry by acquiring Travelocity.

3. Airbnb

Airbnb revolutionized the travel accommodation industry by introducing home-sharing. The website has diverse listings and travelers get a sense of safety as they can know their guest's identity.

Apart from these major OTAs, there are many small ones such as One Travel, Vayama, Tripsta, Travel Merry, Explore Trip, Kiss&Fly, Webjet, GoTo Gate, Travel genio, Book airfare, Fare

boom, Sky booker, Travel2be, One Two Trip, and e-Bookers.

Disintermediation

The term disintermediation refers to the process of cutting out the financial intermediary in a transaction. It may allow a consumer to buy directly from a wholesaler rather than through an intermediary such as a retailer, or enable a business to order directly from a manufacturer rather than from a distributor. In the financial industry, it is seen when an investor is able to buy stock directly rather than through a broker or a financial institution. The purpose of disintermediation is usually to cut costs, speed up delivery, or both.

Reintermediation

Reintermediation is the reintroduction of an intermediary between a goods producer and consumers. While disintermediation removes elements form the supply chain, reintermediation adds new elements to the supply chain. Reintermediation occurs due to many issues associated with the e-commerce disintermediation model, mostly involving issues with the direct-to-consumer model.

Module 5

ICT in Destination and Hospitality Management

Information Communications Technologies (ICT) plays a major role in the tourism, travel, and hospitality industry.

The Integration of ICT in the tourism industry is essential for the success of tourism enterprises. ICT facilitates an individual to access the tourism products information from anywhere at any time.

Meaning

It is the infrastructure and components that enable modern computing.

Introduction

1. Information communication technologies (ICTs) have been transforming tourism globally.
2. The ICT driven re-engineering has gradually generated a new paradigm shift, altering the industry structure and developing a whole range of opportunities and threats.
3. ICTs empower consumers to identify, customize and purchase tourism products and support the globalization of the industry by providing tools for developing, managing and distributing offerings worldwide.
4. Increasingly ICTs play a critical role for the competitiveness of tourism organizations and destinations.
5. ICTs are becoming a key determinant of organizational competitiveness.
6. The enhancements in ICTs' capabilities, in combination with the decrease of the size of equipment and ICTs' costs, improved the reliability, compatibility and interconnectivity of numerous terminals and applications.
7. ICTs provide a powerful tool that can bring advantages in promoting and strengthening the tourism industry's strategy and operations.

The Role of ICT in Tourism

1. Effective and high-speed ICT infrastructure and software applications in the tourism and hospitality industry are crucial for tourism development.
2. ICTs allow customer - management relations and supply chain management to be combined into a single source that facilitates a variety of operations - product selection, ordering, fulfillment, tracking, payment and reporting to be performed with one easy-to use tool.

3. ICTs ultimately cut costs by enabling the provider to be in direct contact with the consumer and also impact employment through the need for required maintenance of ICT equipment.
4. Management within tourism companies use ICTs to undertake a range of tasks that enhance the efficiency of employees in the workplace, notably online reservations.
5. The development of ICTs has also led to changes in demand and supply.
6. A higher demand for flexible, individualized options and quality of information has personalized leisure and tourism behavior, a consequence of increased ICT use.
7. Through new technology and social and economic ratings (e.g., social media platforms like Facebook, Twitter, blogs) customers have the ability to share information and research ratings on destination, quality of service in hotels and restaurants and environmental and social conditions.
8. Number of hotels (e.g., Marriot Hotels and Resorts, Ritz Carlton Hotels, Hyatt Hotels and Resorts) have strengthened their brand image and communicate directly with their customers by posting links to a press release or promoting new package through Twitter.

E-Hospitality

ICTs have penetrated hospitality management at a fast pace, integrating the hotel operations, reshaping the marketing function, improving total efficiency, providing tools for marketing research and partnership building, and enhancing customer services, while also providing strategic opportunities. In addition, consumers increasingly expect ICT facilities in their rooms; internet access via the television set and data ports have become standard for higher hotel categories. The Internet has improved the hotel representation and reservation processes dramatically. Bookings through the web is particularly convenient for customers who frequent the hotel as that provides an efficient and effective communication mechanism. The greater the capacity, number of departments, transactions, arrivals, departures and reservations, the greater the need for technologies to facilitate the processes. Further integration between PMSs and Hotel CRSs can improve efficiency, facilitate control, reduce personnel and minimize the response time to both customers and management requests.

E-Destinations

Destination management System (DMS) have been used to integrate the entire tourism supply at the destination. Their contribution to strategic management and marketing is demonstrated by their ability to integrate all stakeholders at destinations and to reach global market.DMS offering innovative information and sometimes facilitating reservations. Destination Integrated

Computerized Information Reservation Management Systems (DICIRMS) address entire range of needs and services required by both tourism enterprise and consumers for specific destinations. DICRIMS provide the infostructure for communications and business processes between all stake holders, including consumers, principals, distributors and destination marketing organizations.

Property Management System

- It is software that facilitates a hotel's reservation management and administrative tasks.
- It is software that acts as a centralized computer system for organizing, scheduling and managing the day to day functions of an accommodation business.
- The most important functions include front-desk operations, reservations, channel management, housekeeping, rate and occupancy management, and payment processing.
- Although PMS software mostly controls reservation and financial transactions, it may allow you to manage housekeeping and perform human resources management as well.
- PMS facilitates the main processes in a hotel related to internal and external operations.

Functions

The key functions of a good PMS should include:

f) Reservation management
g) Front desk operations management
h) Channel management integration
i) Mobile apps
j) Marketing support
k) CRM & guest communication
l) Housekeeping management
m) Maintenance management
n) Accounting and revenue management

Main modules of PMS

A modern property management system combines multiple work environments in a single piece of software. Depending on the provider, the combination of modules and functions can vary, and the functionality of one module can be slightly different. Additionally, some vendors sell their

systems in separate modules that can be integrated with an existing solution used by a hotel. Here is the basic structure of a hotel PMS.

- Reservation
  - For a modern hotel business, online bookings are in most cases the main sales channel.
  - The reservation module, which helps manage online bookings, effectively becomes indispensable to a property management system. A central reservation system (CRS) or any other reservation platform may be available as a separate module of PMS or implemented as a hotel's separate internal solution.
  - A hotel reservation system holds all inventory data and dates, sending this information to the front desk. The reservation system must be integrated with the website booking engine and other distribution channels. Chain hotels usually have one central reservation system for all properties, while independent hotels have their own reservation systems. If a hotel or a hotel chain already uses a particular reservation software, PMS must offer integration with the existing service.

Key functions of the reservation module include:

- **Room bookings.** The system checks room availability and status, shows free rooms across different channels and the website booking engine. This function monitors double bookings and allows group reservations. Then it schedules bookings and displays information about current and upcoming bookings on a dashboard.
- **Collection of e-payments**, and identification of types and categories of payments that are processed via this module.
- **Management of room inventory and allocation** that prevents overbookings and duplication of bookings. In some software, this function is part of a channel management module.
- **Reservation emails**. The system sends confirmations to guests after they complete booking. In some PMSs, this function is a part of the front-desk operations module.
- **Activities booking**. Some software allows guests to book not only accommodation but also activities with this system.

- Front-desk operations

1. A front-office module allows a front-desk manager to view and update room reservation status, check guests in and out, and process payments.

2. When a guest arrives at the hotel, they want to check in as fast as possible.

3. Support from a receptionist is very important in this case, so front-desk staff should have time to help the guest.

4. Some property management systems offer integration into check-in kiosks or allow checking in or out via QR code.

5. To get a better idea of check-in automation, have a look at how Marriott and other businesses leverage digital self-services in travel.

- **Room management.**

One of the capabilities that this module provides is room management. Using a front-desk module, the front-office manager can access room status and up-to-date information about all reservations, both current and upcoming. With the help of this module, room status should be updated quickly. The front-desk module allocates rooms automatically and facilitates a room change. This module includes management of electronic key cards, processing payments and issuing receipts to guests. The front-office module also allows users to perform night and shift audits.

- Channel management

Channel management software is a single interface to control and distribute inventories across different channels such as GDSs, OTAs, wholesalers, direct booking platforms, etc. A channel manager connects directly to a central reservation system that holds information about the availability and cost of hotel rooms, sharing this information via the distribution channels. It makes room inventory available to travelers who want to book a room or property online, listing rooms on different sources. Also, a channel management module facilitates booking-related transactions.

Different distribution channels expose the inventory to different audiences. For example, connection to OTAs and some airline websites allow a larger number of potential guests to be

reached, those who book flights or plan trips in advance. Metasearch sites compare prices across different channels, letting a customer make the best decision. Connections to global distribution systems assist non-leisure traveler booking as well as group reservations.

Another channel of distribution is a website booking engine. An online booking engine allows travelers to complete reservations directly via a hotel website bypassing travel agents and OTAs. It's important to allow loyal guests to book directly, and website booking must be available to those who find a hotel online. A booking engine must be synchronized with the hotel website and its central reservation system, making it an additional sales channel. Usually, this module processes payments via integrated payment gateways

- Revenue management

A PMS in and of itself is a big step towards improving hotel revenue management indicators, such as *Occupancy*, *RevPAR* (Revenue per Available Room), and *ADR* (Average Daily Rate), which mean a lot in evaluating a hotel's financial success. While GDS and OTA integration helps maximize these rates, revenue management systems help a manager understand how to adjust the processes to achieve better results and control finances. This module helps increase total revenue of rooms using forecasting to optimize occupancy, deciding whether to raise or lower inventory prices.

The revenue management module enables dynamic pricing. Using algorithms, this module helps hotels price the rooms based on historical data about past reservations as it monitors competitors' rates, weather data, and local events. It improves pricing strategies, and updates prices across all distribution channels to sell more rooms at the optimal rate. To learn more about revenue management read our article on how machine learning redefines revenue management in the hotel industry.

- Housekeeping

PMS housekeeping module connects housekeeping staff to the front office. A front-office manager can make a list of tasks to assign, and housekeepers can update room status. If this is a cloud-based PMS, housekeepers can update the status of their assignments or rooms through a mobile app or tablet. Also, this module keeps the list of maintenance tasks and reports for the users.

The main function of this module is housekeeping management and property maintenance. Housekeeping functionality includes management of room status, maid assignment for room cleaning based on a block or floor location, keeping lists of tasks for housekeepers. Maintenance management keeps the record of hotel disruptions and repairs with the further assignment of an attendant who can eliminate a problem.

- CRM and customer data management

It is critical for hoteliers to collect and organize guest data to keep in touch with current and past customers during and after check-out. The CRM module must integrate with the front desk and reservation system, collecting all guest information from these sources. It helps store guest data and provides a database in an accessible format. Also, it includes guest contact information before and after their stay. However, if a hotel already has its own CRM system, the PMS should integrate with it.

This module can also help organize marketing and promotions, measure guest experience, and pre- and post-stay services. The CRM module helps owners personalize the guest experience with membership and loyalty programs, which are especially important for hotel chains and resorts.

- Reports and analytics

To monitor current processes and understand business performance, rely on analytics. A PMS can serve as a business intelligence tool, collecting relevant data and providing hoteliers with various types of automated reports. Depending on the software, it can generate night audit reports, room and tax reports, shift audit reports, departure/arrival reports, housekeeping reports, or other ongoing reporting.

- Back-office management

This PMS module facilitates management of a hotel team, back-office operations, and administrative hotel operations. Functions of a back-office management module may include:

- Event management (conference and reception organization) and catering
- Spa and gym management
- Staff management (human resources management in back and front office: shift management, staff invoicing)

- Inventory analysis
- Sales and management of promotional campaigns
- Reviews management.
- Point-of-sale services

If there are multiple point-of-sale terminals in a hotel, this function is indispensable to handle transactions. It automates transactions and keeps financial data in one place. Most hotels have some kind of restaurant on the premises, not to mention properties with gyms and spas. With a PMS, hoteliers can include additional costs or discounts to the final bill for each customer. Additional costs may include:

- Spa, gyms, and activities
- Food and beverage services (restaurants, cafes, breakfasts)
- In-room services, mini-bar items, TV, or Wi-Fi.

Destination Management System

According to UNWTO (2007), there are already clear signs that tomorrow's successful destination and other tourism industry stakeholders will be those that adapt to the new operating environment and cater to all forms of distribution. Information and Communication Technologies (ICTs) has become the key. Tourism destinations emerge as umbrella brands and they will need to be promoted in the global marketplace as one entity for each target market they try to attract. The emerging globalization and concentration of supply increase the level of competition and require new Internet marketing strategies for destinations (Rita, 2000).

Palmer (2006) discusses that Destination Management Systems (DMS) take the development of an online destination brand beyond the stages of merely offering an online brochure, or providing an online reservation service. A DMS provides a suite of tools for managing a destination's tourism activities. This includes systems for managing information for all of the constituent tourism organizations' websites as well as sales offices, call centers, literature fulfilment and marketing functions. Many researchers agree that DMSs are strategic ICT tools that can help operators and tourism enterprises in developing countries integrate, promote and distribute tourism products and services.

According to UNCTAD (2005), the two primary functions of a destination management system are to:

1. Provide consumers with comprehensive and accurate information for the preparation of their

vacations, and with booking facilities for tourism services and products,

2. Provide tourism enterprises with the means to be better integrated into the tourism supply chain by organizing and promoting personalized and enriched tourism experiences.

System Operation

The primary goal of the system is to function as the main channel of distribution of information and reservations on all major aspects of tourism in India. The objectives of the system are:

1. To make it easier for a tourist to choose as a destination;
2. To improve visitor servicing while in India

The system is supposed to have two main functions:

To make tourist information about India more available in the marketplace and

To facilitate communication between the service providers and tourists

The DMS forms a large network, with the provincial tourism departments all participating in the formulation of overall marketing strategy and policy.

ICT Supports Virtual Networking at Destinations

The use of ICT creates new networking opportunities at both the informational and the transactional level. Numerous processes in the tourism value creation chain can be performed virtually with the help of Internet, Intranet or Extranet solutions. The virtual value creation chain therefore no longer consists of sub processes conducted linearly. Instead, it represents a freely-configurable matrix with a number of starting points (Morris and Morris, 2002). Among the numerous descriptions and definitions to be found in the literature, the following is especially appropriate for this paper: “A tourism network system is the one that compromises a multiplicity of autonomous, interdependent, enterprises without physical borders of separation from the environment, that rely on the Internet infrastructure to integrate and exchange value” (Ndou and Passiante 2005: 440-451).

The primary objective of a Virtual Tourism Network should lie in the creation of a sustainable win-win partnership (Hakolahti and Kokkonen, 2006), in which the partners involved can interact dynamically, creatively and proactively. Such networks are characterised by a healthy blend of cooperation and competition in which the provision of up-todate content plays an essential role. However, the desired common use of information can only be efficient and available widely if all enterprises can participate in the network with a minimum of expenditure and cost. This requires an innovative, but easy-to-use system. In this context, a trend toward open platforms and standards can be observed (Ndou and Passiante, 2005). As a prerequisite for

the implementation of an innovative and successful VTN, a radical change in thinking and acting on the part of organisations is necessary, along with the establishment of new business models. Increasing tendencies towards integration ensure that even SMEs can no longer cut themselves off from these developments.

The European Commission indicated as early as 2003 that SMEs must prepare themselves mentally and technologically for participation in virtual networks (European Commission, 2003). Particularly organizations with complex structures, as are often found among destinations, can gain time-related, monetary and qualitative advantages along with increased flexibility through virtual networking (Ndou and Petti, 2004). Consequently, it is not surprising that most of the established Virtual Tourism Networks (VTN) can be found at the destination level. Contemporary literature regularly refers to Destination Management Systems.

GIS Application in Tourism and Hospitality Industry

Since tourism has a close relationship with space and geography, using geographic information systems (GIS) in tourism and hospitality research and marketing practice seems both relevant and potentially effective. However, GIS applications, especially in tourism and hospitality marketing, have been limited to date, presumably because of a lack of familiarity with GIS and its benefits.

GIS Applications in the Tourism and Hospitality Industry explores the applications of GIS to the leisure travel industry, specifically the importance of GIS in trip planning, online bookings, and location-based services. Highlighting coverage on a wide range of topics such as cultural heritage tourism, geospatial collaborative tourism recommender systems, and decision support systems.