DR.J.VIDHYA, ASSISTANT PROFESSOR, DEPT.OF BUSINESS ADMINISTRATION
GOVERNMENT ARTS AND SCIENCE COLLEGE, MANALMEDU
vidhyajawahar2007@gmail.com

BBA– I YEAR II SEMESTER 16CCBB4 - MATHEMATICS &STATISTICS FOR MANAGERS E-LEARNING MATERIAL

I - UNIT

In calculus, **differentiation** finding is one of the two important concepts apart from integration. It is a method of the derivative of a function or instantaneous rate of change in function based on one of its variables. If x is a variable and y is another variable, then the rate of change of x with respect to y is given by dy/dx.

Functions are generally classified in two categories under Calculus, namely:

(i) Linear functions

(ii) Non-linear functions

A linear function varies with a constant rate through its domain. Therefore, the overall rate of change of the function is the same as the rate of change of a function at any point.

However, the rate of change of function varies from point to point in case of non-linear functions. The nature of variation is based on the nature of the function.

The rate of change of a function at a particular point is defined as a **derivative** of that particular function.

Differentiation in Calculus

Differentiation, in terms of calculus, can be defined as a derivative of a function regarding the independent variable and can be applied to measure the function per unit change in the independent variable.

Let y = f(x) be a function of x. Then, the rate of change of "y" per unit change in "x" is given by:dy / dx

If the function f(x) undergoes an infinitesimal change of h near to any point x, then the derivative of the function is defined as

limh→0f(x+h)–f(x)h

When a function is denoted as y=f(x), the derivative is indicated by the following notations.

1. **D(y) or D[f(x)]** is called Euler's notation.
2. **dy/dx** is called Leibniz's notation.
3. **F'(x)** is called Lagrange's notation.

Differentiation is the process of determining the derivative of a function at any point.

Differentiation Formulas

Some of the important Differentiation formulas in differentiation are as follows.

1. If f(x) = tan (x), then f'(x) = sec^2x
2. If f(x) = cos (x), then f'(x) = -sin x
3. If f(x) = sin (x), then f'(x) = cos x
4. If f(x) = ln(x), then f'(x) = 1/x
5. If f(x) = ex, then f'(x) = ex
6. If f(x) = xn, where n is any fraction or integer, then f'(x) = nxn−1
7. If f(x) = k, where k is a constant, then f'(x) = 0

DR.J.VIDHYA, ASSISTANT PROFESSOR, DEPT.OF BUSINESS ADMINISTRATION
GOVERNMENT ARTS AND SCIENCE COLLEGE, MANALMEDU
vidhyajawahar2007@gmail.com

Differentiation Rules

Some of the basic differentiation rules that need to be followed are as follows.

(i) Sum or Difference Rule

If the function is sum or difference of two functions, the derivative of the functions is the sum or difference of the individual functions, i.e.,

If f(x)=u(x)±v(x)

then, f'(x)=u'(x)±v'(x)

(ii) Product Rule

As per the product rule, if the function f(x) is product of two functions u(x) and v(x), the derivative of the function is,

If f(x)=u(x)×v(x)
then, f′(x)=u′(x)×v(x)+u(x)×v′(x)

(iii) Quotient rule

If the function f(x) is in the form of two functions [u(x)]/[v(x)], the derivative of the function is

If, f(x)=u(x)v(x)
then, f′(x)=u′(x)×v(x)–u(x)×v′(x)(v(x))2

(iv) Chain Rule

If a function y = f(x) = g(u) and if u = h(x), then the chain rule for differentiation is defined as,

dydx=dydu×dudx
This plays a major role in the method of substitution that helps to perform differentiation of composite functions.

II-UNIT =MATRIX

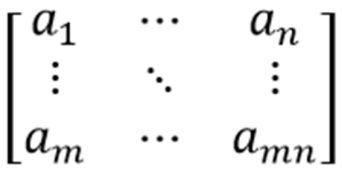
A **matrix** is simply a set of numbers arranged in a rectangular table.

A **determinant of a matrix** represents a single number. We obtain this value by multiplying and adding its elements in a special way. We can use the determinant of a matrix to solve a system of simultaneous equations.

Matrices Definition

Matrices are the ordered rectangular array of numbers, which are used to express linear equations. A matrix has rows and columns. we can also perform the mathematical operations on matrices such as addition, subtraction, multiplication of matrix. Suppose the number of rows is m and columns is n, then the matrix is represented as m × n matrix.

DR.J.VIDHYA, ASSISTANT PROFESSOR, DEPT.OF BUSINESS ADMINISTRATION
GOVERNMENT ARTS AND SCIENCE COLLEGE, MANALMEDU
vidhyajawahar2007@gmail.com



Types of Matrices

There are different **types of matrices**. They are:

- Row matrix
- Column Matrix
- Rectangular matrix
- Triangular matrix
- Square matrix
- Scalar matrix
- Diagonal matrix
- Identity matrix
- Transpose of a matrix
- Null matrix

Inverse of a Matrix

Inverse of a matrix is defined usually for square matrices. For every m × n square matrix, there exists an inverse matrix. If A is the square matrix then A^{-1} is the inverse of matrix A and satisfies the property:

$AA^{-1} = A^{-1}A = I$, where I is the Identity matrix.

Also, the determinant of the square matrix here should not be equal to zero.

Definition of Determinant

A determinant can be defined in many ways for a square matrix.

The first and most simple way is to formulate the determinant by taking into account the top row elements and the corresponding minors. Take the first element of the top row and multiply it by it's minor, then subtract the product of the second element and its minor. Continue to alternately add and subtract the product of each element of the top row with its respective minor until all the elements of the top row have been considered.

For example let us consider a 4×4 matrix A.

DR.J.VIDHYA, ASSISTANT PROFESSOR, DEPT.OF BUSINESS ADMINISTRATION
GOVERNMENT ARTS AND SCIENCE COLLEGE, MANALMEDU
vidhyajawahar2007@gmail.com

$$A = \begin{bmatrix} m & n & o & p \\ q & r & s & t \\ u & v & w & x \\ y & z & a & b \end{bmatrix}$$

Now its determinant |A| is defined as

$$|A| = \begin{vmatrix} m & n & o & p \\ q & r & s & t \\ u & v & w & x \\ y & z & a & b \end{vmatrix}$$

$$= m \begin{vmatrix} r & s & t \\ v & w & x \\ z & a & b \end{vmatrix} - n \begin{vmatrix} q & s & t \\ u & w & x \\ y & a & b \end{vmatrix} + o \begin{vmatrix} q & r & t \\ u & v & x \\ y & z & b \end{vmatrix} - p \begin{vmatrix} q & r & s \\ u & v & w \\ y & z & a \end{vmatrix}$$

III UNIT- STATISTICS

MEANING AND DEFINITIONS OF STATISTICS

In the beginning, it may be noted that the word 'statistics' is used rather curiously in two senses plural and singular. In the plural sense, it refers to a set of figures or data. In the singular sense, statistics refers to the whole body of tools that are used to collect data, organise and interpret them and, finally, to draw conclusions from them. It should be noted that both the aspects of statistics are important if the quantitative data are to serve their purpose. If statistics, as a subject, is inadequate and consists of poor methodology, we could not know the right procedure to extract from the data the information they contain. Similarly, if our data are defective or that they are inadequate or inaccurate, we could not reach the right conclusions even though our subject is well developed.

A.L. Bowley has defined statistics as: (i) statistics is the science of counting, (ii) Statistics may rightly be called the science of averages, and (iii) statistics is the science of measurement of social organism regarded as a whole in all its mani- 3 festations. Boddington defined as: Statistics is the science of estimates and

probabilities. Further, W.I. King has defined Statistics in a wider context, the science of Statistics is the method of judging collective, natural or social phenomena from the results obtained by the analysis or enumeration or collection of estimates.

TYPES OF DATA AND DATA SOURCES

Statistical data are the basic raw material of statistics. Data may relate to an activity of our interest, a phenomenon, or a problem situation under study. They derive as a result of the process of measuring, counting and/or observing. Statistical data, therefore, refer to those aspects of a problem situation that can be measured, quantified, counted, or classified. Any object subject phenomenon, or activity that generates data through this process is termed as a variable. In other words, a variable is one that shows a degree of variability when successive measurements are recorded.

In statistics, data are classified into two broad categories: *quantitative data and qualitative data.* This classification is based on the kind of characteristics that are measured.

IMPORTANCE OF STATISTICS IN BUSINESS

There are three major functions in any business enterprise in which the statistical methods are useful. These are as follows:

(i) The planning of operations: This may relate to either special projects or to the recurring activities of a firm over a specified period.

(ii) The setting up of standards: This may relate to the size of employment, volume of sales, fixation of quality norms for the manufactured product, norms for the daily output, and so forth.

(iii) The function of control: This involves comparison of actual production achieved against the norm or target set earlier. In case the production has fallen short of the target, it gives remedial measures so that such a deficiency does not occur again

DR.J.VIDHYA, ASSISTANT PROFESSOR, DEPT.OF BUSINESS ADMINISTRATION
GOVERNMENT ARTS AND SCIENCE COLLEGE, MANALMEDU
vidhyajawahar2007@gmail.com

LIMITATIONS OF STATISTICS

Statistics has a number of limitations, pertinent among them are as follows:

(i) There are certain phenomena or concepts where statistics cannot be used. This is because these phenomena or concepts are not amenable to measurement. For example, beauty, intelligence, courage cannot be quantified. Statistics has no place in all such cases where quantification is not possible.

(ii) Statistics reveal the average behaviour, the normal or the general trend. An application of the 'average' concept if applied to an individual or a particular situation may lead to a wrong conclusion and sometimes may be disastrous. For example, one may be misguided when told that the average depth of a river from one bank to the other is four feet, when there may be some points in between where its depth is far more than four feet. On this understanding, one may enter those points having greater depth, which may be hazardous.

(iii) Since statistics are collected for a particular purpose, such data may not be relevant or useful in other situations or cases. For example, secondary data (i.e., data originally collected by someone else) may not be useful for the other person.

(iv) Statistics are not 100 per cent precise as is Mathematics or Accountancy. Those who use statistics should be aware of this limitation.

) In statistical surveys, sampling is generally used as it is not physically possible to cover all the units or elements comprising the universe. The results may not be appropriate as far as the universe is concerned. Moreover, different surveys based on the same size of sample but different sample units may yield different results.

(vi) At times, association or relationship between two or more variables is studied in statistics, but such a relationship does not indicate cause and effect' relationship. It simply shows the similarity or dissimilarity in the movement of

the two variables. In such cases, it is the user who has to interpret the results carefully, pointing out the type of relationship obtained.

(vii) A major limitation of statistics is that it does not reveal all pertaining to a certain phenomenon. There is some background information that statistics does not cover. Similarly, there are some other aspects related to the problem on hand, which are also not covered. The user of Statistics has to be well informed and should interpret Statistics keeping in mind all other aspects having relevance on the given problem

IV UNIT -MEAN

ARITHMETIC MEAN

For grouped data, arithmetic mean may be calculated by applying any of the following methods:

(i) Direct method, (ii) Short-cut method , (iii) Step-deviation method

Example 2.3: The following table gives the marks of 58 students in Statistics. Calculate the average marks of this group.

Marks	No. of Students
0-10	4
10-20	8
20-30	11
30-40	15
40-50	12
50-60	6
60-70	2
Total	5

DR.J.VIDHYA, ASSISTANT PROFESSOR, DEPT.OF BUSINESS ADMINISTRATION
GOVERNMENT ARTS AND SCIENCE COLLEGE, MANALMEDU
vidhyajawahar2007@gmail.com
Solution:

Calculation of Arithmetic Mean by Direct Method

marks	Mid-point (m)	No.of students (f)	fm
0-10	5	4	20
10-20	15	8	120
20-30	25	11	275
30-40	35	15	525
40-50	45	12	540
50-60	55	6	330
60-70	65	2	130
			∑fm = 1940

∑fm = 1940

Where,

∑fm/n = 1940/58 =33.45 marks or 33 marks approximately.

Calculation of Arithmetic Mean by Short-cut Method

Marks	Mid-point (m)	No.of students (f)	d	fd
0-10	5	4	-30	-120
10-20	15	8	-20	-160
20-30	25	11	-10	-110
30-40	35	15	0	0
40-50	45	12	10	120
50-60	55	6	20	120
60-70	65	2	30	60
				∑fd = -90

= A+∑fd/n 35+(-90)/58

= 35 - 1.55 = 33.45 or 33 marks approximately