JUSTICE BASHEER AHMED SAYEED COLLEGE FOR WOMEN
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S.I.E.T.

DEPARTMENT OF MATHEMATICS

BUSINESS STATISTICS AND OPERATIONS RESEARCH-I

(Allied Paper I)

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B. COM

SEMESTER – I

ALLIED PAPER – 1

BUSINESS STATISTICS AND OPERATIONS RESEARCH – I

- **Course Objectives:**

To learn the concepts of correlation, regression, time series, large samples and linear programming.

UNIT I

- **Correlation:**
- Positive correlation – Negative correlation
- No correlation Simple correlation
- Scatter diagram
- Correlation coefficient
- Rank Correlation
- Properties of correlation coefficient – Limitations
- Concurrent Deviation Method
- Merits – Demerits – Simple Problems.

UNIT II

Regression:

Regression lines

Regression Coefficients

Simple Problems

UNIT III

Time Series:

Components of Time Series – Secular trend – Seasonal variation – Cyclical variation – Irregular variation

Measurement of trend – Graphic method – Semi average method – Moving average method

Period of moving averages – Method of least squares – Measures of seasonal variation

Method of averages – Moving average method – Ratio to moving average method – Ratio to trend method

Simple Problems

UNIT IV

Large Samples:

- Population – Parameter and Statistic
- Sampling distribution
- Test of hypothesis – Hypothesis testing procedure
- One-tailed and Two-tailed Test – Significance level
- Large Sample test – Procedure for testing
- Test for single mean – Test for Equality of two means – Test for specified proportion – Test for equality of two proportions
- Simple Problems.

UNIT V

Linear Programming:

- Feasible solution and Optimal solution
- Solution by Graphical Method
- Alternative method – Simplex Method

(Exclude formulation and Big-M Method).

TEXT BOOK FOR STUDY:

- P.R. Vittal, 2010, Business Statistics and Operations Research, Margham Publications.

CORRELATION PROBLEMS:

-

1)	x:	5	10	5	11	12	4	3	2	7	1
	y:	1	6	2	8	5	1	4	6	5	2

Soln:

Since the numbers are simple, we can use Direct Method.

$$r(x,y)=\frac{\sum xy-\frac{\sum x \sum y}{n}}{\sqrt{\sum x^2-(\sum x)^2/n}\sqrt{\sum y^2-\frac{(\sum y)^2}{n}}}$$

$\sum x = 60 \quad \sum y = 40 \quad \sum xy = 288$

$\sum x^2 = 494 \quad \sum y^2 = 212$

Ans:0.58

-

2) **x: 10**	**14**	**15**	**28**	**35**	**48**
y: 74	**61**	**50**	**54**	**43**	**26**

Solution:

Since the numbers look large, dx=x-15 , dy = y-54

$\sum dx = 60 \quad \sum dy = 8 \quad \sum dxdy = -1011$

$\sum dx^2 = 1684 \quad \sum dy^2 = 1338$

We will use indirect method.

$$r(x,y) = \frac{\sum dxdy - \frac{\sum dx \sum dy}{n}}{\sqrt{\sum dx^2 - (\sum dx)^2/n}\sqrt{\sum dy^2 - \frac{(\sum dy)^2}{n}}}$$

Ans: -0.91

Calculate r(x,y) from the following data using 20 as the working mean for the price and 70 as the working mean for the demand:

Price:	14	16	17	18	19	20	21	22	23
Demand:	84	78	70	75	66	67	62	58	60

Calculate ‘r’ between Price and Demand

(43,105), (54,98), (85,53), (91,49), (59,84), (95,40), (68,73)
(29,59), (73, 63), (72,52)

X	Y
43	105
54	98
85	85
91	49
59	.
.	.
.	.
.	.

r= -0.6476

Find Between Output and Cost of an automobile factory from the following data.

Output:	3.5	4.2	5.6	6.5	7.0	8.2	8.8	9.0	9.7	10.0
Cost :	9.8	9.0	8.8	8.4	8.3	8.2	8.2	8.0	8	8.1

The correlation coefficient is unaffected by change of origin and the scale.

Multiply outputs by 10 and then subtract 35.

Multiply the cost by 10 and subtract 80.

Solution :

Let X be the variable denoting Output & Y be the variable denoting the Cost

Output(x):3.5 4.2 5.6 6.5 7.0 8.2 8.8 9.0 9.7 10.0

Cost (y) :9.8 9.0 8.8 8.4 8.3 8.2 8.2 8.0 8 8.1

Multiply outputs by 10 and then subtract 35.

(3.5)(10)-35=0

(4.2)(10)-35=7….

;

Multiply the cost by 10 and subtract 80.

(9.8)(10)-80=18

(9)(10)-80=10…

;

r=0.91

X	Y	dx	dy	
0	18			
7	10			
.	.			
.	.			
	.			

	47	52	57	62	67	f	dy	fdy	fdy^2	**fdxdy**	
57	3 4	4 2	2 0	-	-	9	**-2**	-18	36	20	
62	4 2	8 1	8 0	2 -1	-	22	**-1**	-22	22	14	
67	-	7 0	12 0	4 0	4 0	27	**0**	0	0	0	
72	-	3 -1	10 0	8 1	5 2	26	**1**	26	26	15	
77	-	-	3 0	5 2	8 4	16	**2**	32	64	42	
f	7	22	35	19	17	100		18	148	91	
dx	**-2**	**-1**	**0**	**1**	**2**						
fdx	-14	-22	0	19	34	17					
fdx^2	28	22	0	19	68	137					
fdxdy	20	13	0	16	42	91					

- $dx=\frac{x-A}{c}$, A = 57 & c = 5, dx =-2

$dy=\frac{y-B}{c}$, B = 67 & c=5 ,dy= -2

$$r=\frac{\sum fdxdy-\frac{\sum fdx\sum fdy}{N}}{\sqrt{\sum fdx^2-\frac{(\sum fdx)^2}{N}}\sqrt{\sum fdy^2-\frac{(\sum fdy)^2}{N}}}=\frac{91-\frac{(17)(18)}{100}}{\sqrt{137-\frac{(17x17)}{100}}\sqrt{148-\frac{(18x18)}{100}}}$$

=0.6311

REGRESSION ANALYSIS (UNIT II)

Definition:

Regression analysis is statistical method which is used to determine the degree of relationship between a particular independent variable and the other influencing dependent variables.

Hence, **Regression analysis** produces a **regression equation** (which is the simple line equation, Y=mX+C) where the coefficients represent the relationship between each independent variable and the dependent variable.

Equation of Regression line:

- $Y-\bar{Y} = r\,\frac{\sigma_y}{\sigma_x}(X-\bar{X})$: Reg Eqn Y on X
- $X-\bar{X} = r\,\frac{\sigma_x}{\sigma_y}(Y-\bar{Y})$: Reg Eqn X on Y

$r\,\frac{\sigma_y}{\sigma_x}$ called slope of the line Y on X. ie.,Reg Coefficient of Y on X

$r\,\frac{\sigma_x}{\sigma_y}$ called slope of the line X on Y . ie.,Reg Coefficient of X on Y

Regression Coefficients:

- $Y-\bar{Y} = r\frac{\sigma_y}{\sigma_x}(X-\bar{X})$;

$r\frac{\sigma_y}{\sigma_x}$ is denoted as b_{yx}.

i.e., $b_{yx} = r\frac{\sigma_y}{\sigma_x}$

Then, $\boldsymbol{Y-\bar{Y} = b_{yx}(X-\bar{X})}$

- $X-\bar{X} = r\frac{\sigma_x}{\sigma_y}(Y-\bar{Y})$

$r\frac{\sigma_x}{\sigma_y}$ is denoted by b_{xy}

i.e., $b_{xy} = r\frac{\sigma_x}{\sigma_y}$

Then, $\boldsymbol{X-\bar{X} = b_{xy}(Y-\bar{Y})}$

- $b_{yx} = \frac{\sum XY - \frac{\sum X \sum Y}{n}}{\sum X^2 - \frac{(\sum X)^2}{n}}$
- $b_{xy} = \frac{\sum XY - \frac{\sum X \sum Y}{n}}{\sum Y^2 - \frac{(\sum Y)^2}{n}}$

Find the lines of Regression:

- X: 1 2 3 4 5 8 10
- Y: 9 8 10 12 14 16 15

UNIT IV
SAMPLING THEORY
(LARGE SAMPLES)

Sampling theory is a study of relationships existing between a population and **samples** drawn from the population.

INTRODUCTION

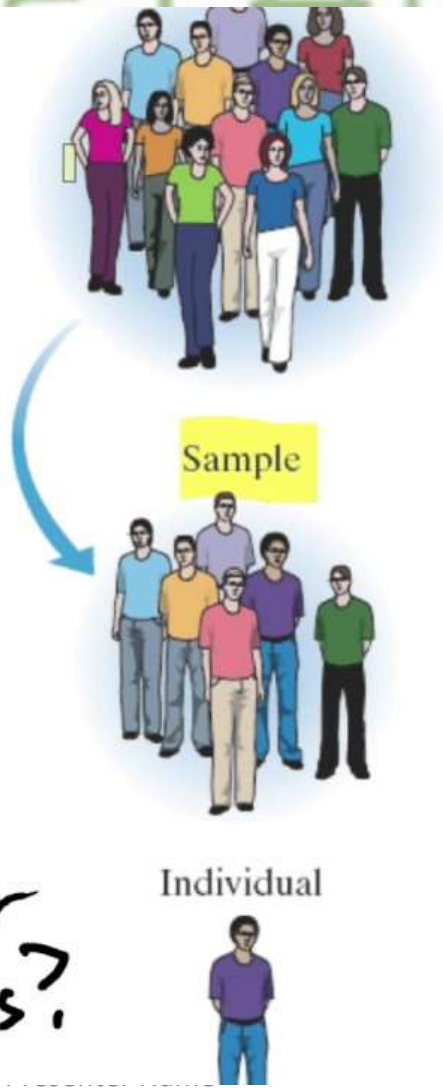
- In **statistical analysis** , the sampling theory is all about the quality assurance of specific individual.

- **This** is achieved by the selection of a subset (called **statistical sample**) of individuals from within a **statistical** population to estimate characteristics of the whole population. ...

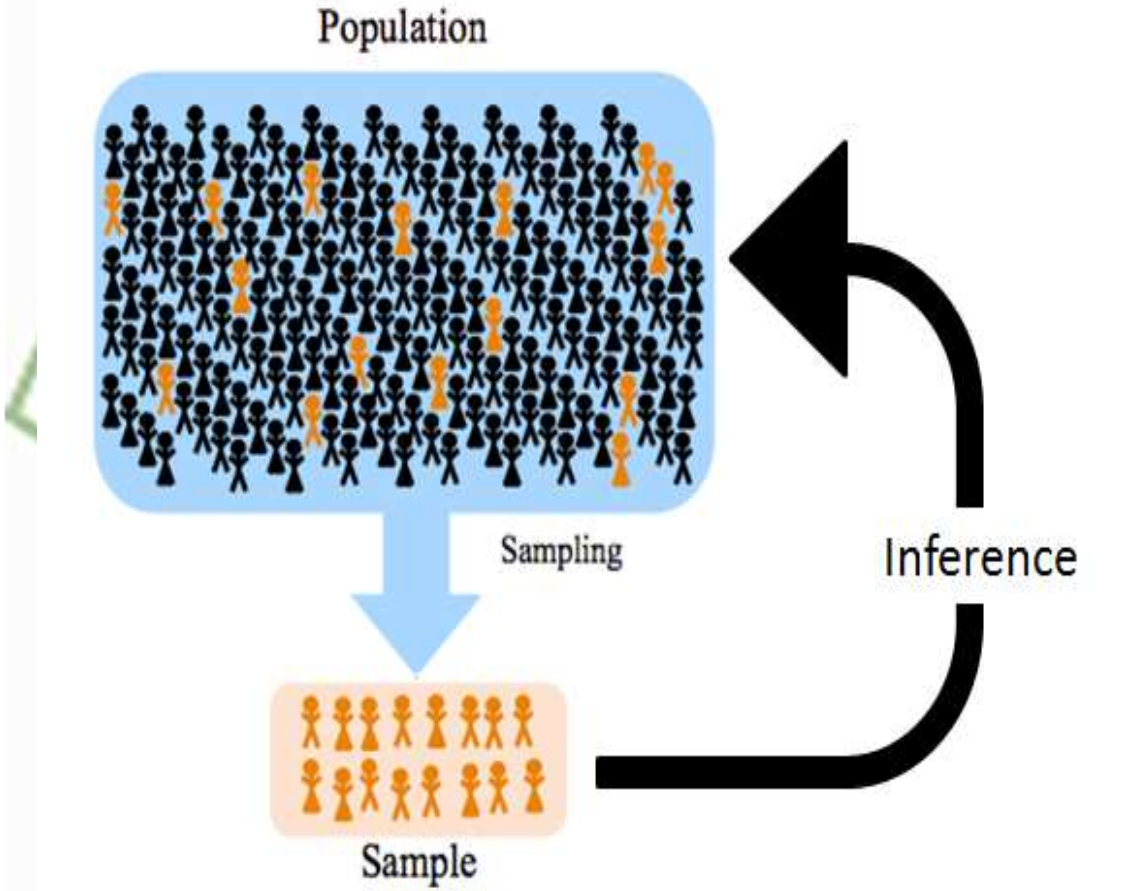
- Therefore sampling theory is a process of learning about population on the basis of samples drawn from it

Population and Sample:

The entire group of individuals to be studied is called the **population**. An **individual** is a person or object that is a member of the population being studied. A **sample** is a subset of the population that is being studied.



Ex: What color car is the most popular in the United States?



SAMPLING THEORY

- is developed to determine mathematically the most effective way to acquire a sample that would accurately reflect the population under study.

EXAMPLES

- Testing the quality of a bulb manufactured by a company

  (This is most of the industry concern before delivering to the market)
- An Auditor checks the sample of account to know the error of the entire data.
- A housewife checks the small quantity of rice (sample) to check whether it is cooked.
- To survey about the specific habit of an individual in a particular village or town or country.