UNIT 12

INTRODUCTION TO STATISTICAL METHODS AND ECONOMETRICS

INTRODUCTION

STATISTICS : MEANING

- Statistics when used in singular form helps in the collection, presentation, classification and interpretation of data to make it easily comprehensible.
- In its plural form it denotes collection of numerical figures and facts. In the narrow sense it has been defined as the science of counting and science of averages.

SCOPE OF STATISTICS

Statistics is applied in every sphere of human activity – social as well as physical – like Biology, Commerce, Education, Planning, Business Management, Information Technology, etc.

LIMITATIONS OF STATISTICS

Statistics with all its wide application in every sphere of human activity has its own limitations.

- Statistics is not suitable to the study of qualitative phenomenon:
- Statistical laws are not exact:
- Statistics table may be misused:
- Statistics is only one of the methods of studying a problem:

DATA

Data is the information about facts or numbers collected to be examined and used to help with decisions. Data are the basic raw materials of statistics. In statistics, data are classified into two broad categories: 1.Quantitative data and Qualitative data.

ARITHMETIC MEAN OR MEAN

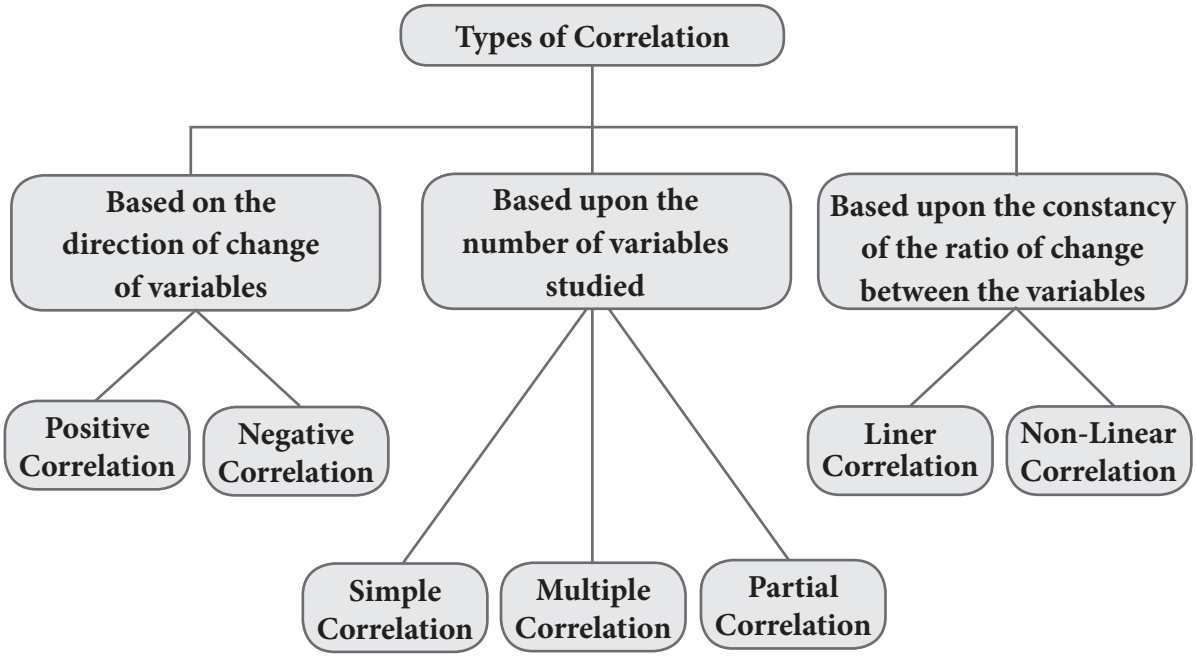
Central value is called a measure of central tendency or an average or a measure of locations. There are five averages. Among them mean, median and mode are called simple averages and the other two averages geometric mean and harmonic mean are called special averages.

STANDARD DEVIATION

It is defined as the positive square-root of the arithmetic mean of the square of the deviations of the given observation from their arithmetic mean.

CORRELATION

Correlation is a statistical device that helps to analyse the covariation of two or more variables.



REGRESSION

Regression is the study of the relationship between the variables. If Y is the dependent variable and X is independent variable, the linear relationship between the variable is called the regression equation of Y on X.

REGRESSION EQUATION AND LINE

Regression equation is used to estimate the value of Y corresponding to the known value of X. The line describing this tendency to regress or going back was called by Galton a "Regression Line".

Two Regression lines

$$X \text{ on } Y \Rightarrow X = a + by$$

$$Y \text{ on } X \Rightarrow Y = a + bx$$

ECONOMETRICS : MEANING

Econometrics may be considered as the integration of economics, Statistics and Mathematics.

OBJECTIVES OF ECONOMETRICS

The general objective of Econometrics is to give empirical content to economic theory. The specific objectives are as follows:

1. It helps to explain the behaviour of a forthcoming period that is forecasting economic phenomena.

2. It helps to prove the old and established relationships among the variables or between the variables

3. It helps to establish new theories and new relationships.

4. It helps to test the hypotheses and estimation of the parameter.

ANATOMY OF ECONOMIC MODELING

Economic theory →Mathematical model of the theory→ Economic model of the theory →Data Estimation of econometric model →Hypothesis Testing Forecasting or prediction →Using the model for control or policy purpose

OFFICIAL STATISTICS

Official Statistics are statistics published by government agencies or other public bodies such as international organizations. They provide quantitative or qualitative information on all major areas of citizens' lives.

MOSPI AND ITS WINGS

- The Ministry of Statistics and Programme Implementation (MOSPI) came into existence as an Independent Ministry in 1999 after the merging of the Department of Statistics and the Department of Programme Implementation.
- The Ministry has two wings, Statistics and Programme Implementation.
- The Statistics Wing called the National Statistical Office (NSO) consists of the Central Statistical Office (CSO), the Computer Centre and the National Sample Survey Office (NSSO).

BOOK EXERCISE QUESTIONS - MULTIPLE CHOICE QUESTIONS

PART - A

1. The word 'statistics' is used as _____

a) Singular

b) Plural

c) Singular and Plural.

d) None of above.

2. Who stated that statistics as a science of estimates and probabilities.

a) Horace Secrist b) R.A Fisher.

c) Ya-Lun-Chou d) Boddington

3. Sources of secondary data are _____.

a) Published sources.

b) Unpublished sources.

c) neither published nor unpublished sources.

d) Both (A) and (B)

4. The data collected by questionnaires are_____.

a) Primary data b) Secondary data

c) Published data d) Grouped data.

5. A measure of the strength of the linear relationship that exists between two variables is called:

a) Slope

b) Intercept

c) Correlation coefficient

d) Regression equation

6. If both variables X and Y increase or decrease simultaneously, then the coefficient of correlation will be:

a) Positive b) Negative

c) Zero d) One

7. If the points on the scatter diagram indicate that as one variable increases the other variable tends to decrease the value of r will be:

a) Perfect positive b) Perfect negative

c) Negative d) Zero

8. The value of the coefficient of correlation r lies between:

a) 0 and 1 b) -1 and 0

c) -1 and +1 d) -0.5 and +0.5

9. The term regression was used by:

a) Newton b) Pearson

c) Spearman d) Galton

10. The purpose of simple linear regression analysis is to:

a) Predict one variable from another variable

b) Replace points on a scatter diagram by a straight-line

c) Measure the degree to which two variables are linearly associated

d) Obtain the expected value of the independent random variable for a given value of the dependent variable

11. process by which we estimate the value of dependent variable on the basis of one or more independent variables is called:

a) Correlation b) Regression

c) Residual d) Slope

12. Y = 2 - 0.2X, then the value of Y intercept is equal to

a) -0.2 b) 2

c) 0.2X d) All of the above

13. In the regression equation Y = β0+β1X, the Y is called:

a) Independent variable

b) Dependent variable

c) Continuous variable

d) none of the above

14. In the regression equation X = β0+β1X, the X is called:

a) Independent variable

b) Dependent variable

c) Continuous variable

d) none of the above

15. Econometrics is the integration of

a) Economics and Statistics

b) Economics and Mathematics

c) Economics, Mathematics and Statistics

d) None of the above

16. Econometric is the word coined by

a) Francis Galton

b) RagnarFrish

c) Karl Person

d) Spearsman

17. The raw materials of Econometrics are:

a) Data b)Goods

c) Statistics d)Mathematics

18. The term Uiin regression equation is

a) Residuals

b) Standard error

c) Stochastic error term

d) none

19. The term Uiis introduced for the representation of

a) Omitted Variable

b) Standard error

c) Bias

d) Discrete Variable

20. Econometrics is the amalgamation of

a) 3 subjects b)4 subjects

c) 2 subjects d)5 subjects

Answers									
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
c	d	d	a	c	a	c	c	d	a
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
b	b	b	a	c	b	a	c	a	a

PART - B

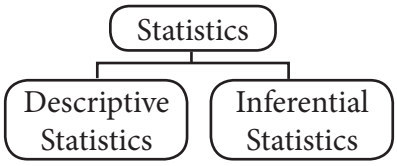
Answer the following questions in one or two sentences

21. What is Statistics?

According to Croxton and Cowden, "Statistics may be defined as the collection, organization, presentation, analysis and interpretation of numerical data"

22. What are the kinds of Statistics?

There are two major types of statistics named as Descriptive Statistics and Inferential Statistics.



Descriptive Statistics

The branch of statistics devoted to the summarization and description of data is called Descriptive Statistics

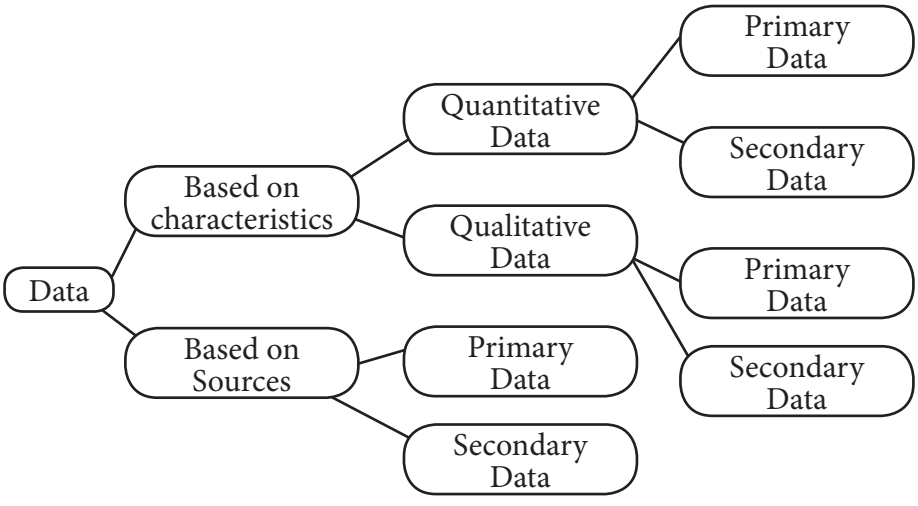
Inferential Statistics

The branch of statistics concerned with using sample data to make an inference about a population of data is called Inferential Statistics.

23. What do you mean by Inferential Statistics?

The branch of statistics concerned with using sample data to make an inference about a population of data is called Inferential Statistics.

24. What are the kinds of data?v



25. Define Correlat ion.

- Correlation is a statistical device that helps to analyse the covariation of two or more variables.

- ❖ Sir Francis Galton, is responsible for the calculation of correlation coefficient.
- ❖ Regression means going back and it is a mathematical measure showing the average relationship between two variables
- ❖ If Y is the dependent variable and X is independent variable, the linear relationship between the variable is called the regression equation of Y on X.
- ❖ The literal meaning of the word "regression" is "Stepping back towards the average".

26. What is Econometrics?

In the words of Arthur S. Goldberger,

"Econometrics may be defined as the social science in which the tools of economic theory, mathematics and statistical inference are applied to the analysis of economic phenomena".

PART - C

Answer the following questions in one Paragraph.

28. What are the functions of Statistics?

- ❖ Statistics presents facts in a definite form.
- ❖ It simplifies mass of figures.
- ❖ It facilitates comparison.
- ❖ It helps in formulating and testing.
- ❖ It helps in prediction.
- ❖ It helps in the formulation of suitable policies.

29. Find the Standard Deviation of the following data: 14, 22, 9, 15, 20, 17, 12, 11

S. No	X	$(x- \bar{x})$	$(x- \bar{x})2$
1	14	-1	1
2	22	7	49
3	9	-6	36
4	15	0	0
5	20	5	25
6	17	2	4
7	12	-3	9
8	11	-4	16
N = 8			
(No. of. Frequency occurred)	$\Sigma X = 120$	0	$\Sigma(x- \bar{x})2 = 140$

$$N = 8$$

$$\bar{x} = \frac{120}{8} = 15$$

$$\sigma = \sqrt{\frac{\Sigma(x-\bar{X})^2}{N}}$$

$$= \sqrt{\frac{140}{8}}$$

$$= \sqrt{17.5}$$

$$\sigma = 4.18$$

30. State and explain the different kinds of Correlation.

Positive Correlation:

The correlation is said to be positive if the values of two variables move in the same direction. Ex. Y= a + bx

Negative Correlation:

The Correlation is said to be negative when the values of variables move in the opposite directions. Ex. Y= a – bx

Simple Correlation:

If only two variables are taken for study then it is said to be simple correlation. Ex. Y= a + bx

Multiple Correlations:

If three or more than three variables are studied simultaneously, then it is termed as multiple correlation.Ex :Qd= f (P, Pc, Ps, t, y)

Partial Correlation:

If there are more than two variables but only two variables are considered keeping the other variables constant, then the correlation is said to be Partial Correlation.

Linear Correlation:

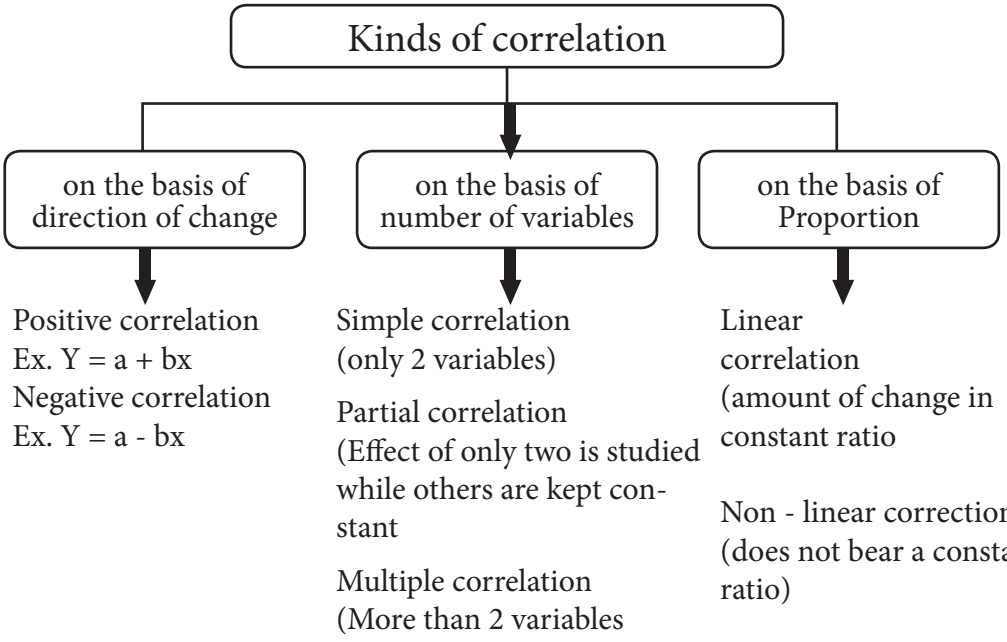
Correlation is said to be linear when the amount of change in one variable tends to bear a constant ratio to the amount of change in the other.

Ex. Y= a + bx

Non Linear:

The correlation would be non-linear if the amount of change in one variable does not bear a constant ratio to the amount of change in the other variables.

Ex. Y= a + bx2



31. Mention the uses of Regression Analysis.

- ❖ It indicates the cause and effect relationship between the variables and establishes functional relationship.
- ❖ Besides verification it is used for the prediction of one value, in relation to the other given value.
- ❖ Regression coefficient is an absolute figure. If we know the value of the independent variable, we can find the value of the dependent variable.
- ❖ It has wider application, as it studies linear and nonlinear relationship between the variables.
- ❖ It has wider application, as it studies linear and nonlinear relationship between the variables

32. Specify the objectives of econometrics.

The general objective of Econometrics is to give empirical content to economic theory. The specific objectives are as follows:

1. It helps to explain the behaviour of a forthcoming period that is forecasting economic phenomena.
2. It helps to prove the old and established relationships among the variables or between the variables
3. It helps to establish new theories and new relationships.
4. It helps to test the hypotheses and estimation of the parameter.

33. Differentiate the economic model with econometric model.

1. Models in Mathematical Economics are developed based on Economic Theories, while, Econometric Models are developed based on Economic Theories to test the validity of Economic Theories in reality through the actual data.
2. Regression Analysis in Statistics does not concentrate more on error term while Econometric Models concentrate more on error terms,

   Statistics Regression : $Yi = \beta + \beta 1Xi$

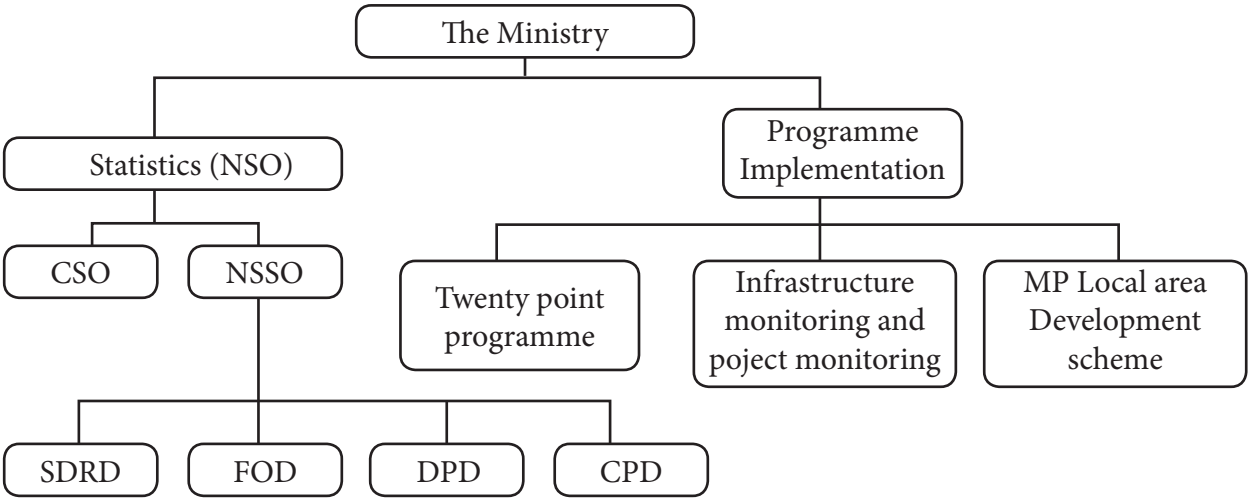
   Economic Regression : $Yi = \beta 0 + \beta 1Xi + Ui$

   (with more than 2 variables) or

$$\mathbf{Y = \beta + \beta 1X1 + \beta 2X2 + \beta 3X3 + Ui}$$

Systematic Part: $\beta 0 + \beta 1Xi$ or explained part and Random Part: Ui unexplained part in a regression. Ui represents the role of omitted variables in specifying a regression relationship of Y on X. Hence, the Ui cannot and should not be ignored.

34. Discuss the important statistical organizations (offices) in India.



The Ministry has two wings, Statistics and Programme Implementation.

The Statistics Wing called the National Statistical Office (NSO) consists of the Central Statistical Office (CSO), the Computer Centre and the National Sample Survey Office (NSSO).

Central Statistical Office (CSO)

- ❖ The Central Statistical Office is one of the two wings of the National Statistical Organisation (NSO).
- ❖ It is responsible for co-ordination of statistical activities in the country and for evolving and maintaining statistical standards.
- ❖ National Sample Survey Organisation (NSSO)
- ❖ The National Sample Survey Organisation, now known as National Sample Survey Office, is an organization under the Ministry of Statistic of the Government of India.
- ❖ It is the largest organisation in India, conducting regular socio-economic surveys.

The Programme Implementation Wing has three Divisions, namely,

i Twenty Point Programme

ii Infrastructure Monitoring and Project Monitoring

iii Member of Parliament Local Area Development Scheme.

PART - D

Answer the following questions in about a page.

35. Elucidate the nature and scope of Statistics.

Definition of Statistics

According to Croxton& Cowden "Statistics may be defined as the collection, organisation, presentation, analysis and interpretation of numerical data"

Nature of Statistics

Different Statisticians and Economists differ in views about the nature of statistics, some call it a science and some say it is an art. Tipett on the other hand considers Statistics both as a science as well as an art.

As numerical statement of facts, 'statistics' should possess thefollowing nature.

1. Statistics are an aggregate of facts.
2. Statistics are numerically enumerated, estimated and expressed.
3. Statistics should be collected in a systematic manner for a predetermined purpose.
4. Should be capable of being used as a technique for drawing comparison
5. Statistics are numerated or estimated according to reasonable standard of accuracy.
6. Statistics are affected to a marked extent by a multiplicity of causes.

Scope of Statistics

Statistics is applied in every sphere of human activity – social as well as physical – like Biology, Commerce, Education, Planning, Business Management, Information Technology, etc.

Statistics and Economics

Statistical data and techniques are immensely useful in solving many economic problems such as fluctuation in wages, prices, production, distribution of income and wealth and so on.

Statistics and Firms

Statistics is widely used in many firms to find whether the product is conforming to specifications or not.

Statistics and Commerce

Statistics are life blood of successful commerce. Market survey plays an important role to exhibit the present conditions and to forecast the likely changes in future.

Statistics and Education

Statistics is necessary for the formulation of policies to start new course, according to the changing environment.

Statistics and Planning:

Statistics is indispensable in planning. In the modern world, which can be termed as the "world of planning", almost all the organisations in the government are seeking the help of planning for efficient working, for the formulation of policy decisions and execution of the same.

In order to achieve the above goals, various advanced statistical techniques are used for processing, analyzing and interpreting data.

Statistics and Medicine

In Medical sciences, statistical tools are widely used. In order to test the efficiency of a new drug or to compare the efficiency of two drugs or two medicines, t - test for the two samples is used.

Statistics and Modern applications

Recent developments in the fields of computer and information technology

have enabled statistics to integrate their models and thus make statistics a part of decision making procedures of many organisations.

36. Calculate the Karl Pearson Correlation Co-efficient for the following data

Demand of Product X :	23	27	28	29	30	31	33	35	36	39
Sale of Product Y:	18	22	23	24	25	26	28	29	30	32

Solution: **Let A = 30 and B = 26 then dx = X- A dy= Y-B**

X	Y	d_x	d_y	d^2_x	d^2_y	$d_x d_y$
23	18	-7	-8	49	64	56
27	22	-3	-4	9	16	12
28	23	-2	-3	4	9	6
29	24	-1	-2	1	4	2
30	25	0	-1	0	1	0
31	26	1	0	1	0	0
33	28	3	2	9	4	6
35	29	5	3	25	9	15
36	30	6	4	36	16	24
39	32	9	6	81	36	54
		11	**-3**	**275**	**159**	**175**

$$r(x,y) = \frac{N\Sigma dxdy - \Sigma dy}{\sqrt{N\Sigma d_x^2 - (\Sigma dx)^2}\ \sqrt{n\Sigma d_y^2 - (\Sigma dy)^2}}$$

$$= \frac{10(175) - (11)(-3)}{\sqrt{10(215) - (11)^2}\ \sqrt{10(159) - (-3)^2}}$$

$$= \frac{1750 + 33}{\sqrt{2150 - 121}\ \sqrt{1590 - 9}}$$

$$= \frac{1783}{\sqrt{(45.044)}\ \sqrt{(39.761)}}$$

$$= \frac{1783}{1790.94}$$

Ans:r(x,y) = **0.9955**

37. Find the regression equation Y on X and X on Y for the following data:

X :	45	48	50	55	65	70	75	72	80	85
Y:	25	30	35	30	40	50	45	55	60	65

X	Y	U=X-65	U=Y-45	U^2	UV	V^2
45	25	-20	-20	400	400	400
48	30	-17	-15	289	255	225
50	35	-15	-10	225	150	100
55	30	-10	-15	100	150	225
65	40	0	-5	0	0	25
70	50	5	5	25	25	25
75	45	10	0	100	0	0
72	55	7	5	49	35	25
80	60	15	15	225	225	225
85	65	20	20	400	400	400
$\Sigma X = 645$	$\Sigma Y = 435$	**$\Sigma U = 5$**	**$\Sigma V = 20$**	**$\Sigma U^2 = 1813$**	**$\Sigma V^2 = 1415$**	**$\Sigma UV = 1675$**

We have,

$$\bar{x} = \frac{\Sigma X}{N} = \frac{645}{10} \quad 64.5 \qquad \text{and} \qquad \bar{y} = \frac{\Sigma Y}{N} = \frac{435}{10} \quad 43.5$$

$$b_{yx} = \frac{N\Sigma UV - (\Sigma U \Sigma V)}{N\Sigma U^2 - (\Sigma U)^2}$$

$$= \frac{(10)x1415-(5)x(-20)}{(10)x1813-(5)^2}$$

$$= \frac{14150+100}{18130-25} = \frac{14250}{18105} = 0.787$$

Regression equation of Y on X is

$y-\bar{y} = b_{yx}(x-\bar{x})$
$y-43.5 = 0.787(X-64.5)$
or $Y = 0.787X+7.26$

Similarly b_{xy} can be calculated as

$$b_{yx} = \frac{N\Sigma UV - (\Sigma U \Sigma V)}{N\Sigma U^2 - (\Sigma U)^2}$$

$$\frac{(10)x1415 - (5)\ x\ (-20)}{(10)\ x\ 1675 - (-20)^2}$$

$$= \frac{14150+100}{16750 - 400} = \frac{14250}{16350} = 0.87$$

Regression equation of X on Y will be

$x-\bar{x} = b_{xy}(y-\bar{y})$
$y-64.5 = 0.87(Y-43.5)$
or $X = 0.87Y+26.65$

38. Describe the application of Econometrics in Economics (write any five)

1. **Forecasting macroeconomic indicators:**

   Some macroeconomists are concerned with the expected effects of monetary and fiscal policy on the aggregate performance of the economy. Time-series models can be used to make predictions about these economic indicators.

2. **Estimating the impact of immigration on native workers:**

   Immigration increases the supply of workers, so standard economic theory predicts that equilibrium wages will decrease for all workers. However, since immigration can also have positive demand effects, econometric estimates are necessary to determine the net impact of immigration in the labor market.

3. **Identifying the factors that affect a firm's entry and exit into a market:**

   The microeconomic field of industrial organization, among many issues of interest, is concerned with firm concentration and market power. Theory suggests that many factors, including existing profit levels, fixed costs associated with entry/exit, and government regulations can influence market structure. Econometric estimation helps determine which factors are the most important for firm entry and exit.

4. **Determining the influence of minimum-wage laws on employment levels:**

   The minimum wage is an example of a price floor, so higher minimum wages are supposed to create a surplus of labor (higher levels of unemployment). However, the impact of price floors like the minimum wage depends on the shapes of the demand and supply curves. Therefore, labor economists use econometric techniques to estimate the actual effect of such policies.

5. **Finding the relationship between management techniques and worker productivity:**

   The use of high-performance work practices (such as worker autonomy, flexible work schedules, and other policies designed to keep workers happy) has become more popular among managers. At some point, however, the cost of implementing these policies can exceed the productivity benefits. Econometric models can be used to determine which policies lead to the highest returns and improve managerial efficiency.

6. **Measuring the association between insurance coverage and individual health outcomes:**

   One of the arguments for increasing the availability (and affordability) of medical insurance coverage is that it should improve health outcomes and reduce overall medical expenditures. Health economists may use econometric models with aggregate data (from countries) on medical coverage rates and health outcomes or use individual-level data with qualitative measures of insurance coverage and health status.

7. **Deriving the effect of dividend announcements on stock market prices and investor behavior:**

   Dividends represent the distribution of company profits to its shareholders. Sometimes the announcement of a dividend payment can be viewed as good news when shareholders seek investment income, but sometimes they can be viewed as bad news when shareholders prefer reinvestment of firm profits through

retained earnings. The net effect of dividend announcements can be estimated using econometric models and data of investor behavior.

8. Predicting revenue increases in response to a marketing campaign:

The field of marketing has become increasingly dependent on empirical methods. A marketing or sales manager may want to determine the relationship between marketing efforts and sales. How much additional revenue is generated from an additional dollar spent on advertising? Which type of advertising (radio, TV, newspaper, and so on) yields the largest impact on sales? These types of questions can be addressed with econometric techniques.

9. Calculating the impact of a firm's tax credits on R&D expenditure:

Tax credits for research and development (R&D) are designed to provide an incentive for firms to engage in activities related to product innovation and quality improvement. Econometric estimates can be used to determine how changes in the tax credits influence R&D expenditure and how distributional effects may produce tax-credit effects that vary by firm size.

10. Estimating the impact of cap-and-trade policies on pollution levels:

Environmental economists have discovered that combining legal limits on emissions with the creation of a market that allows firms to purchase the "right to pollute" can reduce overall pollution levels. Econometric models can be used to determine the most efficient combination of state regulations, pollution permits, and taxes to improve environmental conditions and minimize the impact on firms.

Additional One marks

1. The first book to have statistics as its title was 'Contributions to vital Statistics' by ……?

a. Karl Pearson

b. Francis GP Neison

c. Crowther

d. Fisher

2. Ronald Fisher is known as ……?

a. Father of statistics

b. Father of Mathematical economics

c. Father of econometrics

d. Father of Applied Economics

3. Evidence from history proves that during the reign of Chandra Gupta Maurya, there existed a system of maintaining……..

a. vital statistics

b. descriptive statistics

c. inferential statistics

d. none of the above

4. There existed a system of maintaining vital statistics including registration of births and deaths found in ……?

a. Thriukkural b. Arthashastra

c. Das Capital d. Agananuru

5. The book ……mentions the statistical and administrative surveys conducted during Akbar's rule.

a. Arthasasthara

b. Tholkappiyam

c. Ain-e-Akbari

d. none of the above

6. **P.C.Mahalanobis is known as the founder of ……**
   a. classical statistics
   b. mathematical economics
   c. modern statistics
   d. applied econometrics

7. **…… is known as the founder of modern statistics and also as father of …….. in India.**
   a. P.C. Mahalanobis and statistical economics
   b. Viswesvaraya and statistics
   c. P.C. Mahalanobis and statistics
   d. None of the above

8. **Since 2007 ……. every year is celebrated as Statistics Day to commemorate his birth anniversary.**
   a. 28th of June b. 29th of July
   c. 28th of July d. 29th of June

9. **The term 'Statistics' is used in two senses: as …… and ……**
   a. singular and plural
   b. horizontal and vertical
   c. numerical and inferential
   d. none of the above

10. **Find the author who said this "Statistics as a science of estimates and probabilities"**
    a. Croxten and Crowden
    b. Boddington
    c. Irving Fisher
    d. Lowernce

11. **Find the author who said this "Statistics may be defined as the collection, organisation, presentation, analysis and interpretation of numerical data"**
    a. Croxton& Cowden
    b. Karl Pearson
    c. Spearman
    d. Von Hayek

12. **In order to test the efficiency of a new drug or to compare the efficiency of two drugs or two medicines, ……for the two samples is used.**
    a. F-test b. Z - test
    c. Large test d. t - test

13. **Which is not a limitation of statistics?**
    a. Statistics is not suitable to the study of qualitative phenomenon
    b. Statistical laws are not exact
    c. Statistical collection should be systematic with a predetermined purpose
    d. Statistics is only one of the methods of studying a problem

14. **There are two major types of statistics named as …… and …….. based on nature.**
    a. new statistics and old statistics
    b. descriptive statistics and inferential statistics
    c. numerical statistics and inferential statistics
    d. none of the above

15. **The branch of statistics concerned with using sample data to make an inference about a population of data is called …….**
    a. Mathematical Statistics
    b. Descriptive Statistics
    c. Vital Statistics
    d. Inferential Statistics

16. The branch of statistics devoted to the summarization and description of data is called ……..

a. Descriptive Statistics
b. Inferential Statistics
c. Modern Statistics
d. Applied Statistics

17. Which is not a character of descriptive statistics?

a. It describes the population under study
b. It uses hypotheses, testing and predicting on the basis of the outcome.
c. It presents the data in a meaningful way through charts, diagrams, graphs, other than describing in words.
d. It gives the summary of data.

18. ……. are those that can be quantified in definite units of measurement.

a. Qualitative data b. Raw data
c. Quantitative data d. Refined data

19. ……are further classified as nominal and rank data.Eg.Gender, Community, honesty.

a. Raw data b. Qualitative data
c. Refined data d. Quantitative data

20. ……are the outcome of classification into two or more categories of items or units comprising a sample or a population according to some quality characteristic.

a. Real data b. Quantitative data
c. Nominal data d. Qualitative data

21. ……. data already exist in some form: published or unpublished in an identifiable secondary source.

a. primary b. vital
c. raw d. secondary

22. The following are the examples for …….. : "Data from CSO, NSSO, RBI…."

a. secondary data b. primary data
c. tertiary data d. applied data

23. Those data which do not already exist in any form, and thus have to be collected for the first time from the primary source(s).

a. Secondary data b. Vital data
c. Raw data d. Primary data

24. Not a meaning of average?

a. A measure of central tendency is a typical value around which other figures congregate
b. An average stands for the whole group of which it forms a part yet represents the whole
c. One of the most widely used set of summary figures is known as measures of location
d. It uses hypotheses, testing and predicting on the basis of the outcome

25. Calculate the mean for given data 2,4,6,8,10.

a. 6 b. 30 c. 5 d. 15

26. There are two kinds of measures of dispersion, namely

a. Absolute measure of dispersion and Relative measure of dispersion
b. Relative measure of dispersion and Relative measure of dispersion
c. Absolute measure of dispersion and Absolute measure of dispersion

d. Relative measure of dispersion and Absolute measure of dispersion

27. Standard Deviation is one of the methods of ..... of dispersion.

a. Relative measure

b. Real measure

c. Absolute measure

d. Nominal measure

28. Who introduced the concept of standard deviation in 1893?

a Relative measure

b. Absolute measure

c. Real measure

d. Nominal measure

29. ..... is also called Root- Mean Square Deviation?

a. Correlation

b. Mean deviation

c. Arithmetic mean

d. Standard deviation

30. The standard deviation of the population is denoted by the Greek letter ....., the standard deviation of sample is denoted as 's'.

a. β b. π

c. σ d. μ

31. There are two methods of calculating Standard deviation in an individual series.

a. deviations taken from actual mean and deviation taken from assumed mean

b. deviations taken from assumed mean and deviation taken from actual mean

c. deviations taken from actual median and deviation taken from assumed mean

d. None of the above

32. Find the formula for standard deveiation.

a. Y= a – bx b. Y= a + bx

c. $\sqrt{\Sigma \mid x - \bar{X}}$ **d.** $\sqrt{\frac{\Sigma \mid x - \bar{x} \mid^2}{n}}$

33. Who is responsible for the calculation of correlation coefficient?

a. Francis Galton

b. Von Neuman

c. Philip

d. Irving Fisher

34. Find the positive correlation equation.

a. Y= a – bx

b. Y= a + bx

c. Y= b – ax

d. Y= a – by

35. Find the negative correlation equation.

a. Y= a – by

b. X= a – bx

c. Y= a + bx

d. Y= a – bx

36. In correlation, there are ..... types based upon the number of variables studied as

a. one

b. two

c. three

d. four

37. Which of the following is not a kind of correlation based on number of variables?

a. Simple Correlation

b. Multiple Correlation

c. Partial Correlation

d. Rank Correlation

38. Find the equation of multiple correlation.

a. Qd= f (P, Pc, Ps, t, y)

b. X= a – bx

c. Y= a + bx

d. Y= a – bx

39. The correlation would be …….. if the amount of change in one variable does not bear a constant ratio to the amount of change in the other variables.

a. linear

b. scatter

c. non-linear

d. downward always

40. Find the equation of non-linear correlation

a. Y= a + bx2

b. Y= a + bx

c. Y= b – ax

d. Y= a – by

41. Which is not a method of studying correlation?

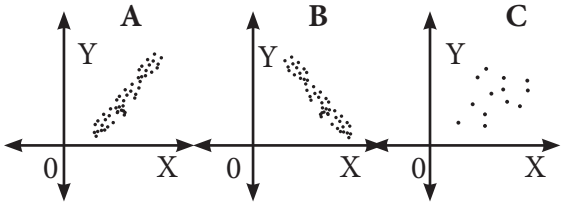
a. Scatter diagram Method

b. Graphic Method

c. Karl Pearson's Co - efficient of correlation and

d. Analysis of variance method

42. Given the diagram, find the nature of correlation.



a. A, B, C, are positive

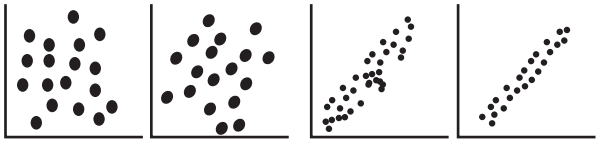
b. A, B, C, are negative

c. A is positive, B is Negative and C is Positive

d. A is positive, B is Negative and C is Zero

43. Given the diagram, find the correct answer.

Degrees of correlation :



None Low High Perfect

a. all the above are correct

b. all the above are incorrect

c. I and II are correct, III and IV are incorrect

d. I and II are incorrect, III and IV are correct

44. Karl Pearson's Method is popularly known as Pearson's coefficient of correlation denoted by the symbol ……. r.

a. KP b. k

c. r d. β

45. Find the incorrect match.

I. Σdxdy = Sum of product of the deviations x and y series from their assumed means.

II. Σdx2 = Sum of the squares of the deviations of x series from an assumed mean

III. Σdy2= sum of the deviation of x series from an assumed mean of x

IV. Σdx= Sum of the squares of the deviations of y series from an assumed mean

a. I, II, III, IV are correct

b. I, II, III are correct, IV is incorrect

c. II and IV are incorrect, I and III are correct

d. III and IV are only incorrect

46. The term 'Regression' was first coined and used in 1877 by ……

a. Hicks b. Friedman

c. Galton d. Spearman

47. The line describing this tendency to regress or going back was called by Galton a …?

a. Regression Line

b. Regression Curve

c. Correlation Line

d. Correlation Curve

48. What are the two Regression lines?

a. X on X => X = a + by and Y on X => Y = a + bx

b. X on Y => X = a + by and Y on X => Y = a + bx

c. Y on Y => X = a + by and Y on X => Y = a + bx

d. X on Y => X = a + bX and Y on X =>X = a + bx

49. Irving Fisher is the first person, developed …….. in the quantity theory of money with help of data.

a. statistical inference

b. econometrics

c. mathematical equation

d. applied economics

50. Whonamed the integration of three subjects such that mathematics, statistical methods and economics as 'Econometrics' in 1926?

a. Galton b. Schumpeter

c. Milton Friedman d. Ragnar Frisch

51. Econometrics may be considered as the integration of…….

a. economics, statistics and mathematics

b. econometrics, statistics and mathematics

c. economics, applied statistics and mathematics

d. econometrics, statistics and applied mathematics

52. Find the incorrect equation.

I. Economics + Mathematics= Mathematical Economics

II. Mathematical Economics+ Statistical Data & Its Technique = Econometrics

III. {Economics + Statistics + Mathematics}+Empirical Data = Applied Econometrics

a. I b. III

c. III and II d. II and I

53. Who said "Econometrics is concerned with the empirical determination of economic laws"

a. Galton b. H Theil

c. Fisher d. Dalton

54. What is the term given for the following sequence of action?

"Economic theory, Mathematical model of the theory, Economic model of the theory, Data Estimation of econometric model, Hypothesis Testing, ,Forecasting or prediction Using the model for control or policy purpose"

a. Anatomy of Economic Modeling

b. Anatomy of Mathematical Economic Modeling

c. Anatomy of Econometric Modeling

d. None of the above

55. Find an example of Statistics Regression.

a. $Yi = \beta0 + \beta1Xi$

b. $Yi = \beta0 + \beta1Xi + Ui$

c. $Xi = \beta0 + \beta1Xi + Ui$

d. $Yo = \beta0 + \beta1Xi + Uo$

56. Find an example of Econometrics Regression

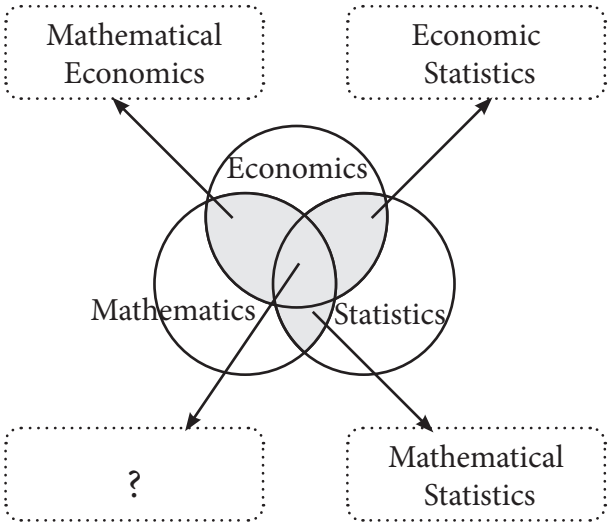
a. $Yi = \beta0 + \beta1Xi$

b. $Yi = \beta0 + \beta1Xi + Ui$

c. $Xi = \beta0 + \beta1Xi + Ui$

d. $Yo = \beta0 + \beta1Xi + Uo$

57. Given the chart, find the missing term.



a. applied Economics

b. Mathematical Economics

c. Econometrics

d. Statistical Economics

58. Expand the term MOSPI.

a. The Ministry of Statistics and Programme Implementation

b. The Ministry of Statistics and Probability Implementation

c. The Ministry of Statistical and Programme Improvements

d. None of the above

59. The Statistics Wing called the National Statistical Office (NSO) consists of the……., the Computer Centre and …….

a. NSO and MOSP

b. CSOand NSSO

c. ISRO and BARC

d. NSSO and NSO

60. The Central Statistical Office is one of the two wings of the……..

a. NSSO b. CSIR

c. MSOP d. NSO

61. How many divisions of operations that NSSO has?

a. four divisions b. three divisions

c. five divisions d. two divisions

62. Which of the following doesn't come under NSSO

a. Survey Design and Research Division (SDRD)

b. Field Operations Division (FOD)

c. Data Processing Division (DPD)

d. Central Statistical Office (CSO)

63. The downwards slope in the scatter plot above would have a correlation coefficient that is close to:

a. –1.0 b. –0.5 c. +1.0 d. +0.5

64. When the correlation coefficient, r, is close to one:

a. there is no relationship between the two variables

b. there is a strong linear relationship between the two variables

c. it is impossible to tell if there is a relationship between the two variables

d. the slope of the regression line will be close to one

65. A statistic is:

a. a sample characteristic

b. a population characteristic

c. unknown

d. normally distributed

66. A scatter plot of number of teachers and number of people with commerce degrees for cities in India reveals a positive association. The most likely explanation for this positive association is:

a. Teachers encourage people to get college degrees, so an increase in the number of teachers is causing an increase in the number of people with college degrees.

b. Larger cities tend to have both more teachers and more people with college degrees, so the association is explained by a third variable, the size of the city.

c. Teaching is a common profession for people with college degrees, so an increase in the number of people with college degrees causes an increase in the number of teachers.

d. Cities with higher incomes tend to have more teachers and more people going to college, so income is a confounding variable, making causation between number of teachers and number of people with college degrees difficult to prove.

67. The value of a correlation is reported by a researcher to be r = –0.5. Which of the following statements is correct?

a. The x-variable explains 25% of the variability in the y-variable.

b. The x-variable explains –25% of the variability in the y-variable.

c. The x-variable explains 50% of the variability in the y-variable.

d. The x-variable explains –50% of the variability in the y-variable.

68. One use of a regression line is,….?

a. to determine if any x-values are outliers

b. to determine if any y-values are outliers

c. to determine if a change in x causes a change in y

d. to estimate the change in y for a one-unit change in x.

69. What is the simple arithmetic mean of 15,0,36,0 and 9?

a 20 b. 15 c. 10 d. 60

70. If all values of a sample are same, then its variance is

a. 1

b. 0

c. 2

d. Cannot be determined

71. ____ is a coefficient to measure the degree of relationship between two sets of data by using ranks of observations

a. Pearson's Correlation Coefficient

b. Rank Correlation Coefficient

c. Partial Correlation

d. Multiple Correlation

72. Rank Correlation was obtained by _____ to measure degree of relationship between qualitative characteristics.

a. Karl Pearson b. Galton

c. Spearman d. None of them

73. Which among the following gives the value of byxin the regression equation of y on x?

a. Pxy/σy 2 b. Pxy/σx 2

c. Pxy/σx.σy d. σy/σx

74. Which of the statements do not hold true?

a. Both regression coefficients cannot be greater than 1

b. Regression coefficients are unaffected by origin shift and scale shift

c. Both correlation and regression coefficients are of same sign

d. Two regression lines coincide if r=±1

75. What is the mean for the following scores: 2, 5, 4, 1, 8?

a. 3 b. 4 c. 5 d. 20

76 . A scatterplot shows:

a. the frequency with which values appear in the data.

b. the average value of groups of data.

c. scores on one variable plotted against scores on a second variable.

d. the proportion of data falling into different categories.

77. R 2 is the notation for:

a. the coefficient of correlation.

b. the coefficient of determination.

c. the coefficient of variation.

d. the coefficient of regression.

78. In a linear regression equation, Y=a + bX, what is the b denote?

a. the regression coefficient, the slope of the line.

b. the intercept with the y-axis.

c. the correlation coefficient, the strength of the line

d. the score on the variable x.

79. In a linear regression equation, what does a slope of 2.5 indicate?

a. for every increase of 2.5 on the y-axis, there is an increase of 5.0 on the x-axis.

b. for every increase of 2.5 on the x-axis, there is an equivalent increase on the y-axis.

c. for every increase of 1.00 on the x-axis, there is an increase of 2.5 on the y-axis.

d. for every increase of 1.00 on the y-axis, there is an decrease of 2.5 on the x-axis.

80. A magazine editor designs a survey to better serve the interests of the magazine's readers. Some of the questions about the respondent include the respondent's . Which of these variables are qualitative?

i) age. ii) gender. iii) income.

a. ii) b. i) and iii)

c. ii) and iii) d. i), ii), and iii)

81. Participants in a weight-loss program are asked for the following biographical information upon entering the program: Which of these variables are quantitative?

i) weight

ii) gender

iii) age

a. i) b. ii)

c. iii) d. i) and iii)

82. The correlation coefficient is used to determine:

a. A specific value of the y-variable given a specific value of the x-variable

b. A specific value of the x-variable given a specific value of the y-variable

c. The strength of the relationship between the x and y variable**s**

d. None of these

83. If there is a very strong correlation between two variables then the correlation coefficient must be

a. any value larger than 1

b. much smaller than 0, if the correlation is negative

c. much larger than 0, regardless of whether the correlation is negative or positive

d. None of these alternatives is correct.

84. In regression, the equation that describes how the response variable (y) is related to the explanatory variable (x) is:

a. the correlation model

b. the regression model

c. used to compute the correlation coefficient

d. None of these alternatives is correct.

85. In regression analysis, the variable that is being predicted is the

a. response, or dependent, variable

b. independent variable

c. intervening variable

d. is usually x

86. If the correlation coefficient is a positive value, then the slope of the regression line

a. must also be positive

b. can be either negative or positive

c. can be zero

d. can not be zero

87. The correlation coefficient may assume any value between……. and ……?

a. 0 and 1 b. $-\infty$ and ∞

c. 0 and 8 d. -1 and 1

88. Assertion (A) :Statistics is indispensable in planning.

Reason (R) :In order to achieve the above goals, various advanced statistical techniques are used for processing, analyzing and interpreting data.

a. Both A and R are true and R is the correct explanation of A.

b. Both A and R are true but R is not the correct explanation of A.

c. A is true but R is false.

d. A is false but R is true.

89. The branch of economics wherein mathematics and statistics are used to measure and analyze economics activities is called……..

a. Applied Economics

b. Econometrics

c. Statistics

d. Macro Economics

90. Match the correct codes

1	Statistics as a science of estimates and probabilities	i	H Theil
2	Statistics may be defined as the collection, organisation, presentation, analysis and interpretation of numerical data	ii	Ragnar Frisch
3	"Econometrics is concerned with the empirical determination of economic laws"	iii	Croxton& Cowden
4	"The mutual penetration of quantitative econometric theory and statistical observation is the essence of econometrics"	iv	Boddington

Codes

a. (1) – (i) (2) – (ii) (3) – (iv) (4) – (iii)

b. (1) – (ii) (2) – (iii) (3) – (iv) (4) – (i)

c. (1) – (iv) (2) – (iii) (3) – (i) (4) – (ii)

d. (1) – (i) (2) – (ii) (3) – (iii) (4) – (iv)

91. Match the correct codes

1	Statistics Regression	i	$Y = \beta0 + \beta1X1 + \beta2X2 + \beta3X3+Ui$
2	Econometrics Regression	ii	$\beta0 + \beta1Xi$
3	More than 2 variables	iii	$Yi = \beta0 + \beta1Xi$
4	Systematic Part	iv	$Yi = \beta0 + \beta1Xi$

Codes

a. (1) – (i) (2) – (ii) (3) – (iv) (4) – (iii)

b. (1) – (ii) (2) – (iii) (3) – (iv) (4) – (i)

c. (1) – (iv) (2) – (iii) (3) – (i) (4) – (ii)

d. (1) – (i) (2) – (ii) (3) – (iii) (4) – (iv)

Answers									
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
b	a	a	b	c	c	c	d	a	b
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
a	d	c	b	d	a	b	c	b	c
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
d	a	d	d	a	a	c	b	d	c
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
a	d	a	b	d	c	d	a	c	a
41	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**
d	d	a	c	d	c	a	b	c	d
51	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
a	b	b	c	a	b	c	a	b	d
61	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**
a	d	a	b	a	b	a	d	c	b
71	**72**	**73**	**74**	**75**	**76**	**77**	**78**	**79**	**80**
b	c	b	b	b	c	b	a	c	a
81	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**
d	c	b	b	a	a	d	a	b	c
91									
c									

Additional Two Marks

1. Write a brief note on origin of Indian Statistics.

- Evidence from history proves that during the reign of Chandra Gupta Maurya, there existed a system of maintaining vital statistics, incuding registration of births and deaths.
- Such records can be found in Kautilya'sArthashastra even before 300B.C.
- The book "Ain-e-Akbari" (1596-97) mentions the statistical and

administrative surveys conducted during Akbar's rule.

2. Comment – "Statistics and Education"

- ❖ Statistics is necessary for the formulation of policies to start new course, according to the changing environment.
- ❖ There are many educational institutions owned by public and private engaged in research and development work to test the past knowledge and evolve new knowledge.
- ❖ These are possible only through statistics.

3. Write a short note on Statistics and Economics.

Statistical data and techniques are immensely useful in solving many economic problems such as fluctuation in wages, prices, production, distribution of income and wealth and so on.

4. Write brief note on Statistics and Medicine.

- ❖ In Medical sciences, statistical tools are widely used.
- ❖ In order to test the efficiency of a new drug or to compare the efficiency of two drugs or two medicines, t - test for the two samples is used.
- ❖ More and more applications of statistics are at present used in clinical investigation.

5. List the major differences between Descriptive Statistics and Inferential Statistics

S. No	Descriptive Statistics	Inferential Statistics
1	It describes the population under study.	It draws conclusion for the population based on the sample result.
2	It presents the data in a meaningful way through charts, diagrams, graphs, other than describing in words	It uses hypotheses, testing and predicting on the basis of the outcome.
3	It gives the summary of data	It tries to understand the population beyond the sample.

6. What is data?

Data is the information about facts or numbers collected to be examined and used to help with decisions. Data are the basic raw materials of statistics.

7. State the meaning of different types of data.

1. Quantitative data are those that can be quantified in definite units of measurement. These refer to characteristics whose successive measurements yield quantifiable observations. Eg.Age, income, number of firms etc.
2. Qualitative data refer to qualitative characteristics of a subject or an object. A characteristic is qualitative in nature when its observations are defined and noted in terms of the presence or absence of a certain attribute in discrete numbers. These data are further classified as nominal and rank data. Eg. Gender, Community, honesty…

8. What are Nominal Data?

- ❖ Nominal data are the outcome of classification into two or more

categories of items or units comprising a sample or a population according to some quality characteristic.

- ❖ Classification of students according to their sex (as males and females), Workers according to their skill (as skilled, semi-skilled, and unskilled), and of employees according to their level of education (as matriculates, undergraduates, and post-graduates).

9. Write the meaning of Rank Data/

- ❖ Rank data, on the other hand, are the result of assigning ranks to specifyorder in terms of the integers 1,2,3, ..., n.
- ❖ Ranks may be assigned according to the level of performance in a test, a contest, a competition, an interview, or a show.

10. Write the key difference between primary and secondary data.

i) Primary data: Those data which do not already exist in any form, and thus have to be collected for the first time from the primary source(s). By their very nature, these data are fresh and first-time collected covering the whole population or a sample drawn from it

(ii) Secondary data: They already exist in some form: published or unpublished in an identifiable secondary source. They are, generally, available from published source(s), though not necessarily in the form actually required. Eg. Data from CSO, NSSO, RBI….

11. What is central tendency?

- ❖ Central value is called a measure of central tendency or an average or a measure of locations. There are five averages.
- ❖ Among them mean, median and mode are called simple averages and the other two averages geometric mean and harmonic mean are called special averages.

12. A student's marks in 5 subjects are 75,68,80,92,and 56. Find his average mark.

X	**d = X - A**
75	7
68 → A	0
80	12
92	24
56	-12
Total	**31**

$$\bar{x} = A + \frac{\Sigma d}{n}$$

$$= 68 + \frac{31}{5}$$

$$= 68 + 6.2$$

$$= 74.2$$

13. What is dispersion? List its types.

The degree of variation is evaluated by various measures of dispersion. There are two kinds of measures of dispersion, namely

1. Absolute measure of dispersion
2. Relative measure of dispersion

14. Write a note on absolute measure of dispersion.

Absolute measure of dispersion indicates the amount of variation in a set of values in terms of units of observations.

15. Mention the meaning of relative measure of dispersion.

- ❖ Relative measures of dispersion are free from the units of measurements of the observations.
- ❖ They are pure numbers.
- ❖ They are used to compare the variation in two or more sets, which are having different units of measurements of

observations.

16. What is meant by standard deviation?

- ❖ It is defined as the positive square-root of the arithmetic mean of the square of the deviations of the given observation from their arithmetic mean.
- ❖ The standard deviation of the population is denoted by the Greek letter σ (sigma) The standard deviation of sample is denoted as 's'.

17. What are the methods of calculating SD?

There are two methods of calculating Standard deviation in an individual series.

a) Deviations taken from Actual mean

b) Deviation taken from Assumed mean

18. Write the meaning of the term "Correlation"

- ❖ Correlation is a statistical device that helps to analyse the covariation of two or more variables.
- ❖ Sir Francis Galton, is responsible for the calculation of correlation coefficient.

19. What is Positive Correlation?

The correlation is said to be positive if the values of two variables move in the same direction.

Ex 1: If income and Expenditure of a Household may be increasing or decreasing simultaneously. If so, there is positive correlation. Ex. Y= a + bx

20. What is Negative Correlation?

The Correlation is said to be negative when the values of variables move in the opposite directions. Ex. Y= a – bx

Ex 1: Price and demand for a commodity move in the opposite direction.

21. Distinguish between simple and multiple correlation.

Simple Correlation:

If only two variables are taken for study then it is said to be simple correlation. Ex. Y= a + bx

Multiple Correlations:

If three or more than three variables are studied simultaneously, then it is termed as multiple correlation.

Ex: Determinants of Quantity demanded

Qd= f (P, Pc, Ps, t, y)

Where Qd stands for Quantity demanded, f stands for function.

22. What is the meaning of Partial Correlation?

If there are more than two variables but only two variables are considered keeping the other variables constant, then the correlation is said to be Partial Correlation

23. Mention the difference between linear and non linear correlation.

Linear Correlation: Correlation is said to be linear when the amount of change in one variable tends to bear a constant ratio to the amount of change in the other.

Ex. Y= a + bx

Non Linear: The correlation would be non-linear if the amount of change in one variable does not bear a constant ratio to the amount of change in the other variables.

Ex. Y= a + bx2

24. What are the Methods of Studying Correlation:?

The various methods of ascertaining whether two variables are correlated or not are:

1. Scatter diagram Method
2. Graphic Method
3. Karl Pearson's Co - efficient of correlation and
4. Method of Least Squares.

25. Define "Scatter Diagram" Method of correlation.

- ❖ Scatter diagram is a graph of observed plotted points where each point represents the values of X and Y as a coordinate.
- ❖ It portrays the relationship between these two variables graphically.

26. Write the Advantages of Scatter Diagram method .

(1) It is very simple and non- mathematical method

(2) it is not influenced by the size of extreme item.

(3) It is the first step in resting the relationship between two variables.

27. What is the important Disadvantages of Scatter diagram method?

It cannot establish the exact degree of correlation between the variables, but provides direction of correlation and depicts it is high or low.

28. "Coefficient of correlation' – define.

- ❖ Karl Pearson's Method is popularly known as Pearson's coefficient of correlation denoted by the symbol 'r'.
- ❖ The coefficient of correlation 'r' measures the degree of linear relationship between two variables say X and Y. The Formula for computing Karl Pearson's Coefficient of correlation is:

$$r = \frac{N\Sigma XY - (\Sigma X)(\Sigma Y)}{\sqrt{N\Sigma X^2 - (\Sigma X)^2}\sqrt{N\Sigma Y^2 - (\Sigma Y)^2}}$$

29. Explain the following term:$\Sigma dxdy$, Σdx^2, Σdy^2, Σdx and Σdy.

- ❖ $\Sigma dxdy$ = Sum of product of the deviations x and y series from their assumed means.
- ❖ $\Sigma dx2$ = Sum of the squares of the deviations of x series from an assumed mean
- ❖ $\Sigma dy2$= Sum of the squares of the deviations of y series from an assumed mean
- ❖ Σdx = sum of the deviation of x series from an assumed mean of x
- ❖ Σdy = sum of the deviation of y series from an assumed mean of y

30. What are the Two Regression lines equations?

i. X on Y => X = a + by

ii. Y on X => Y = a + bx

31. List different equation forms of econometrics.

i. Economics + Mathematics= Mathematical Economics

ii. Mathematical Economics+ Statistical Data & Its Technique = Econometrics

iii.{Economics + Statistics + Mathematics}+Empirical Data = Econometrics

32. Write the definition of economics in the words of Ragnar Frisch.

"The mutual penetration of quantitative econometric theory and statistical observation is the essence of econometrics".

33. Write an equation on : i) Statistics Regression, ii) Econometrics Regression

i. Statistics Regression: $Yi = \beta 0 + \beta 1Xi$

ii. Econometrics Regression: $Yi = \beta 0 + \beta 1Xi + Ui$

34. List the Limitations of statistics.

1. Statistics is not suitable to the study of qualitative phenomenon

2. Statistical laws are not exact:

3. Statistics table may be misused:

4. Statistics is only one of the methods of studying a problem

35. Write some of econometric software that you may know.

There are many other packages which are used by econometricians, include Eviews, Gretl, PcGive, Python, RATS, SAS.

Additional Three marks

1. List the Assumptions of the Linear Regression Model.

The Linear regression model is based on certain assumptions

1. Some of them refer to the distribution of the random variable .
2. Some of them refer to the relationship between Ui and the explanatory variables (x1, x2, x3 given in the above example).
3. Some of them refer to the relationship between Ui the explanatory variables themselves.

2. Write note on MOSPI.

- The Ministry of Statistics and Programme Implementation (MOSPI) came into existence as an Independent Ministry in 1999 after the merging of the Department of Statistics and the Department of Programme Implementation.
- The Ministry has two wings, Statistics and Programme Implementation. The Statistics Wing called the National Statistical Office (NSO) consists of the Central Statistical Office (CSO), the Computer Centre and the National Sample Survey Office (NSSO).

3. Write a note on CSO.

Central Statistical Office (CSO)

- The Central Statistical Office is one of the two wings of the National Statistical Organisation (NSO).
- It is responsible for co-ordination of statistical activities in the country and for evolving and maintaining statistical standards.
- Its activities include compilation of National Accounts; conduct of Annual Survey of Industries and Economic Censuses, compilation of Index of Industrial Production as well as Consumer Price Indices.
- It also deals with various social statistics, training, international cooperation, Industrial Classification, etc.

4. What is NSSO?

National Sample Survey Organisation (NSSO)

i. The National Sample Survey Organisation, now known as National Sample Survey Office, is an organization under the Ministry of Statistic of the Government of India.

ii. It is the largest organisation in India, conducting regular socio-economic surveys.

5. What are the divisions of NSSO?

NSSO has four divisions:

1. Survey Design and Research Division (SDRD)
2. Field Operations Division (FOD)
3. Data Processing Division (DPD)
4. Co-ordination and Publication Division (CPD)

6. List the wings of Programme Implementation.

The Programme Implementation Wing has three Divisions, namely,

(i) Twenty Point Programme

(ii)Infrastructure Monitoring and Project Monitoring

(iii)Member of Parliament Local Area Development Scheme.

7. List any of three scopes of statistics with explanation.

Statistics and Economics

Statistical data and techniques are immensely useful in solving many economic problems such as fluctuation in wages, prices, production, distribution of income and wealth and so on.

Statistics and Firms

Statistics is widely used in many firms to find whether the product is conforming to specifications or not.

Statistics and Commerce

Statistics are life blood of successful commerce. Market survey plays an important role to exhibit the present conditions and to forecast the likely changes in future.

8. Discuss the limitations of statistics.

1. Statistics is not suitable to the study of qualitative phenomenon:

Since statistics is basically a science and deals with a set of numerical data. It is applicable to the study of quantitative measurements.

2. Statistical laws are not exact:

It is well known that mathematical and physical sciences are exact. But statistical laws are not exact and statistical laws are only approximations.

3. Statistics table may be misused:

Statistics must be used only by experts; otherwise, statistical methods are the most dangerous tools on the hands of the inexpert.

4. Statistics is only one of the methods of studying a problem:

Statistical method does not provide complete solution of the problems because problems are to be studied taking the background of the countries culture, philosophy, religion etc., into consideration.

9. Explain the correlation based on the direction of change of variables.

Correlation is classified into two types as Positive correlation and Negative Correlation based on the direction of change of the variables.

Positive Correlation:

The correlation is said to be positive if the values of two variables move in the same direction.

Ex: If income and Expenditure of a Household may be increasing or decreasing simultaneously. If so, there is

positive correlation. Ex. Y= a + bx

Negative Correlation:

The Correlation is said to be negative when the values of variables move in the opposite directions. Ex. Y= a – bx

Ex :Price and demand for a commodity move in the opposite direction.

10. State the types of correction on the basis of number of variables studied.

There are three types based upon the number of variables studied as

a) Simple Correlation

b) Multiple Correlation

c) Partial Correlation

Simple Correlation:

If only two variables are taken for study then it is said to be simple correlation. Ex. Y= a + bx

Multiple Correlations:

If three or more than three variables are studied simultaneously, then it is termed as multiple correlation.

Ex: Determinants of Quantity demanded

Qd= f (P, Pc, Ps, t, y)

Where Qd stands for Quantity demanded, f stands for function.

P is the price of the goods,

Pc is the price of competitive goods

Ps is the price of substituting goods

t is the taste and preference

y is the income.

Partial Correlation:

If there are more than two variables but only two variables are considered keeping the other variables constant, then the correlation is said to be Partial Correlation

11. Distinguish between linear and non linear correlation.

Linear Correlation: Correlation is said to be linear when the amount of change in one variable tends to bear a constant ratio to the amount of change in the other.

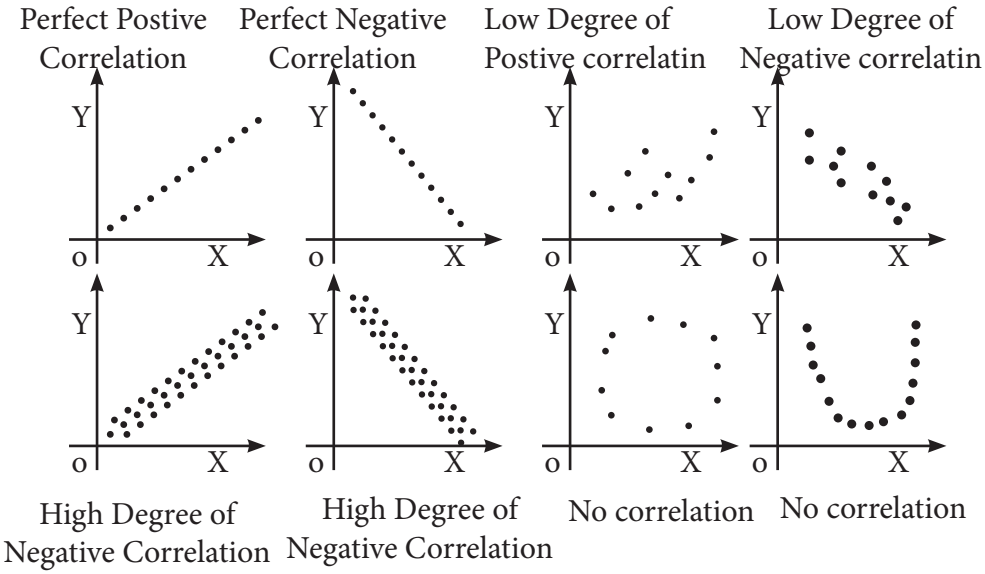
Ex. Y= a + bx

Non Linear: The correlation would be non-linear if the amount of change in one variable

does not bear a constant ratio to the amount of change in the other variables.

Ex. Y= a + bx2

12. Draw the various kinds of scatter diagram.



13. Calculate the AM of 305, 320, 332, 350

X	**d = X - 320**
305	-15
320	0
332	12
350	30
	27

$\bar{x}$	=	A +	$\frac{\Sigma d}{n}$
	=	320 +	$\frac{27}{4}$
	=	320 + 6.75	
	=	326.75	

14. Calculate the SD of the following data. 2 3 , 2 5 , 2 8 , 3 1 , 3 8 , 4 0 , 4 6

X	**(x- $\bar{x}$)**	**(x- $\bar{x}$)2**
13	-10	100
28	-8	64
28	-5	25
31	-2	4
38	5	25
40	7	49
46	13	169

$$SD = \sqrt{\frac{\Sigma\ (x) - \bar{X})^2}{n}} = 7.89$$

231		436
$\bar{x}$	=	231 / 7 =33

15. Given the diagrams, find the nature of correlation of various figures.

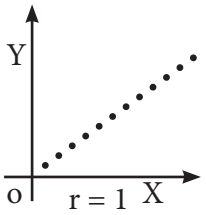


Fig. 1

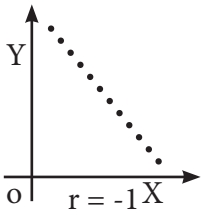


Fig. 2

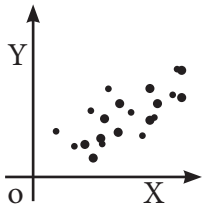


Fig. 3

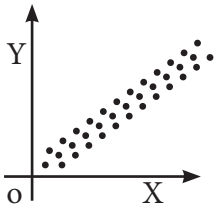


Fig. 4

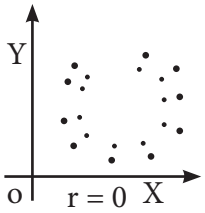


Fig. 5

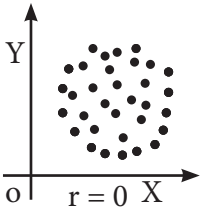


Fig. 6

Solution

Fig.1 : Perfect Positive Correlation

Fig.2 : Perfect Negative Correlation

Fig.3 : High Degree of Positive Correlation

Fig.4 : High Degree of Negative Correlation

Fig.5 : No Correlation

Fig.6 : No Correlation

16. List various degrees of Karl Pearson co-efficient of correlation

- If r xy = 1, we say that there is perfect positive correlation between x and y.
- If r xy = – 1, we say that there is perfect negative correlation between x and y.
- If r xy = 0, we say that there is no correlation between the two variables, i.e., the two variables are uncorrelated.

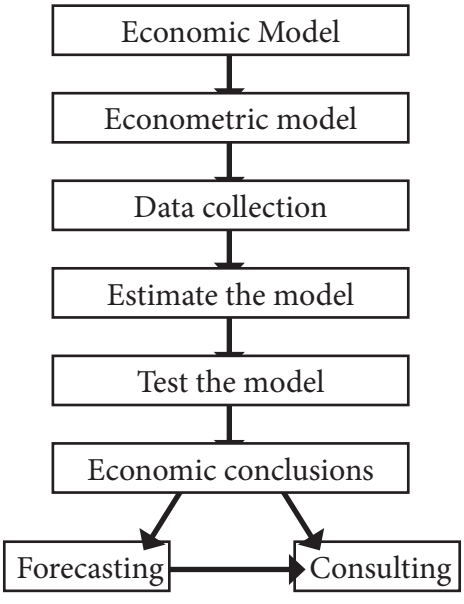
- If r xy> 0, we say that the correlation between x and y is positive (direct).
- If r xy< 0, we say that the correlation between x and y is negative (indirect).

17. List any three difference between correlation and regression.

S. No	Correlation	Regression
1	Correlation is the relationship between two or more variables, which vary with the other in the same or the opposite direction	Regression means going back and it is a mathematical measure showing the average relationship between two variables
2	Both the variables X and Y are random variables	Both the variables may be random variables
3	It finds out the degree of relationship between two variables and not the cause and effect relationship.	It indicates the cause and effect relationship between the variables and establishes functional relationship.
4	It is used for testing and verifying the relation between two variables and gives limited information	Besides verification it is used for the prediction of one value, in relation to the other given value.

18. How an econometric model is done?

The following chart depicts how an economic model is done.



19. What are the aims of econometrics analysis?

Aims of econometric analysis:

- Testing economic hypotheses

- ❖ Quantifying economic parameters
- ❖ Forecasting
- ❖ Establishing new facts from statistical evidence (e.g. empirical relationships among variables).

Additional Five marks

1. Discuss in detail about the limitations of statistics.

1. Statistics is not suitable to the study of qualitative phenomenon:

- ❖ Since statistics is basically a science and deals with a set of numerical data.
- ❖ It is applicable to the study of quantitative measurements.
- ❖ As a matter of fact, qualitative aspects like empowerment, leadership, honesty, poverty, intelligence etc., cannot be expressed numerically and statistical analysis cannot be directly applied on these qualitative phenomena.

2. Statistical laws are not exact:

- ❖ It is well known that mathematical and physical sciences are exact.
- ❖ But statistical laws are not exact and statistical laws are only approximations. Statistical conclusions are not universally true.
- ❖ They are true only on an average.

3. Statistics table may be misused:

- ❖ Statistics must be used only by experts; otherwise, statistical methods are the most dangerous tools on the hands of the inexpert.
- ❖ The use of statistical tools by the inexperienced and untrained persons might lead to wrong conclusions.

4. Statistics is only one of the methods of studying a problem:

- ❖ Statistical method does not provide complete solution of the problems because problems are to be studied taking the background of the countries culture, philosophy, religion etc., into consideration.
- ❖ Thus the statistical study should be supplemented by other evidences.

2. Compare and contrast primary and secondary data.

BASIS FOR COMPARISON	PRIMARY DATA	SECONDARY DATA

Meaning	Those data which do not ready exist in any form, and thus have to be collected for the first time from the primary source(s).	They already exist in zome form: published or npublished in an identifiable secondary source.
Nature	Real time data - first-time collected	Past data - available from published source(s)
Process	Very involved	Quick and easy
Source	Surveys, observations, experiments, questionnaire, personal interview, etc.	Government publications, websites, books, journal articles, internal records etc. Eg. Data from CSO, NSSO, RBI
Cost effectiveness	Expensive	Economical
Collection time	Long	Short
Form	Crude form	Refined form
Accuracy and Reliability	More	Relatively less

3. What are the Steps involved in standard deviation calculation?

4. Distinguish between Qualitative and Quantitative data.

1. Find out the actual mean of given data ($\bar{x}$)
2. Find out the deviation of each value from the mean ($x = X - \bar{x}$)
3. Square the deviations and take the total of squared deviations Σx^2
4. Divided the total Σx^2 by the number of observation $\left(\frac{\Sigma x^2}{n}\right)$
5. The square root of $\left(\frac{\Sigma x^2}{n}\right)$ is standard deviation.

BASIS FOR COMPARISON	QUALITATIVE DATA	QUANTITATIVE DATA
Meaning	Qualitative data is the data in which the classification of objects is based on attributes and properties.	Quantitative data are those that can be quantified in definite units of measurement.
Examples	Eg. Gender, Community, honesty	Age, income, number of firms etc
Approach	Subjective	Objective
Collection of data	Unstructured	Structured

Sample	Small number of non-representative samples	Large number of representative samples
Outcome	Develops initial understanding.	Recommends final course of action.

5. Calculate the standard deviation from the following data by Actual Mean Method: 25, 15, 23, 42, 27, 25, 23, 25, and 20.

Solution: Deviations from actual mean.

S.No	X	(x- x)	$(x-\bar{x})^2$
1	25	25-25=0	0
2	15	15-25=10	100
3	23	23-25=-2	1
4	42	42-25-17	289
5	27	27-25-2	4
6	25	25-25-0	0
7	23	23-25=-2	4
8	25	25-25=0	0
9	20	20-25=-5	25
N-9	225	0	126

$$\bar{x} = \frac{225}{9} = 25$$

$$\sigma = \sqrt{\frac{\Sigma(x-\bar{X})^2}{N}}$$

$$= \sqrt{\frac{426}{9}}$$

$$= \sqrt{47.33}$$

$$\sigma = 6.88$$

6. Calculate the standard deviation for the following data by assumed mean method: 43, 48, 65, 57, 31, 60, 37, 48, 78, 59

S.No	(X)	D=X-A (A=57)	$(x-\bar{x})^2$
1	43	-14	196
2	48	-9	87
3	65	8	64
4	57	0	0
5	31	-26	679
6	60	3	9
7	37	-20	400

8	48	-9	81
9	78	21	441
10	59	2	4
N-9		Σd=44	$\Sigma d^2$1952

$$\sigma = \sqrt{\frac{\Sigma d^2}{n} - \frac{(\Sigma d)^2}{(n)}} = \sqrt{\frac{1952}{10} - \frac{(-44)^2}{(10)}}$$

$$= \sqrt{195.2 - 19.36} = \sqrt{175.84} = 13.26$$

7. What are the the Formula for computing Karl Pearson's Coefficient of correlation?

1. $r = \dfrac{N\Sigma XY - (\Sigma X)(\Sigma Y)}{\sqrt{N\Sigma X^2 - (\Sigma X)^2}\ \sqrt{N\Sigma Y^2 - (\Sigma Y)^2}}$

'r' is calculated by Direct Method without taking deviation of terms either from actual mean or assumed mean.

2. r is calculated by taking the Deviation from acutual mean.

$r = \dfrac{\Sigma xy}{\sqrt{\Sigma x^2 - \Sigma y^2}}$ where x = (x - $\bar{x}$), y = ($\bar{x}$)

3) 'r' is calculated by taking assumed mean

$$r = \frac{N\Sigma dxdy - (\Sigma dx)(\Sigma dy)}{\sqrt{N\Sigma dx^2 - (\Sigma dx)^2}\ \sqrt{N\Sigma dy^2 - (\Sigma dy)^2}}$$

Where dx refers to deviations of x series from assumed mean (x-$\bar{x}$), dy refers to deviations of y series from an assumed mean of (y-$\bar{y}$)

- Σdxdy = Sum of product of the deviations x and y series from their assumed means.
- Σdx2 = Sum of the squares of the deviations of x series from an assumed mean
- Σdy2= Sum of the squares of the deviations of y series from an assumed mean
- Σdx = sum of the deviation of x series from an assumed mean of x
- Σdy = sum of the deviation of y series from an assumed mean of y

8. Explain the steps involved computing the correlation Coefficient.

Procedure for Computing the Correlation Coefficient: (For Direct and Deviation from actual mean method).

- ❖ Step-1 Calculate the mean of two series 'X"Y'
- ❖ Step-2 Calculate the deviations 'X' and Y in two series from their respective mean.
- ❖ Step-3 Square each deviations of 'X' and 'Y' then obtain the sum of the Squared deviation, Step-4 Multiply each deviation under X with each deviation under Y and obtain the product of 'xy'. Then obtain the sum of the product of X,Y. Then obtain the sum of the product of x,y is Σxy.
- ❖ Step-5 Substitute the value in the formula.

9. Calculate Karl Pearson's Coefficient of correlation from the following data and interpret its value:

Example 1

Calculate Karl pearson's Cofficient of correlation form the followng data and interpret its value:

Price : x	10	12	14	15	19
Supply : Y	40	41	48	60	50

Solution : Let us take price as X and supply as Y

Compulation of Pearson's Correlation Coefficient				
Price: X	Supply : Y	XY	X^2	Y^2
10	40	400	100	1600
12	41	492	144	1681
14	48	672	196	2304
15	60	900	2250	3600
19	50	950	3610	2560
$\Sigma x = 70$	$\Sigma y = 239$	$\Sigma xy = 3414$	$\Sigma x^2 = 1026$	$\Sigma y^2 = 11685$

$$r = \frac{N\Sigma XY - (\Sigma X)(\Sigma Y)}{\sqrt{N\Sigma X^2 - (\Sigma X)^2}\sqrt{N\Sigma Y^2 - (\Sigma Y)^2}} \qquad r = \frac{(5x3414) - (70x239)}{\sqrt{(5x1026) - (70)^2}\sqrt{5x11685 - (239)^2}}$$

$$r = \frac{17,070 - 16,730}{\sqrt{230x}\sqrt{1304}} \qquad r = \frac{340}{547.65} = +0.621$$

Pirce of the product and supply for the product is positively correlated. When price of the product increases then the supply for the product also incresases.

10.Estimate the coefficient of correlation with actualmean method for the following data.

Age of Cars in years	3	6	8	9	10	6

Cost of Annual Maintains	1	7	4	6	8	4

$$r = \frac{\Sigma xy}{\sqrt{\Sigma x^2 - \Sigma y^2}}$$ where x = Σ (x - $\bar{x}$), y = Σ(y-$\bar{y}$)

S.No	X	x - $\bar{x}$ x - 7 = x	(x - x$\bar{x}$)² =x²	y	y- $\bar{y}$ y - 5 = y	(y- $\bar{y}$)² = y²	xy
1	3	-4	16	1	-4	1	16
2	6	-1	1	7	2	49	-2
3	8	+1	1	4	-1	16	-1
4	9	2	4	6	1	36	2
5	10	3	9	8	3	64	9
6	6	-1	1	4	-1	16	+1
$\bar{x}$ 42/6	= 7	0	32	$\bar{y}$ 42/6	=7	0	182	25
Σx² = 32				Σy² = 182		Σxy = 25	

Applying formula

$$r = \frac{\Sigma xy}{\sqrt{\Sigma x^2}\sqrt{\Sigma y^2}} = \frac{25}{\sqrt{32}\sqrt{182}} = \frac{25}{5.66 x 13.49} = \frac{25}{76.35}$$

r = 0.327, The car is getting old in years the cost of maintenane is also increasing. The age of Car and its maintenance are postively correlated.

11.Find the Karl Pearson coefficient of Correlation between X and Y from the following data:

X:	10	12	13	16	17	20	25
Y:	19	22	26	27	29	33	37

Solution:

Formula for Assumed Mean Deviation method.

$$r = \frac{N\Sigma dxdy - (\Sigma dx)(\Sigma dy)}{\sqrt{N\Sigma dx^2 - (\Sigma dx)^2}\sqrt{N\Sigma dy^2 - (\Sigma dy)^2}}$$

S.No	X	Y	(X-A)=dx	(Y-A)=dy	dx2	dy2	dxdy
1	10	19	-6	-8	36	64	48
2	12	22	-4	-5	16	25	20
3	13	26	-3	-1	9	1	3

4	16	27	0	0	0	0	0
5	17	29	1	2	1	4	2
6	20	33	4	6	16	36	24
7	25	37	9	10	81	100	30
N =7	ΣX = 113	ΣY= 193	**Σ**	**Σ(Y-A)=1**	**Σ(Y-A)=4**	**Σdx^2 = 159**	**Σdxdy = 187**

$$\bar{X} = \frac{\Sigma}{N} = \frac{113}{7} = 16\frac{1}{7}$$

$$\bar{Y} = \frac{\Sigma Y}{N} = \frac{193}{7} = 27\frac{4}{7}$$

Take the assumed values A = 16 & B =27 therefore dx = X - A → X - 16 and Wdy = → Y - 27

$$r = \frac{N\Sigma dxdy - (\Sigma dx)(\Sigma dy)}{\sqrt{N\Sigma dx^2 - (\Sigma dx)^2}\sqrt{N\Sigma dy^2 - (\Sigma dy)^2}}$$

$$= \frac{7\,X187 - 1X4}{\sqrt{7\,X159 - (1)^2}\sqrt{7X230 - (4)^2}}$$

$$= \frac{1309 - 4}{\sqrt{1112}\sqrt{1610 - 16}}$$

$$= \frac{1305}{\sqrt{1112}\sqrt{1594}} = \frac{1305}{\sqrt{33.34}\sqrt{39.92}}$$

$$= \frac{1305}{1330.9} = 0.9865 \quad r = 0.986$$

12. Distinguish between correlation and regression.

S. No	Correlation	Regression
1	Correlation is the relationship between two or more variables, which vary with the other in the same or the opposite direction	Regression means going back and it is a mathematical measure showing the average relationship between two variables
2	Both the variables X and Y are random variables	Both the variables may be random variables
3	It finds out the degree of relationship between two variables and not the cause and effect relationship.	It indicates the cause and effect relationship between the variables and establishes functional relationship.
4	It is used for testing and verifying the relation between two variables and gives limited information	Besides verification it is used for the prediction of one value, in relation to the other given value.

5	The coefficient of correlation is a relative measure. The range of relationship lies between –1 and +1	Regression coefficient is an absolute figure. If we know the value of the independent variable, we can find the value of the dependent variable
6	There may be spurious correlation between two variables.	In regression there is no such spurious regression
7	It has limited application, because it is confined only to linear relationship between the variables	It has wider application, as it studies linear and nonlinear relationship between the variables
8	It is not very useful for further mathematical treatment.	It is widely used for further mathematical treatment

13. Fit two regression equation

X on Y and Y on X for the following data.

$\bar{x}$=12, y=10, σy= 0.2, σx =0.1 and r = 0.85

Solution

he regression X on y is

$$(X-\bar{X}) = r \times \frac{\sigma x}{\sigma y} \times (Y-\bar{Y})$$

Given $\bar{X}$ = 12, $\bar{Y}$ = 10

r = 0.85,ox = 0.1 and σy =0.2

Then substituting the values in formula

$(X-12) = 0.85 \times (0.1/0.2)\ \sigma y = 0.2$

$(X-12) = 0.85 \times (0.5) \times (Y-10)$

$X = 0.425 \times (Y-10) + 12$

$X = 0.425y - 4.25 + 12$

$x = 0.425Y + 7.75$

X on Y

Answer

X = 0.425Y + 7.75

The regression Y on X is

$$(Y-\bar{Y}) = r \times \frac{\sigma x}{\sigma y} \times (X-\bar{X})$$

Given $\bar{X}$ = 12, $\bar{y}$ = 10

r = 0.85,ox = 0.1 and σy =0.2

Then substituting the values in formula

$(Y-10) = 0.85 \times (0.2/0.1) \times (X-12)$

$(Y-10) = 0.85 \times (2) \times (X-12)$

$$Y = 1.7 \times (X-12) + 10$$
$$Y = 1.7\,X - 20.4 + 10$$
$$Y = 1.7\,X + 10.4$$

Y on X

Answer

$$Y = \mathbf{1.7\,X - 10.4}$$

14. Enumerate the methodology of econometrics?

Broadly speaking, traditional or classical econometric methodology consists of the following steps.

1) Statement of the theory or hypothesis

2) Specification of the mathematical model of the theory

3) Specification of the econometric model of the theory

4) Obtaining the data

5) Estimation of the parameters of the econometric model

6) Hypothesis testing

7) Forecasting or prediction

8) Using the model for control or policy purposes.

15. Given the following data on sales (in thousand units) and expenses (in thousand rupees) of afirm for 10 month.

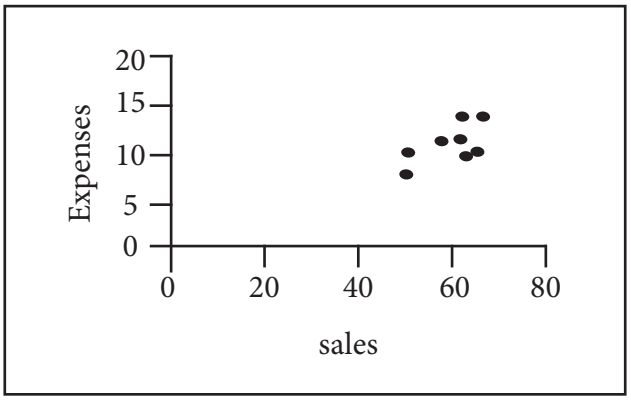
Month	J	F	M	A	M	J	J	A	S	O
Sales :	50	50	55	60	62	65	68	60	60	50
Expenses	11	13	14	16	16	15	15	14	13	13

a) Make a Scatter Diagram

b) Do you think that there is a correlation between sales and expenses of the firm? Is it positive or negative? Is it high or low?

Solution:

(a) The Scatter Diagram of the given data is shown in Figure



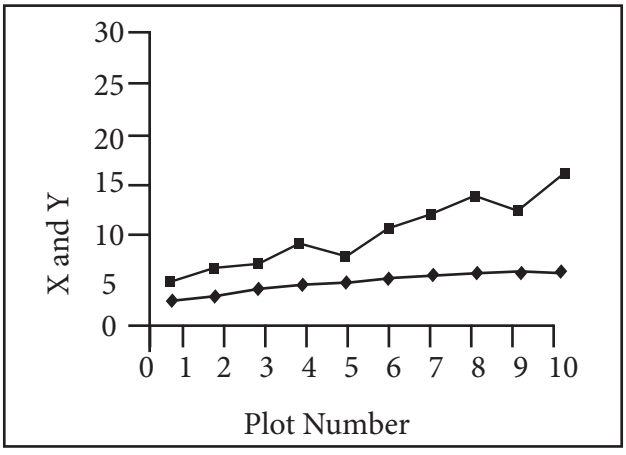
- ❖ Figure shows that the plotted points are close to each other and reveal an upward trend.
- ❖ So there is a high degree of positive correlation between sales and expenses of the firm.

16. Find out graphically, if there is any correlation between price yield per plot (qtls); denoted by

Y and quantity of fertilizer used (kg); denote by X.

Plot No :	1	2	3	4	5	6	7	8	9	10
y:	3.5	4.3	5.2	5.8	6.4	7.3	7.2	7.5	7.8	8.3
x:	6	8	9	12	10	15	17	20	18	24

Solution : The correlogram of the given data is show in Figure 4-3



The figure shows that the two curves move in the same direction and, moreover, they are veryclose to each other, suggesting a close relationship between price yield per plot (qtls) andquantity of fertilizer used (kg)

17. List the degrees of correlation corresponding to variousvalues of r.

Value of r	Degree of correlation
±1	Perfect correlation
±0.90 or more	very high degree of correlation
±0.75 to ± 0.90	sufficiently high degree of correlation
±0.60 to0.90	moderate degree of correlation
±0.30 to ± 0.60	only the possibility of a correlation
less than ±0.30	possibly no correlation
0	absence of correlation

18. Find the Pearsonian correlation coefficient between sales (in thousand units) andexpenses (in

thousand rupees) of the following 10 firms:

Firm	1	2	3	4	5	6	7	8	9	10
Sales :	50	50	55	60	65	65	65	60	60	50
Expenses :	11	13	14	16	16	15	15	14	13	13

Solution: Let sales of a firm be denoted by X and expenses be denoted by Y

Calculations for Coefficient of Correlation

Form	X	Y	$d_x = (X - \bar{X})$	$d_y = (y - \bar{y})$	d^2_x	d^2_y	$d_x d_y$
1	50	11	-8	-3	64	9	24
2	50	13	-8	-1	64	1	8
3	55	14	-3	0	9	0	0
4	60	16	2	2	4	4	4
5	65	16	7	2	49	4	14
6	65	15	7	1	49	1	7
7	65	15	7	1	49	1	7
8	60	14	2	0	4	00	15
9	60	13	2	-1	4	1	-2
10	50	13	-8	-1	64	1	8
	ΣX	ΣY	**11**		Σd^2_x	Σd^2_y	$\Sigma d_x d_y$
	–	–			**–360**	**–22**	**–70**
	580	140					

$$\bar{X} = \frac{\Sigma X}{N} = \frac{580}{10} = 58 \quad and \quad \bar{Y} = \frac{\Sigma Y}{N} = \frac{140}{10} = 14$$

Applying the Eq. (4.3a), we have, Pearsonian coefficient of correlation

$$r_{xy} = \frac{\Sigma d_x d_y}{\sqrt{\Sigma d_x{}^2 d_y{}^2}}$$

$$r_{xy} = \frac{70}{\sqrt{360x22}}$$

$$r_{xy} = \frac{70}{\sqrt{7920}}$$

$$r_{xy} = 0.78$$

The value of = 0.78 xyr , indicate a high degree of positive correlation between sales and expenses.

19. The data on price and quantity purchased relating to a commodity for 5 months is given below: Find the Pearsonian correlation coefficient between prices and quantity and comment on itssign and magnitude.

Month	January	February	March	April	May
Prices (Rs) :	10	10	11	12	12
Quantity (Kg):	5	6	4	3	3

Solution: Let price of the commodity be denoted by X and quantity be denoted by Y

Calculations for Coefficient of Correlation

Month	**X**	**Y**	**X²**	**Y²**	**XY**
1	10	5	100	25	50
2	10	6	100	36	60
3	11	4	121	16	44
4	12	3	144	9	36
5	12	3	144	9	36
	ΣX=55	ΣY=21	ΣX^2=609	ΣY^2=95	ΣXY=226

$$r_{xy} = \frac{N\Sigma XY - \Sigma X \Sigma Y}{\sqrt{N\Sigma X^2 - (\Sigma X)^2}\sqrt{N\Sigma Y^2 - (\Sigma Y)^2}}$$

$$r_{xy} = \frac{5x226 - 55x21}{\sqrt{(5x609 - 55x55)(5x95 - 21x21)}}$$

$$r_{xy} = \frac{1130 - 1155}{\sqrt{20x34}}$$

$$r_{xy} = \frac{-25}{\sqrt{680}}$$

$$r_{xy} = -0.98$$

The negative sign of r indicate negative correlation and its large magnitude indicate a very

- high degree of correlation.
- So there is a high degree of negative correlation between pricesand quantity demanded.

20. An eighth debator was awarded 36 marks by judge A, while Judge B was not present. If

- Judge B were also present, how many marks would you expect him to award to the eighth
- debator, assuming that the same degree of relationship exists in their judgement?

Debator	Marks by A	Marks by B
1	40	32
2	34	39
3	28	26
4	30	30
5	44	38
6	38	34
7	31	28

Solution: Let us use marks from Judge A as X and those from Judge B as Y. Now we have to work out the regression line of Y on X from the calculation below

Debtor	X	Y	U=X-35	V=Y-30	U^2	V^2	UV
1	40	32	5	2	25	4	10
2	34	39	-1	9	1	81	-9
3	28	26	-7	-4	49	16	28
4	30	30	-5	0	25	0	0
5	44	38	9	8	81	64	72
6	38	34	3	4	9	16	12
7	31	28	-4	-2	16	4	8
N=7			ΣU=0	ΣV=17	ΣU^2=206	ΣV^2=185	ΣUV=121

$$\bar{X} = A + \frac{\Sigma U}{N} = 35 + \frac{0}{7} = 35$$

and

$$\bar{Y} = A + \frac{\Sigma V}{N} = 30 + \frac{17}{7} = 32.43$$

$$b_{yx} = b_{yx} = \frac{N\Sigma UV - (\Sigma UV - (\Sigma U \Sigma V)}{N\Sigma U^2 - (\Sigma U)^2}$$

$$= \frac{7x121 - 0x17}{7x206 - 0} = 0.587$$

Hence regression equation can be written as

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

$Y - 32.43 = 0.587(X - 35)$

or Y = 0.587X + 11.87

When X = 36 (awarded by Judge A)

Y = 0.587 x 36 + 11.87

= 33

❖ Thus if Judge B were present, he would have awarded 33 marks to the eighth debator.

21. The height of a child increases at a rate given in the table below. Fit the straight line using the method of least-square and calculate the average increase and the standard error of estimate.

Month	1	2	3	4	5	6	7	8	9	10
Height:	52.5	58.7	65	70.2	75.4	81.1	87.2	95.5	102.2	108.4

Solution : For Egression Calculations, we draw the following table

Month (X)	Height (Y)	X^2	XY
1	52.5	1	52.5
2	58.7	4	117.4
3	65.0	9	195.0
4	70.2	16	280.8
5	75.4	25	377.0
6	81.1	36	486.6
7	87.2	49	610.4

8	95.5	64	764.0
9	102.2	81	919.8
10	108.4	100	1084.0
ΣX=55	**ΣU=796.2**	**ΣX^2=385**	**ΣXY=4887.5**

Considering the regression line as Y = a + bX, we can obtain the values of a and b from the above values.

$$a = \frac{\Sigma Y \Sigma X^2 - \Sigma X \Sigma XY}{N\Sigma X^2 - (\Sigma X)^2}$$

$$a = \frac{796.2x385 - 55x4887.5}{10x385 - 55x55}$$

$$= 45.73$$

$$b = \frac{N\Sigma XY - \Sigma X \Sigma Y}{N\Sigma X^2 - (\Sigma X)^2}$$

$$a = \frac{10x4887.5 - 55x796.2}{10x385 - 55x55}$$

$$= 6.16$$

Hence the regression line can be written as

Y = 45.73 + 6.16x

22. Compute the Pearson r for the same sets of data using the raw score method

X	9,	13,	6,	18,	14,	12,	11,	7,	2,	6,	14,	15,	5,	8,
Y	23,	40,	10,	48,	25,	30,	15,	10,	5,	45,	40,	35,	12,	27

S/No	X	Y	XY	X^2	Y^2
1	9	23	207	81	529
2	13	40	520	169	1600
3	6	10	60	36	100
4	18	48	864	32	2304
5	14	25	350	196	625
6	12	30	360	144	900
7	11	15	165	121	225
8	7	10	70	49	100
9	2	5	10	4	25

10	6	45	270	36	2025
11	14	40	560	196	1600
12	15	35	525	225	1225
13	5	12	60	25	144
14	8	27	216	64	729
Σ	**140**	**365**	**4237**	**1670**	**12131**

Apply the formula

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

$$r = \frac{14x4237 - (140x365)}{\sqrt{(14x1670 - 140^2)(14x12131 - 365^2)}}$$

$$r = \frac{59318 - 51100}{\sqrt{(14x1670 - 140^2)(14x12131 - 365^2)}}$$

$$r = \frac{8218}{\sqrt{13642020}} = \frac{8218}{\sqrt{11763.589}}$$

$$= 0.6985963$$

$$= 0.70$$

23. Calculate the coefficient of correlation for the following data.

Solution

Here we prepare the following table

Here we prepare the following table

X	Y	X^2	Y^2	XY
6	9	36	81	54
2	11	4	121	22
10	5	100	25	50
4	8	16	64	32
8	7	64	49	56
30	40	220	340	214

$$r = \frac{n\Sigma XY - (\Sigma X)(\Sigma Y)}{\sqrt{n\Sigma X^2 - (\Sigma X)^2}\sqrt{n\Sigma Y^2 - (\Sigma Y)^2}}$$

$$= \frac{5x214 - 30\,X\,40}{\sqrt{5\,X220 - 30^2}\sqrt{5X340 - 40^2}}$$

$$= \frac{= 130}{\sqrt{200}\sqrt{100}} = 0.919$$

PUBLIC EXAM MODEL QUESTION PAPER

+2 ECONOMICS

Duration 2.30 Hrs **Max Marks : 90**

Section A

I. Answer all the questions **(20 x 1 = 20)**

1. An economic system where the economic activities of a nation are done both by the private and public together is termed as_____.

a) Capitalistic Economy b) Socialistic Economy

c) Globalised Economy d) Mixed Economy

2. The government has a limited role in a capitalistic economy.

The government provides basic services such as, defense, public health, education, etc.

Codes:

a. Both (A) and (R) are true and (R) is the correct explanation of (A).

b. Both (A) and (R) are true, but (R) is not the correct explanation of (A).

c. (A) is true, but (R) is false.

d. (A) is false, but (R) is true.

3. The largest proportion of national income comes from …….

(a) Private sector (b) Local sector

(c) Public sector (d) None of the above

4. In case of transfer payments of nation income, expenditures towards payment incurred by the government like old age pension……..?

a. should be included b. should not be included

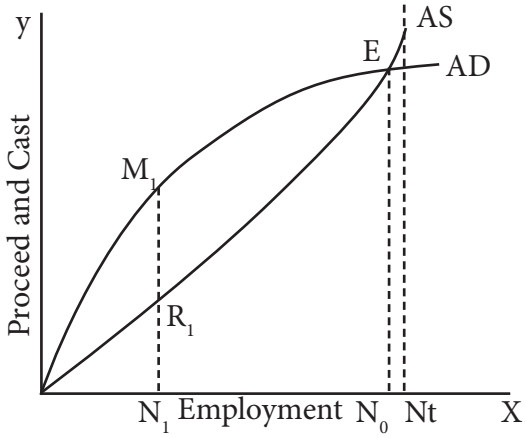
c. both d. none

5. According to Keynes, which type of unemployment prevails in capitalist economy ?

(a) Full employment (b) Voluntary unemployment

(c) Involuntary unemployment (d) Under employment

6. Consider the following diagram.



What do you understand about the difference between No – Nf ?

a. the level of employment b. the level of unemployment

c. the level of underemployment d. none of the above

7. Find the incorrect match with context of classical theory

a. Equilibrium	–	Short-run equilibrium
b. S & I	–	Saving and investment equilibrium through interest rate
c. Money	–	The function of money is to act as a medium of exchange
d. Approach	–	Micro foundation to macro problems

8. Arrange the order of Accelerator effects.

I. Increase in consumer demand

II. Films get close to fill capacity

III. Films invest to meet rising demand

a. I, II, III b. II, I, III c. III, II, I d. III,I,II

9. By Galloping inflation, the percentage of the same is almost ..... from an overall perspective.

a. 1% - 2 % b. 100% - 200 % c. 10% - 20% d. 20% to 100%

10. Given the equation , V^1 represents ...? $PT = MV + M^1V^1$

(a) the quantity of money in circulation (b) the velocity of circulation of money

(c) the volume of bank credit money (d) the velocity of circulation of credit money

11. Identify the odd one.

a. Bank of Imperial (1921) b. Bank of Bengal (1809)

c. Bank of Bombay (1840) d. Bank of Madras (1843)

12. ..... and .....are the frequently used tools with which the RBI can control the availability and the supply of money in the economy

a. The Repo Rate and the Reverse Repo Rate b. CRR, SLR

c. Moral Suasion, Credit Ceiling d. The Reverse Repo Rate, The Repo Rate

13. State which of the following statements are True and which are false. Pick 'T' for True and 'F' for a False statement:

(a) Loans and advances are both granted by banks to customers for a long period of time.

(b) Banks keep our jewellery and important documents safe with them.

(c) Banks grant loans to students for their studies at reasonable interest rate.

(d) Discounting of bills is done by banks free of cost.

(e) Through overdraft, a customer can withdraw more money than the amount in his/her bank account

a. (a) F, (b) F, (c) T, (d) T, (e) F b. (a) T, (b) F, (c) T, (d) F, (e) T

c. (a) F, (b) T, (c) T, (d) F, (e) T d. (a)T, (b) F, (c) T, (d) F, (e) F

14. Cyclical disequilibrium in BOP occurs because of

a) Different paths of business cycle.

b) The income elasticity of demand or price elasticity of demand is different.

c) long-run changes in an economy

d) Both (a) and (b).

15. Which of the following is correct representation in terms of trade agreement?

a. EU < CM > CU > FTA b. EU > CM > CU > FTA

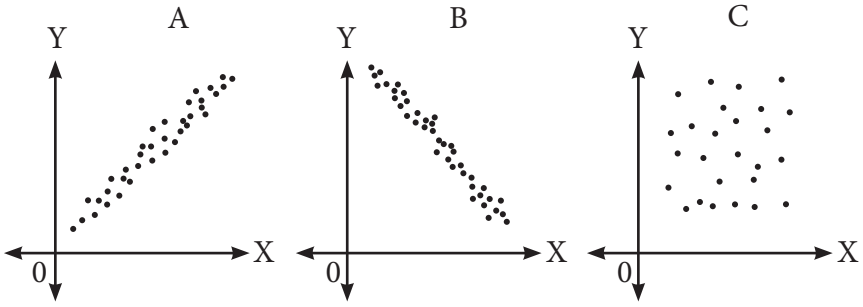
c.EU > CM< CU > FTA d. EU< CM < CU < FTA\

16. Who issues the Special Drawing Rights (SDR) in the following?

a. World Bank b. World Trade Organization

c. Asian Development Bank d. International Monetary Fund

17. Given the diagram, find the nature of correlation.



a. A, B, C, are positive b. A, B, C, are negative

c. A is positive, B is Negative and C is Positive d. A is positive, B is Negative and C is Zero

18. The value of a correlation is reported by a researcher to be r = −0.5. Which of the following statements is correct?

a. The x-variable explains 25% of the variability in the y-variable.

b. The x-variable explains −25% of the variability in the y-variable.

c. The x-variable explains 50% of the variability in the y-variable.

d. The x-variable explains −50% of the variability in the y-variable.

19. The word biotic means environment

a. living b. non-living c. physical d. None of the above

20. Find the meaning of the following statement "A Majority of the poor people do not participate in the process of development".

a. crony capitalism b. mixedism c. socialism d. modern socialism

Section B

II. Write any of the following seven (Q.No30 is a compulsory) **(7 x 2 = 14)**

21. What do you mean by Inferential Statistics?
22. Write a note on the term "Eutrophication"
23. Write the formula for calculating GNP
24. Differentiate tax and fee.
25. What is rationing of credit?
26. What is the main difference between Adam Smith and Ricardo with regard to the emergence of foreign trade?
27. Classify the economies based on status of development.
28. What is Free trade area?
29. Explain the following term: $\Sigma dxdy$, Σdx^2, Σdy^2, Σdx and Σdy.
30. Write a short note on NITI Aayog.

III. Write any of the following seven (Q.No. 40 is a compulsory) **(7 x 3 = 21)**

31. Give a brief note on NBFI.
32. Briefly explain the two sector circular flow model.
33. Write note on MOSPI.
34. Distinguish between Balance of Trade and Balance of Payments.
35. Form a chart how supply and demand sides of vicious circle of poverties are happening.

36. Trace the evolution of economic planning in India.
37. Elucidate major causes of vicious circle of poverty with diagram
38. What are the objectives of organic farming?
39. Mention the various forms of economic integration.
40. Calculate the SD of the following data. 23, 25, 28, 31, 38, 40, 46

IV. Write all the questions. **(7 x 5 = 35)**

41. a. Describe the functions of Reserve Bank of India. (OR)
    b. Explain the four sector model of economy with chart.
42. a. An eighth debator was awarded 36 marks by judge A, while Judge B was not present. If Judge B were also present, how many marks would you expect him to award to the eighth debator, assuming that the same degree of relationship exists in their judgement? Use regression. (OR)

Debtor	Marks by A	Marks by B
1	40	32
2	34	39
3	28	26
4	30	30
5	44	38
6	38	34
7	31	28

    b. Explain the steps involved computing the correlation Coefficient.
43. a. Compare and contrast the "Planning Commission" and NITI Aayog". (OR)
    b. Elucidate various measures of economic development.
44. a. Explain the importance of sustainable development and its goals. (OR)
    b. What are the difficulties involved in the measurement of national income?
45. a. State and explain instruments of fiscal policy. (OR)
    b. Compare and contrast fixed and flexible exchange rates.
46. a. List the Achievements of SAARC organization. (OR)
    b. Explain the chain of events that results from an expansionary monetary policy.
47. a. State the 'Full Employment' in The Classical view. (OR)
    b. Given the table, calculate GNP, NNP, National Income, Personal Income and Disposable income.

	Billions of Dollars
GDP	8000
Receipts of factor income from the rest of the world	250
Depreciation	300
Indirect taxes minus subsidies	900
Corporate profits minus dividends	500
Social insurance payments	700
Personal interest income received from the government and consumers	300
Transfer payments to persons	1100
Personal taxes	1000