



NEERAJ®

E.C.O.-7

**ELEMENTS OF
STATISTICS**

By: Preeti Gupta, M.Sc.

*Question Bank cum Chapterwise Reference Book
Including Many Solved Question Papers*



**NEERAJ
PUBLICATIONS**

(Publishers of Educational Books)
(An ISO 9001 : 2008 Certified Company)

Sales Office:
1507, 1st Floor, Nai Sarak, Delhi - 6
Ph.: 011-23260329, 45704411,
23244362, 23285501
E-mail: info@neerajignoubooks.com
Website: www.neerajignoubooks.com

MRP ₹ 240/-

Published by:

NEERAJ PUBLICATIONS

Sales Office : 1507, 1st Floor, Nai Sarak, Delhi-110 006

E-mail: info@neerajignoubooks.com

Website: www.neerajignoubooks.com

Reprint Edition with Updation of Sample Question Paper Only

Typesetting by: *Competent Computers*

Printed at: *Novelty Printer*

Notes:

1. For the best & upto-date study & results, please prefer the recommended textbooks/study material only.
2. This book is just a Guide Book/Reference Book published by NEERAJ PUBLICATIONS based on the suggested syllabus by a particular Board /University.
3. The information and data etc. given in this Book are from the best of the data arranged by the Author, but for the complete and upto-date information and data etc. see the Govt. of India Publications/textbooks recommended by the Board/University.
4. Publisher is not responsible for any omission or error though every care has been taken while preparing, printing, composing and proof reading of the Book. As all the Composing, Printing, Publishing and Proof Reading etc. are done by Human only and chances of Human Error could not be denied. If any reader is not satisfied, then he is requested not to buy this book.
5. In case of any dispute whatsoever the maximum anybody can claim against NEERAJ PUBLICATIONS is just for the price of the Book.
6. If anyone finds any mistake or error in this Book, he is requested to inform the Publisher, so that the same could be rectified and he would be provided the rectified Book free of cost.
7. The number of questions in NEERAJ study materials are indicative of general scope and design of the question paper.
8. Question Paper and their answers given in this Book provide you just the approximate pattern of the actual paper and is prepared based on the memory only. However, the actual Question Paper might somewhat vary in its contents, distribution of marks and their level of difficulty.
9. Any type of ONLINE Sale/Resale of "NEERAJ BOOKS/NEERAJ IGNOU BOOKS" published by "NEERAJ PUBLICATIONS" on Websites, Web Portals, Online Shopping Sites, like Amazon, Flipkart, Ebay, Snapdeal, etc. is strictly not permitted without prior written permission from NEERAJ PUBLICATIONS. Any such online sale activity by an Individual, Company, Dealer, Bookseller, Book Trader or Distributor will be termed as ILLEGAL SALE of NEERAJ IGNOU BOOKS/NEERAJ BOOKS and will invite legal action against the offenders.
10. Subject to Delhi Jurisdiction only.

© Reserved with the Publishers only.

Spl. Note: This book or part thereof cannot be translated or reproduced in any form (except for review or criticism) without the written permission of the publishers.

How to get Books by Post (V.P.P.)?

If you want to Buy NEERAJ IGNOU BOOKS by Post (V.P.P.), then please order your complete requirement at our Website www.neerajignoubooks.com. You may also avail the 'Special Discount Offers' prevailing at that Particular Time (Time of Your Order).

To have a look at the Details of the Course, Name of the Books, Printed Price & the Cover Pages (Titles) of our NEERAJ IGNOU BOOKS You may Visit/Surf our website www.neerajignoubooks.com.

No Need To Pay In Advance, the Books Shall be Sent to you Through V.P.P. Post Parcel. All The Payment including the Price of the Books & the Postal Charges etc. are to be Paid to the Postman or to your Post Office at the time when You take the Delivery of the Books & they shall Pass the Value of the Goods to us by Charging some extra M.O. Charges.

We usually dispatch the books nearly within 4-5 days after we receive your order and it takes Nearly 5 days in the postal service to reach your Destination (In total it take atleast 10 days).



NEERAJ PUBLICATIONS

(Publishers of Educational Books)

(An ISO 9001 : 2008 Certified Company)

1507, 1st Floor, NAI SARAK, DELHI - 110006

Ph. 011-23260329, 45704411, 23244362, 23285501

E-mail: info@neerajignoubooks.com Website: www.neerajignoubooks.com

CONTENTS

ELEMENTS OF STATISTICS

Question Bank – (Previous Year Solved Question Papers)

<i>Question Paper—June, 2019 (Solved)</i>	1-4
<i>Question Paper—June, 2018 (Solved)</i>	1-3
<i>Question Paper—June, 2017 (Solved)</i>	1-3
<i>Question Paper—June, 2016 (Solved)</i>	1-3
<i>Question Paper—June, 2015 (Solved)</i>	1-4
<i>Question Paper—June, 2014 (Solved)</i>	1-4
<i>Question Paper—June, 2013 (Solved)</i>	1-3
<i>Question Paper—June, 2012 (Solved)</i>	1-4
<i>Question Paper—June, 2011 (Solved)</i>	1-2
<i>Question Paper—June, 2010 (Solved)</i>	1-4

<i>S.No.</i>	<i>Chapterwise Reference Book</i>	<i>Page</i>
--------------	-----------------------------------	-------------

BASIC STATISTICAL CONCEPTS

1. Meaning and Scope of Statistics	1
2. Organising a Statistical Survey	7
3. Accuracy, Approximation and Errors	16
4. Ratios, Percentages and Rates	25

COLLECTION, CLASSIFICATION AND PRESENTATION OF DATA

5. Collection of Data	33
6. Classification of Data	42
7. Tabular Presentation	51
8. Diagrammatic Presentation	57
9. Graphic Presentation	70

<i>S.No.</i>	<i>Chapter</i>	<i>Page</i>
<u>MEASURES OF CENTRAL TENDENCY</u>		
10.	Concept of Central Tendency and Mean	86
11.	Median	96
12.	Mode	105
13.	Geometric, Harmonic and Moving Averages	115
<u>MEASURES OF DISPERSION AND SKEWNESS</u>		
14.	Measures of Dispersion-I	124
15.	Measures of Dispersion-II	134
16.	Measures of Skewness	148
		■ ■

**Sample Preview
of the
Solved
Sample Question
Papers**

Published by:



**NEERAJ
PUBLICATIONS**

www.neerajbooks.com

QUESTION PAPER

(June - 2019)

(Solved)

ELEMENTS OF STATISTICS

Time: 2 Hours]

[Maximum Marks : 50

[Weightage: 70%

Note : Attempt any **four** questions. All questions carry equal marks. Simple calculator is allowed.

SECTION-A

Q. 1. (a) Fill in the blanks with a suitable word as given in the brackets:

- (i) Schedule method of data collection is for the collection ofdata.
(primary/secondary)

Ans. Primary.

- (ii) When the two terms of a ratio are interchanged, the second ratio so obtained is called the.....ratio.

(inverse/distribution)

Ans. Distribution.

- (iii) Ininterview, set questions are asked and the answers are recorded in a standardised form.

(Informal/Formal)

Ans. Informal.

- (iv) In a distribution, mean, mode and standard deviation are 46.83, 51.67 and 14.8 respectively. Its skewness is..... .

(0.051/-0.327)

Ans.

$$S_x = \frac{\text{Mean} - \text{Mode}}{\text{S.D}}$$

$$= \frac{46.83 - 51.67}{14.8} = \frac{-4.84}{14.8}$$

$$= -0.327$$

- (v) The skewness is.....if mean < median < mode.

(positive/negative)

Ans. Negative.

- (vi)mean is reciprocal of arithmetic mean.

(Geometric/Harmonic)

Ans. Harmonic.

- (vii)sampling is one of the methods of non-probability sampling.

(Stratified/Judgement)

Ans. Judgement.

- (viii) A graph of time series data is called.....

(Historigram/Histogram)

Ans. Historigram.

- (b) State the causes of non-sampling errors.

Ans. Ref.: See Chapter-3, Page No. 19, 'Non-Sampling Errors' and Page No. 21, Q. No. 7.

Q. 2. (a) Calculate median from the data given below:

Weekly Expenditure (in '00 ₹)	No. of Families
0-10	14
10-20	23
20-30	27
30-40	21
40-45	15

Ans.

Weekly Expenditure	No. of families	Commulative Frequency
0-10	14	14
10-20	23	37
20-30	27	64
30-40	21	85
40-50	15	100

Here, $n = 100 \Rightarrow n/2 = \frac{100}{2} = 50$

which falls in the class 20-30.

$$M = L + \frac{\frac{n}{2} - c}{f} \times i$$

$L = 19.95$

$n = 100$

$c = 37$

$f = 27$

$i = 10$

Medium = $19.95 + \frac{\frac{n}{2} - 37}{27} \times 10.$

$$= 19.95 + \frac{50 - 37}{27} \times 10$$

$$= 19.95 + 4.81$$

$$= 24.76.$$

(b) Explain the concept of Tabulation.

Ans. Ref.: See Chapter-7, Page No. 51, 'Meaning of Tabulation'.

Q. 3. Calculate standard deviation from the following data:

Marks	No. of Students
10-20	5
20-30	12
30-40	15
40-50	20
50-60	10
60-70	4
70-80	2

Ans.

Marks (x)	No. of Students (f)	M	fM	$d = \frac{M - 45}{2}$	Fd	$f(d)^2$
10-20	5	15	75	-15	-75	1125
20-30	12	25	300	-10	-120	1200
30-40	15	35	525	-5	-75	375
40-50	20	45	900	0	0	0
50-60	10	55	550	5	50	250
60-70	4	65	260	10	40	400
70-80	2	75	150	15	30	450
	68		2760		-150	3800

Standard Deviation (σ)

$$= c + \sqrt{\frac{\sum fd^2}{n} - \frac{(\sum fd)^2}{n^2}}$$

$$= 10 + \sqrt{\frac{3800}{68} - \frac{(-150)^2}{(68)^2}}$$

$$= 10 + \sqrt{55.88 - 4.86}$$

$$= 10 + \sqrt{51.02}$$

$$= 10 + 7.14$$

$$= 17.14$$

Q. 4. (a) Draw a pie diagram to represent the following information regarding the expenditure of a family and various items during a month.

	Items	Expenditure (₹)
(i)	Food	5,000
(ii)	Clothing	2,000
(iii)	Rent	5,000
(iv)	Education	6,000
(v)	Others	1,000

Sample Preview of The Chapter

Published by:



**NEERAJ
PUBLICATIONS**

www.neerajbooks.com

ELEMENTS OF STATISTICS

BASIC STATISTICAL CONCEPTS



Meaning and Scope of Statistics

INTRODUCTION

The word 'STATISTICS' came into existence in the middle of the 18th century and has been defined variously by different writers because of its considerably wider scope. Statistical methods have become useful tools in the economy of any country, business affairs, and government affairs and in science etc. A high degree of flexibility is the important quality of statistics which enable its usefulness in business, economics, sociology, agriculture, industry and science. For example, for keeping birth and death records, employment records and facts regarding area, our government depends on statistical methods. A businessman can estimate his market demand, growth rate, profitability over the years with a fair degree of accuracy with the help of statistics.

At the end of the chapter we will be able to understand the definition and meaning of statistics (descriptive and inferential), its function, importance, limitation and distrust of statistics.

CHAPTER AT A GLANCE

MEANING OF STATISTICS

Many people had explained the meaning of term Statistics but a much better definition is given by *Horace Secrist*. According to him, "*Aggregates of facts, affected to a market extent by a multiplicity of causes, numerically expressed, enumerated or estimated*

according to reasonable standards of accuracy, collected in a systematic manner for a pre-determined purpose and placed in relation to each other is defined as Statistics."

The word Statistics can be used in plural as well as in the singular sense.

Statistics Defined in Plural Sense

When this term is used in plural, it refers to the numerical statements of facts. Numerical data must have following characteristics:

1. They must be aggregate of facts i.e. no individual figure is regarded as statistics.
2. They are affected by multiplicity of factors like circumstances. For example: any yield of crop is affected by various circumstances soil, seed, rainfall, temperature etc.
3. They must be enumerated or estimated according to reasonable standards of accuracy. However degree of accuracy depends on nature of data. Again, whatever standard of accuracy is once adopted, it should be maintained throughout the whole study.
4. They must be collected in a systematic manner for a predetermined purpose i.e., the data must be properly arranged.
5. They must be placed in relation to each other i.e. the facts should be comparable regarding time, space or condition.

2/NEERAJ : ELEMENTS OF STATISTICS

Statistics Defined in Singular Sense

When this term is used in singular, it means 'Methodology of Statistics' which is a technique used to obtain, organise, present, analyse, summarise and interpret the quantitative data. It refers to all methods, techniques and tools which are applied for data collection and converting a mass of unwieldy figures into easily understandable statements of facts.

Statistics as defined by **Seligman**, "*Science which deals with the methods of collecting, classifying, presenting, comparing and interpreting numerical data collected to throw some light on any sphere of enquiry.*" is one of the best and simple ways to define.

In short 'Statistics are numerical statement of facts, all facts numerically stated are not statistics.'

DESCRIPTIVE AND INFERENTIAL STATISTICS

Broadly, statistical methods can be divided into:

1. Descriptive Statistics and
2. Inferential Statistics

Descriptive Statistics: Deals with the measures like measures of central tendency and measures of dispersion, which are used to explain and describe the characteristic features of the data. Graphs, tables, charts like pi-charts etc. are the important tools of this type of statistics.

Inferential Statistics: Describes the observation of group characteristics of the particular data and to draw valid inferences based on statistical analysis of the sample data.

FUNCTIONS OF STATISTICS

Some of the important functions of statistics are given below:

1. It present facts in a simple, definite and easily understandable form by simplifying and arranging unwieldy and complex data.
2. It makes technique of comparison easy by studying relationship between different phenomenons.
3. It helps in formulation of policies in different fields such as social, economical and business fields.
4. It helps in checking uncertainty by forecasting future.
5. These methods are extremely useful in testing, formulating hypothes is and developing new theories.
6. Statistics enable to interpret conditions by developing possible causes for the result described.

IMPORTANCE OF STATISTICS

In recent years, statistical methods has become useful tools in the world of affairs and its scope has widened considerably. They are useful in various fields such as business management, economics, administration, industries, science and social sciences.

Importance of Statistics in State Administration

State government maintains the record of statistical data relating to prices, production, consumption, income and expenditure (in short , the whole budget) for dealing with their economy and the various policies are formulated on the basis of strong analysis of statistical data for the development and welfare of the state and its people.

Importance of Statistics in Economics

Statistical data and methods of statistical analysis render valuable assistance in all important branches of economics. A variety of economic problems always involves facts that are capable of being expressed numerically, e.g. data on prices, wages, investment, volume of trade, output of industries, bank deposits etc. Statistical analysis helps us to study the manner in which people spend their incomes over various items like food, clothing, house, rent etc. Statistics of production analyse wealth of nation and compare it year after year, thereby showing the effects of changing economics policies.

Apart from economic policy, the development of economic theory has also been facilitated by the use of statistics. Modern economists use statistical data with more precise facts for testing various economic hypotheses.

Importance of Statistics in Business and Management

Modern statistical methods and statistical data are widely used in the formulation, and developing new policies on which the success of business depends. Today, a business executive requires all the information regarding his product for the successful conduct of affairs. The tabulation, analysis and interpretation of the information are the statistical tools that enable him to take suitable decision in the face of uncertainty. Statistical methods of analysis are helpful in the marketing function as it helps in marketing research, advertisement campaigns in comparing the sales performances. Effective control over sales can also be exercised through determination of aggregates.

LIMITATIONS OF STATISTICS

Although flexible nature of statistics makes it popular generally in every field, it has also some limitations. These are as follows:

1. Statistics deals only with those studies, which are capable of being quantitatively measured and numerically expressed.
2. Statistics deals with the aggregates of facts only. It does not pay attention to individuals.
3. Statistical methods are not exact. Interpretation and conclusions based on them are only approximate.
4. Statistical results are not mathematically correct. Results are estimated according to a reasonable standard of accuracy.
5. Statistics can be misused by establishing wrong conclusions. Therefore, results must be drawn on the advice of experts only.

DISTRUST OF STATISTICS

Lack of reliability, confidence and trust in statistical methods and data create distrust in statistics. While applying statistical tool one should understand its proper use and its real purpose. If used in inappropriate way, wrong conclusions can be drawn, which has resulted in lot of distrust.

Some of its important reasons are as follows:

1. Numerical figures or data are capable of being easily manipulated in any desired manner.
2. Results based on inadequate sample can mislead (i.e., if the person reach the conclusion on the basis of very small sample of study).
3. If a person concludes without understanding the whole circumstances and conditions, then even if the correct figures are used, wrong decisions can be taken.
4. Statistical data do not carry the label of their quality; therefore unintentionally faulty conclusions may be drawn.
5. By applying wrong statistical tool to even correct and complete data, one can reach far away from the correct result.

SELF-ASSESSMENT QUESTIONS

Q. 1. Comment on the following statements:

- (i) Webster and Secrist defined descriptive statistics.
- (ii) Definition of statistics given by Yule and Kendall is contained in the one by Secrist.
- (iii) Qualitative data cannot be studied under statistics.
- (iv) Methods of statistics relate to collection and analysis of the data only.

(v) The definition of science of statistics by Bowley covers the different stages of statistical methodology.

(vi) Inferential statistics is related to the study of samples.

Ans. (i) According to Webster, "Statistics are the classified facts representing the conditions of the people in a state specially those facts which can be stated in numbers or any tabular or classified arrangements." According to Secrist, "Aggregates of facts, affected to a market extent by a multiplicity of causes, numerically expressed, enumerated or estimated according to reasonable standards of accuracy, collected in a systematic manner for a predetermined purpose and placed in relation to each other is defined as Statistics."

Descriptive statistics are used to explain and describe the characteristic features of the data. It is also concerned with the collection of data. Graphs, tables, charts like pi-charts etc., are the important tools of this type of statistics. The definition given by Webster data and Secrist do not emphasis on the characteristics of data.

(ii) Yule and Kendall define statistics as the quantitative data affected to a market extent by multiplicity of causes. According to him variety of circumstances affects the whole study but Secrist definition for statistics is quiet comprehensive and he had explained the same characteristics with some more detail.

(iii) Qualitative characteristics such as complexion of skin, honesty etc., cannot be measured and cannot be expressed numerically. Therefore, qualitative data can be studied under statistics after quantifying these characteristics.

(iv) Methodology of Statistics is a technique used to obtain, organise, present, analyse, summarise and interpret the quantitative data. It refers to all methods, techniques and tools which are applied for data collection and converting a mass of unwieldy figures into easily understandable statements of facts. Therefore, we don't agree with the given statement, which says that methods of statistics relate to collection and analysis of the data only.

(v) The definition of science of statistics by Bowley covers the different stages of statistical methodology. According to Bowley, statistics is a numerical statement of facts in any department of inquiry placed in relation to each other. He called statistics as the science of counting, science of averages.

(vi) Inferential statistics draw valid inferences about the characteristics of population data on the basis of

4/NEERAJ : ELEMENTS OF STATISTICS

sample data. The term population refers here totality of data in any field of inquiry. Therefore, Inferential statistics is related to the study of samples.

Q. 2. Define statistics and discuss the various functions of statistics.

Or

Enumerate the functions of statistics.

Ans. The word statistics is derived from the Latin word Status means a political state. Statistics is used in two senses:

- (a) The Plural Sense and
- (b) The Singular Sense

In Plural Sense: It refers to quantitative information or simply statistical data (numerical statements of facts).

In Singular Sense: It means the science of collection, presentation, analysis and interpretation of data.

Statistics has been defined variously by different writers, but a much better definition is provided by *Horace Secrist*, who defines statistics as 'Aggregates of facts, affected to a marked extent by a multiplicity of causes, numerically expressed, enumerated or estimated according to reasonable standards of accuracy, collected in systematic manner for a predetermined purpose, and placed in relation to each.'

This definition specifies certain characteristics which numerical data must possess. Although statistics find its applications in various diversified fields but some of the important functions of statistics are given below:

1. Statistical methods present general facts and statements in a simple, definite and easily understandable form.
2. It helps in simplifying and arranging unwieldy and complex data.
3. It makes the technique of comparison easy using statistical measures such as ratio, percentage, average etc.
4. Different statistical measures like correlation and regression are used in studying relationship between different phenomenons.
5. It helps in checking uncertainty by forecasting future and with the help of probability theorem.
6. It helps in formulation of various policies in different fields such as social, economical and business fields.

7. These methods are extremely useful in testing, formulating hypotheses and developing new theories.

8. Statistics enable to interpret conditions by drawing inferences and developing possible causes for the result described.

Q. 3. Write brief comments on the following statements:

- (i) **Statistics only perform the function of simplifying complexities.**
- (ii) **Statistics help in testing the laws of other sciences.**
- (iii) **Future course of events is uncertain, so statistics can hardly be of any help in their study.**
- (iv) **Planning is not conceivable without statistics.**
- (v) **A personnel officer of big corporation can draw a workable personnel plan without the knowledge of statistics.**

Ans. (i) Statistics perform various functions besides simplifying complexities. It arranges data in proper form formulate policies, forecast futures, helps in developing new theories, interpret results etc.

(ii) It provides necessary information by collecting relevant data accordingly designed statistical analysis. It has become a useful tool and is extensively used in Biology, Psychology, Economics etc. Thus helps in testing the laws of other sciences.

(iii) No, with the help of data collection of past and probability theory, it is devised for forecasting and deriving information through samples. Also, we can measure the chance of occurrence of uncertain event.

(iv) Planning is not conceivable without statistics because planning requires a large number of relevant statistical information for the desired results. For example, at the time of the floatation of the concern, facts are required for the purpose of drawing up the financial plan of the proposed unit.

(v) No, because a workable personnel plans requires a lot of market research, management of cost and budget control etc. Statistical method of analysis is very helpful in formulating and managing policies as the success of the plan depends on the previous performance of any

Q. 4. "Statistics are numerical statements of facts but all facts numerically stated are not statistics." Comment.

Ans. Statistics is concerned with the systematic collection of numerical data and its interpretation. It