



NOTE: Attempt FIVE questions selecting at least TWO questions from each section. Use of Scientific Calculators and Statistical tables is allowed.

SECTION-I

- Q.1 (a) Give merits and demerits of median and mode. (4,5,6)
 (b) Find arithmetic means of the numbers 1, 2, 3,n
 (c) If the mean of the following frequency distribution is 3.66. Find the value of a. Also find median and mode of distribution.
 $x = 1, 2, 3, 4, 5, 6$
 $f = 3, 9, a, 11, 8, 7$

- Q.2 (a) Write down any five properties of standard deviation. (3,2,10)
 (b) Explain the difference between absolute dispersion and relative dispersion.
 (c) The scores obtained by two batsmen A and B in a series of 10 innings are:
 A = 12, 15, 6, 73, 7, 19, 199, 36, 84, 29
 B = 47, 12, 76, 48, 4, 51, 37, 48, 13, 0
 i. Who is better as a run getter?
 ii. Who is more consistent player?

- Q.3 (a) Define an index number and discuss the following index numbers: (5,10)
 i. Price index ii. Quantity index iii. Value index
 (b) Given the following data:

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
A	1	50	2	5
B	1	5	x	2

Find x if ratio of Laspeyre's index to pasche's index is 28:27.

- Q.4 (a) Differentiate between time series and analysis of time series. Discuss how you would analyse a time series to determine the trend and the seasonal variations. (5,10)
 (b) Calculate the seasonal indices by the link relative method for following time series.

Year	I	II	III	IV
2010	112	125	129	110
2011	119	132	147	115
2012	120	142	150	118
2013	128	151	162	125

- Q.5 (a) What is linear regression model? Explain the assumptions underlying the linear regression model. (3,12)
 (b) For the following data, obtain the correlation co-efficient between x and y.
 $x = 2.3, 2.7, 2.8, 2.8, 2.9, 3.0, 3.1, 3.3, 3.5, 3.6$
 $y = 1.8, 2.0, 2.2, 2.7, 2.1, 2.9, 2.7, 2.9, 2.8, 2.9$
 Find the regression co-efficient. Verify that r is the geometric mean of two regression coefficients.

SECTION – II

- Q.6 (a) Define the following: (4,5,6)
 i) Sample space ii) Equally likely events
 iii) Mutually exclusive events iv) Non-mutually exclusive events

- (b) Let A, B and C be events (subsets) in a sample space S defined by:
 $S = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$
 $A = \{2, 3, 4\}, B = \{3, 4, 5\}, C = \{5, 6, 7\}$
 List the members of the following events:
 i. $\bar{A} \cap B$ ii. $\bar{A} \cup B$ iii. $\bar{A} \cap \bar{B}$ iv. $\bar{A} \cap (B \cup C)$
 (c) A card is drawn from a well-shuffled pack of 52 playing cards. What is probability that it is:
 i. An Ace ii. A heart card
 iii. Not a red card iv. A pictured card

- Q.7 (a) State and prove the addition law of probability for mutually exclusive events A and B. (6,9)

- (b) Show that in a single throw of two fair dice, the probability of throwing more than 7 is equal to that of throwing less than 7, and hence find the probability of throwing exactly 7.

- Q.8 (a) Let X_1 and X_2 be two independent random variables having variances K and Z respectively. If $\text{Var}(3X_2 - X_1) = 25$, find K. (5,10)

- (b) Two ordinary dice are rolled. Let X represents the number of sixes. Find the probability distribution of X. Also find the mean and variance of this probability distribution.

- Q.9 (a) Define hypergeometric experiment and what are its properties? (3,6,6)

- (b) A milk case contains 5 packs of milk, only 4 of which are fresh. If we randomly select 2 of these (without replacement). What is probability that:
 i. We get both fresh packs ii. The unfresh pack is one of the two selected.

- (c) If X is a poisson random variable with $P(X=0) = 0.2019$, then find:
 i. Parameter of the distribution ii. $P(X \leq 4)$

- Q.10(a) Prove that the mean of the normal distribution is μ . (5,10)

- (b) In a normal distribution of 31% of the items are under 45 and 8% are over 64. Find mean and standard deviation of the distribution.



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 Use of Scientific calculators and statistical tables is allowed.*

Section - I

- Q.1. (a) Explain sampling and non-sampling errors. What methods would you suggest to control each type of error? (06)
 (b) The random variable X has the following probability distribution: (09)

X	4	5	6	7
P(X=x)	0.2	0.4	0.3	0.1

- (i) Find the mean μ_x and variance σ^2_x of the mean \bar{X} for a random sample of 36.
 (ii) Find the probability that the mean of 36 items will be less than 5.5

- Q.2. (a) Describe the sampling distribution of sample proportion. What are its properties and explain its usefulness in statistical inference? (06)
 (b) Two random samples of size $n_1 = 40$ and $n_2 = 45$ are drawn from a binomial population with $p = 0.70$. What is the probability that $-0.1 < \hat{p}_1 - \hat{p}_2 < 0.1$? (09)

- Q.3. (a) What do you mean by point estimation? Explain briefly the desirable properties of a good point estimator. (06)
 (b) A manufacturing company consists of two departments producing identical products. It is suspected that the hourly outputs in the two departments are different. Two random samples of production hours are respectively selected, and the following data are obtained. (09)

	Department 1	Department 2
Sample Size	64	49
Sample Mean	100	90

The population variances of the hourly outputs for the two departments are known to be 256 and 196 respectively. What is the point estimate for the true difference between the mean outputs of the two departments? Find the 95 percent confidence limits for the true difference.

- Q.4. (a) Distinguish between Type I and Type II errors and give one example for each of them. (06)
 (b) An electrical company claimed that at least 95% of the parts which they supplied on a government contract are confirmed to specifications. A sample of 400 parts was tested, and 60 did not meet specifications. Can we accept the company's claim at a 0.05 level of significance? (09)
- Q.5. (a) What are the various applications of Chi-Square distribution? (04)
 (b) The percent moisture content in a puffed cereal where samples are taken from two different "guns" showed: (11)

Gun I: 3.6, 3.8, 3.6, 3.3, 3.7, 3.4
 Gun II: 3.7, 3.9, 4.2, 4.2, 4.9, 3.6, 3.5, 4.0

Test the hypothesis of equal variances at 5% significance level.

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Section – II

- Q.6. (a) Two hundred adults were asked whether they prefer to watch sports or dramas on television. The following table lists the preferences of these men and women. (07)

	Sports	Dramas
Men	51	39
Women	68	42

Test at 10% significance level if gender and preference for watching sports or dramas are related.

- (b) The grades in a statistics course are as follows: (08)

Grade	A	B	C	D	E
Frequency	14	18	32	20	16

Test the hypothesis at the 0.05 level of significance that the distribution of grades is uniform.

- Q.7. (a) Explain the procedure for testing a hypothesis about the population correlation coefficient equals zero. (05)

- (b) A random sample of size 20 from a bivariate normal population showed a correlation coefficient of 0.92. Find a 98% confidence interval for the population correlation coefficient. (10)

- Q.8. Given the data: (15)

Y	12	10	9	13	20
X ₁	2	2	3	4	4
X ₂	1	1	0	0	3

- (i) Obtain the least squares estimates of the parameters in the multiple regression model: $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$
 (ii) How much of the variation in Y is explained by X₁ and X₂?

- Q.9. (a) Partition the total variation in one way classification when the samples sizes are equal. (06)

- (b) The following are the three consecutive weeks' earnings of three salesmen employed by a firm: (09)

Salesmen		
A	B	C
152	181	160
175	171	130
180	203	124

Test whether differences between salesmen are significant. Use $\alpha=0.05$.

- Q.10. (a) Differentiate between Completely Randomized design and Randomized Complete Block Design. (04)

- (b) In a randomized complete block design, in each of four blocks I, II, III and IV, four varieties of wheat A, B, C and D are grown in the layout given below and the yields are also indicated therein: (11)

I	B 27	A 17	C 15	D 25
II	A 28	D 22	B 26	C 16
III	D 14	C 11	A 22	B 25
IV	C 18	B 18	D 19	A 17

Perform the analysis of variance to test at 0.05 significance level, the difference in the yields of varieties and in blocks.



UNIVERSITY OF THE PUNJAB
B.A. / B.Sc. (Composite) Annual Exam – 2019

Roll No.

Subject: Statistics
PAPER: Optional

MAX. TIME: 3 Hr.
MAX. MARKS: 100

NOTE: Attempt FOUR questions. All questions carry equal marks.

1. (a) Explain the difference between the following: (6)
 i. Variable and Constant.
 ii. Discrete data and Continuous data.
 (b) The following table gives the weights of 40 students at a University. (19)

137	147	168	146	161	164	158	126	173	145
151	140	138	142	135	132	147	176	147	142
145	136	163	135	150	125	148	119	153	156
148	152	154	140	143	157	144	165	125	126

Make a frequency distribution taking a class interval of size 9 e.g. 118-126, 127-135 etc.

2. (a) What is statistical average? Name the important types of averages. (6)
 (b) The following distribution shows Kilowatt-Hours of electricity used in one month by residential consumers in a certain locality of Lahore. (19)

Consumption	5-24	25-44	45-64	65-84	85-104	105-124	125-144	145-164
No. of Consumer	5	12	16	14	13	10	7	3

Calculate mean, median and mode.

3. (a) Define Weighted Arithmetic mean and Mode. (6)
 (b) Calculate Quartile deviation. (19)

Age groups	0-1	1-5	5-10	10-20	20-30	30-40	40-60	60-80
No of persons	2	11	17	14	12	10	7	3

4. (a) Define Range and Quartile deviation. (6)
 (b) Find Range and Coefficient of Variation. (19)

Class	35-39	40-44	45-49	50-54
Frequency	13	15	17	28
Classes	55-59	60-64	65-69	
Frequency	12	10	5	

5. (a) Explain the difference between the following: (i) Intercept of line (ii) Slope of line. (6)
 (b) The final grades in algebra and physics obtained by 9 students selected at random form a large group of students are given below: (19)

Algebra (X)	75	80	93	65	87	71	98	68
Physics (Y)	82	78	86	72	91	80	95	72

Find a least-squares line fitting the data using X as the independent variable.

6. (a) Define Positive Correlation and Negative Correlation. (6)
 (b) Calculate and interpret the Correlation Coefficient for the following data on Heights (X) and Weights (Y). (19)

Height(X)	58	62	70	66	59	60	65
Weight(Y)	60	60	75	70	64	65	69

7. (a) What is the association of attributes? Also define and explain coefficient of association of attributes. (6)
 (b) Discuss the resemblance of the stature of parents with their offspring for the following data using 5% level of significance. (19)

Offspring	P a r e n t s		
	Very tall	Tall	Short
Very tall	20	30	15
Tall	30	25	10
Short	40	45	35

8. (a) Describe the advantages of sampling. (6)
 (b) A finite population consists of 1, 3, 5, 7, 9 and 11. Take all possible samples of size 2 without replacement. Construct the sampling distribution of the sample means. Calculate mean and variance of this sampling distribution and verify that

$$\mu_{\bar{y}} = \mu \quad \text{and} \quad \sigma_{\bar{y}}^2 = \frac{\sigma^2}{n} \cdot \frac{N-n}{N-1}$$