

PUNJAB PUBLIC SERVICE COMMISSION
COMBINED COMPETITIVE EXAMINATION FOR
RECRUITMENT TO THE POSTS OF
PROVINCIAL MANAGEMENT SERVICE-2019

SUBJECT: STATISTICS (PAPER-I)

TIME ALLOWED: THREE HOURS

MAXIMUM MARKS: 100

NOTE: Attempt Any FIVE Questions in All. Calculator is Allowed. (Not Programmable)

- Q No. 1:
- State the properties of Arithmetic mean.
 - Calculate the variance and standard deviation from the marks obtained by 9 students
45, 32, 37, 46, 39, 36, 41, 48, 36
 - The second moment about the mean of a symmetrical distribution is 25. What must be the value of the fourth moment about the mean in order that the distribution be
 i) Leptokurtic ii) Mesokurtic iii) Platykurtic
- (4 + 6 + 10 = 20 Marks)

- Q No. 2:
- If X_1, X_2, \dots, X_n are n observations of a variable x having arithmetic mean \bar{X} , then prove that

$$\sum_{i=1}^n (x_i - \bar{x})^2 \leq \sum_{i=1}^n (x_i - a)^2$$
 - Construct a stem and leaf display for the following data.
210, 217, 208, 215, 202, 209, 207, 210, 221, 218, 212, 210, 210, 213, 200, 208, 203, 199, 218, 214.
 - Draw box and whisker plot of the following data.

Height	60-62	63-65	66-68	69-71	72-74
No. of Students	5	18	42	27	8

(05 + 05 + 10 = 20 Marks)

- Q No. 3:
- Two dice are tossed. Let E_1 denote the event of an odd total, E_2 the event of an ace on the first die. Are E_1 and E_2 independent?
 - Given the following joint probability distribution.

$$f(x, y) = \begin{cases} (6 - x - y)/8 & \text{for } 0 \leq x \leq 2, \text{ and } 2 \leq y \leq 4 \\ 0 & \text{Elsewhere} \end{cases}$$
 Show that $f(x, y)$ is a joint probability density function. Find marginal densities $g(x)$ and $h(y)$ and conditional densities $f(x|y)$ and $f(y|x)$.

(10 + 10 = 20 Marks)

- Q No. 4:
- The two discrete random variables x and y are such that
 $g(x) = 1/3$, for $x = 1, 2, 3$
 $h(y) = 1/2$, for $y = 0, 1$
 If $z = 2x - y$, then verify that $E(z) = 2E(x) - E(y)$

P.T.O

- b) Show that moment generating function of sum of two independent r.v's x and y is the product of their moment generating functions.

- c) For what value of A , the function defined below will be density function.

$$f(x) = A(x^3)(1-x) \quad 0 \leq x \leq 1$$

Find mean and variance also.

(05 + 03 + 12=20 Marks)

Q No. 5:

- a) If the random variable x has binomial distribution, then show that variance is less than mean of this binomial distribution.
- b) Telephone calls being placed through a telephone exchange at random on the average of 36 calls per hour. Determine the probability,
(i) in a 10 minutes interval, there will be 3 or more calls.
(ii) In a 4 minutes interval, there will be no call.

(10 + 10=20 Marks)

Q No. 6:

- a) Show that for normal distribution
Mean Deviation = $\frac{4}{5}$ (Standard Deviation)
- b) In a normal distribution, $\mu = 30$ and $\sigma = 5$. Find
(i) a point that has 15% area below it.
(ii) probability between 20 and 40.

(10 + 10=20 Marks)

Q No. 7:

- a) What is principal of least square. Use it to find normal equations of straight line $y = a + bx$
- b) The discharge of a capacitor through a resistance gave the following results. Fit a curve of the type $v = ae^{tb}$

t (Seconds)	0.5	0.8	1.4	2.0	2.5
v (Volts)	9.1	8.4	7.5	6.7	6.1

(10 + 10=20 Marks)

Q No. 8:

- a) Show that $r = \sqrt{b \times d}$ for the following data.

x	2	4	5	6	8	11
y	18	12	10	8	7	5

- b) Calculate simple correlation and rank correlation for the following data.

x	4.7	2.9	6.4	2.5	4.9	7.3
y	8.6	5.4	6.2	4.9	8.3	7.2

(08 + 12=20 Marks)