



ROLL NO

**PUNJAB PUBLIC SERVICE COMMISSION**  
**COMBINED COMPETITIVE EXAMINATION**  
**FOR RECRUITMENT TO THE POSTS OF**  
**PROVINCIAL MANAGEMENT SERVICE, ETC -2023**  
**CASE NO. 1C2024**

**SUBJECT: STATISTICS (PAPER-I)**

**TIME ALLOWED: THREE HOURS**

**MAXIMUM MARKS: 100**

**NOTE:**

- All the parts (if any) of each Question must be attempted at one place instead of at different places.
- Write Q. No. in the Answer Book in accordance with Q. No. in the Q. Paper.
- No Page/Space be left blank between the answers. All the blank pages of Answer Book must be crossed.
- Extra attempt of any question or any part of the question will not be considered.

**NOTE:**

**Attempt FIVE questions in all. Non-Programmable calculator is allowed.**

Q.No.1

(a) The ages of 30 patients admitted to a certain hospital during a particular week are as follows:  
 48, 31, 39, 37, 18, 64, 61, 43, 40, 42, 54, 62, 74, 48, 29, 67, 20, 49, 71, 71, 51, 51, 42, 52, 65, 53, 68,  
 38, 57, 26, 27, 58.  
 Construct a stem and leaf display from the data and list the data in an array.

(b) Find the missing entries in the following frequency distribution table:

Class Limits	Frequency	Relative Frequency	Cumulative Frequency	Cumulative Percentage
8 To -	0		1	25
- To -	2	0.05	3	
- To -	8	0.1	9	
- To -	6	0.30	15	
- To 32	10		25	

(12+8=20 Marks)

Q.No.2

(a) A coin and a die are tossed together. Find the probability of getting a head and even number.

(b) If two fair dice are thrown, what is the probability of getting:

(i) Sum between 4 & 8 inclusive.

(ii) Product between 4 & 8 inclusive.

(8+12=20 Marks)

(a) A man draws 2 balls from a bag containing 3 white and 5 black balls. If he receives Rs.70 for each white ball he draws and Rs.7 for every black ball he draws, find the expectation.

(b) Find the expected value of the r.v.  $x$  having p.d.f:

$$f(x) = \begin{cases} 2(1-x) & 0 < x < 1 \\ 0 & \text{elsewhere} \end{cases}$$

(10+10=20 Marks)

Q.No.4

(a) A car hire firm has 2 cars which it hires out day by day. The number of demands for a car on each day is distributed as a Poisson distribution with parameter 1.5. Calculate the proportion of days on which some demand is refused. [ $e^{-1.5} = 0.2231$ ].

(b) A random sampling of 4 members of a 150 member club has shown that 3 prefer no smoking in the clubhouse dining room. What is the probability that this will in fact occur if only 20% of the members prefer no smoking in the dining room. Find this probability assuming that the sample was obtained under: (i) Sampling without replacement and (ii) Sampling with replacement. Compare the two.

(10+10=20 Marks)

**P.T.O**

Q.No.5

(a) The heights of applicants to the police force are normally distributed with mean 170 and standard deviation 3.8cm. If 30% of applicants are rejected because they are too small, what is the minimum accepted height for the police force?

(b) If  $X$  is  $b(x; 20, 0.4)$  find  $P(6 \leq X \leq 10)$ . Then find the approximations to this probability using

(i) The Poisson Distribution

(ii) The Normal Distribution.

(10+10=20 Marks)

Q.No.6

Find conditional expectation of bivariate normal distribution.

(20 Marks)

Q.No.7

a) Fit an exponential curve  $Y = ae^{bx}$  to the following data:

X	1	2	3	4	5	6
Y	1.6	4.5	13.8	40.2	145.0	363.0

b) Find the normal equations which determine the values of  $a$  and  $b$  in least squares line  $Y = a + bX$ ; and show that the sum of squares of residuals from the least squares line is given by:

$$\Sigma Y^2 - a\Sigma Y - b\Sigma XY$$

(10+10=20 Marks)

Q.No.8

(a) Given the following data:

$X_1$	1	4	1	3	2	4
$X_2$	1	8	3	5	6	10
$X_3$	2	8	1	7	4	6

Find the least-squares regression line where  $X_1$  is the dependent variable and  $X_2$  and  $X_3$  are independent variables.

(b) The following data represent concomitant value~ of three variables:

$X_1$	32	18	52	16	42	48
$X_2$	3	2	5	1	4	6
$X_3$	2	4	2	5	3	9

Calculate all the multiple correlation coefficient, working out the usual simple correlation coefficient.

(10+10=20 Marks)