



**PUNJAB PUBLIC SERVICE COMMISSION**  
**COMBINED COMPETITIVE EXAMINATION**  
**FOR RECRUITMENT TO THE POSTS OF**  
**PROVINCIAL MANAGEMENT SERVICE, ETC -2022**  
**CASE NO. 2C2023**

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

**TIME ALLOWED: THREE HOURS**

**MAXIMUM MARKS: 100**

**NOTE:**

- i. All the parts (if any) of each Question must be attempted at one place instead of at different places.
- ii. Write Q. No. in the Answer Book in accordance with Q. No. in the Q. Paper.
- iii. No Page/Space be left blank between the answers. All the blank pages of Answer Book must be crossed.
- iv. 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) Name the different measurement scales.
- b) Find mean, median and mode of the following data:

Weight	Frequency
65 – 84	9
85 – 104	10
105 – 124	17
125 – 144	10
145 – 164	5
165 – 184	4
185 – 204	5

**(5+15=20 Marks)**

**Q.No.2**

In a factor, machines A, B and C manufacture 25, 30 and 45 percent of the total output respectively. Of their outputs 5, 4, 3 percent, respectively are defective items. An item is selected at random and found to be defective. What is the probability that the item is manufactured from machine B?

**(20 Marks)**

**Q.No.3**

- a) Find the probability distribution and distribution function for the number of heads when 3 balanced coins are tossed.

- b) A r.v x is has a p.d.f:

$$\begin{aligned} f(x) &= 2x & 0 \leq x \leq 1 \\ &= 0 & \text{elsewhere} \end{aligned}$$

Find  $P[x \leq 1/2 \mid 1/3 \leq x \leq 2/3]$

**(10+10=20 Marks)**

**Q.No.4**

An architect is designing the interior door in a men's gymnasium. He wants to make them high enough so that 90 percent of the men using the doors will have at least a one-foot clearance. Assuming that the heights will be normally distributed with a mean of 6 feet and a standard deviation of 0.4 feet, how high must the architect make the door?

**(20 Marks)**

Q.No.5

(a) If  $x$  is binomially distributed with mean 3.2 and variance 1.152. Find the probability  $P[X < \mu - 2\sigma^2]$

b) Suppose that customers enter a shop at the rate of 30 persons per hour and follow Poisson distribution. Calculate the probability that in a 3 minute interval no customers enter the shop.

(10+10=20 Marks)

Q.No.6

Find the moment generating function of bivariate normal distribution. (20 Marks)

Q.No.7

a) Fit an equation of the form  $Y=aX^b$  to the following data:

X	1	2	3	4	5	6
Y	2.98	4.26	5.21	6.10	6.80	7.50

b) The profits, £Y, of a certain company in the Xth year of its life are given by

X	1	2	3	4	5
Y	2500	2800	3300	3900	4600

Taking  $u = X-3$  and  $v = (Y - 3300)/100$ , find the parabolic curve of  $v$  on  $u$  in the form  $v=a+bu+cu^2$  deduce the curve of  $Y$  on  $X$ .

(10+10=20 Marks)

Q.No.8

Define regression and discuss the properties of the least square simple linear regression.

(20 Marks)

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**CASE NO. 2C2023**

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

**TIME ALLOWED: THREE HOURS**

**MAXIMUM MARKS: 100**

**NOTE:**

- i. All the parts (if any) of each Question must be attempted at one place instead of at different places.
- ii. Write Q. No. in the Answer Book in accordance with Q. No. in the Q. Paper.
- iii. No Page/Space be left blank between the answers. All the blank pages of Answer Book must be crossed.
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**NOTE:** Attempt any FIVE questions in all. Calculator is allowed. (Not Programmable).

**Q.No.1**

A population consists of the elements: [2, 4, 6, 10]. Another population consists of the elements: [3, 5, 7, 11]. Draw all possible samples of size 2 without replacement from each population. Calculate mean for each sample. Construct the sampling distribution of the difference between means of the two populations. Calculate standard error of the difference between sample means from the two populations. (20 Marks)

**Q.No.2**

- a. Define and differentiate point estimate and interval estimate.
- b. A total of 125 candidates appeared in an examination. Of which there were 70 boys who scored an average of 72 marks with a standard deviation of 5. While 55 girls who scored an average of 79 marks with a standard deviation of 8.
  - i. Find a 95% confidence interval for the difference between population means of boys and girls.
  - ii. Find a 90% confidence interval for the ratio of two population variances.

(5+15=20 Marks)

**Q.No.3**

(a) Each boy in a random sample of males, age 10 to 18, was classified according to smoking status and response to a question asking whether he likes to do risky things. The data are given in the following table:

Behavior	Smoking Status	
	Smoker	Nonsmoker
Likes Risky Things	45	46
Doesn't Like Risky Things	36	153

Calculate mean square Contingency Coefficient to check an association between smoking and unhealthy behaviors. Interpret the Coefficient.

(b) The data in the accompanying table are from two independently selected samples of civil service workers.

Working hours per week	Sample size	Number who usually get less than 7 hours of sleep at night
Over 40 hours	1501	750
35-40 hours	958	407

Do these data support the theory that the proportion that usually get less than 7 hours of sleep a night is higher for those who work more than 40 hours per week than for those who work between 35 and 40 hours per week? Carry out a test of hypothesis with a 5% level of significance. (10+10=20 Marks)

**Q.No.4**

(a) The following table shows the yields per acre of four different plant crops grown on lots treated with three different types of fertilizer. Determine at the 0.05 significance level whether there is a difference in yield per acre

- i) due to the fertilizers
- ii) due to the crops.

	Crop I	Crop II	Crop III	Crop IV
Fertilizer A	4.5	6.4	7.2	6.7
Fertilizer B	8.8	7.8	9.6	7.0
Fertilizer C	5.9	6.8	5.7	5.2

(b) Write short note on the relative efficiency of experimental designs.

(10+10=20 Marks)

**P.T.O**

**Q.No.5**

- a. Describe the different components of time series and their behavior.  
b. Given the following time series:

Year	Values
2011	3
2012	4
2013	6
2014	7
2015	9
2016	12
2017	11
2018	15
2019	18
2020	17
2021	19
2022	20

Determine the trend by using the (i) 3-years moving average method (ii) least-square line.

Comment, which method you think is more appropriate for trend estimation for this data.

**(6+14=20 Marks)**

**Q.No.6**

Write brief note on

- (a) Theoretical tests for index numbers  
(b) Walsh and Palgrave's index number

**(10+10=20 Marks)**

**Q.No.7**

Statistical organizations collect data and produce various reports and documents. Give and discuss the important documents produced by statistical organizations in Pakistan.

**(20 Marks)**

**Q.No.8**

The following table shows the 1982 and 1984 populations and 1982 deaths for a certain country.

Age Group (Years)	1982 Population ('0000)	Deaths in 1982	1984 Census Population as Standard ('0000)
0-9	656	119717	684
10-19	482	7193	508
20-29	317	8996	333
30-39	186	7852	191
40-49	137	8290	146
50-59	97	10690	103
60-69	63	15248	67
70+..	50	31041	54

i) Calculate the crude death rate for the country in 1982.

ii) Use the direct method to obtain the 1982 adjusted death rate for country using 1984 population as the standard. Interpret your result.

**(10+10=20 Marks)**