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1612N1000

Candidate's Seat No:____

IMBA TY Sem.-5 Examination
Quantitative Techniques
December-2025

Time : 2.30 Hours] [Max.Marks : 70

Note: 1. Statistical Tables shall be provided on request.
2. Non-Programmable Scientific Calculators are allowed.

Q1. Attempt **ANY TWO** of the following.

(A) Explain **[14]**

(i) Sampling Errors **(5)**

(ii) Statistics **(2)**

(B) A population consists of numbers 2, 3, 6, 8, 11. **(7)**
Enumerate all possible samples of size 2 which can be drawn from the population without replacement and show that the mean of the sampling distribution of the sample means is equal to the population mean. Calculate the variance of the sampling distribution of the sample mean and check whether it is more or less than the population variance.

(C) (i) A Pathologist wants to determine on the basis of sample study, the mean time required to complete a certain analysis so that he may be 98% confident that the mean may remain within ±3 days of the true mean. As per the available record, the population variance is 81 days. What must be the size of the sample for his study? **(3)**

(ii) In a survey of banking habits of the population, 1000 persons were interviewed. Of these 800 had an account with banks and remaining did not have any account in any of the banks. Assuming that this is a random sample from a population of 50,000 people, construct a 95% confidence interval for the true proportion of the population having banking relations with the banks. **(4)**

Q2. Attempt **ANY TWO** of the following.

(A) A firm believes that the tyres produced by process A on an average last longer than tyres produced by process B. To test this belief, random samples of tyres produced by the two processes were tested and the results are: **[14]**

Process	*Sample size*	*Average Life Time (in km)*	*Standard Deviation (km)*
A	50	22,400	1000
B	50	21,800	1000

Is there evidence at 5% level of significance that the firm is correct in its belief?

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(B) On a certain day, 74 trains were arriving on time at Delhi station during the rush hours and 83 were late. At New Delhi station there were 65 on time and 107 late. Is there any difference in the proportions arriving on time at the two stations?

(C) In order to test whether declaration of dividends has any effect on the market price of a share of a company a random sample of 8 companies was taken from companies which have declared dividends. The data regarding share prices of the sample companies is:

Company:	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***
Market Price 10 days Before Dividends were Declared:	70	65	112	58	25	147	95	68
Market Price 10 days After the Declaration of Dividends:	80	85	110	64	32	159	100	70

Can we say that the increase in average market price after declaration of dividends is significant (use 5% level of significance).

Q3. Attempt **ANY TWO** of the following. **[14]**

(A) Survey of 320 families with 5 children each revealed the following distribution:

No. of Girls:	0	1	2	3	4	5
No. of Families:	14	56	110	88	40	12

Is the result consistent with the hypothesis that male and female births are equally probable (test at $\alpha = 0.01$)? Fit a Binomial Distribution to test the goodness of fit.

(B) To test the efficiency of a new drug a controlled experiment was conducted wherein 300 patients were administered the new drug and 200 other patients were not given the drug. The patients were monitored and the results were obtained as follows:

	Cured	***Condition Worsened***	***No Effect***
Given the Drug	200	40	60
Not Given the Drug	120	30	50

Use χ^2 test for finding the effect of the drug at 2% level of significance.

(C) Weights in kg. of 10 students are given below:

38, 40, 45, 53, 47, 43, 55, 48, 52, 49

Can we say that the variance of the distribution of weights of all students from which the above sample of students was drawn, is equal to 20 square kg (test at $\alpha = 0.05$).

Q4. (A) Two horses A and B were tested according to the time (in seconds) to run a particular track with the following results: **(6)**

Horse A:	28	30	32	33	33	29	34
Horse B:	29	30	30	24	27	29	

Test at $\alpha = 0.02$ whether the two horses have the same variances in running capacity?

(B) As head of the department of a consumer's research organization, you have the responsibility for testing and comparing lifetimes of four brands of electric bulbs. The data are shown below, each entry representing the lifetime of an electric bulb, measured in hundreds of hours: **(8)**

Brand			
A	**B**	**C**	**D**
20	25	24	23
19	23	20	20
21	21	22	20

Can we infer that the mean life times of the four brands of electric bulbs are equal?

Q5. (A) Define (i) Acceptance Quality Level **(4)**
(ii) Lot Tolerance Proportion Defectives

(B) A machine is set to deliver packets of a given weight. 10 samples of size 5 each were recorded. Below are given relevant data: **(10)**

Sample No.:	1	2	3	4	5	6	7	8	9	10
Mean $(\bar{X})$:	49	45	48	53	39	47	46	39	51	45
Range (R):	7	5	7	9	5	8	8	6	7	6

Calculate the control limits in respect of $\bar{X} - Chart\ and\ R - Chart.$
$(A_2 = 0.58, D_3 = 0, D_4 = 2.15)$. Comment on the state of control.

OR

Q5. (A) Samples of 100 tubes are drawn randomly from the output of a process that produces several thousand units daily. Sample items are inspected for quality and defective tubes are rejected. The results of 15 samples are shown below: **(7)**

Sample No.	***No. of Defective Tubes***
1	8
2	10
3	13
4	9
5	8
6	10
7	14
8	6
9	10
10	13
11	18
12	15
13	12
14	14
15	9

On the basis of information given above prepare a control chart for fraction defective (p-chart). What conclusion do you draw from the control chart?

(B) For a Single Sampling Plan (50, 10, 0), draw OC and ATI curves. **(7)**

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