



N.B.: (1) Attempt any **five** questions; each question is of **20** marks.

(2) Question No. 1 is **compulsory**.

(3) Scientific calculator can be used.

(4) Appropriate Statistical Tables can be used.

1. (a) In a sample of 49 adolescents, one variable of interest was the diameter of skin test reaction to an antigen. The sample mean and standard deviation were 21 and 11 mm erythema, respectively. Can it be concluded from these data that the population mean is less than 30? Let $\alpha = 0.05$. 5
- (b) The following table shows 1000 nursing school applicants classified according to scores made on a college entrance examination and the quality of the high school from which they graduated. 5

Score	Quality of High Schools		
	Poor	Average	Superior
	(P)	(A)	(S)
Low (L)	105	60	55
Medium (M)	70	175	145
High (H)	25	65	300

Calculate the following probabilities :

- (i) $P(M \cap P)$
- (ii) $P(H/S)$
- (iii) Made a low score
- (iv) Made a high score or graduated from a superior high school.
- (c) The following table shows the lifetimes in hours of samples from three different types of television tubes manufactured by a company. test at 0.01 level of significance whether there is a difference in the three types. 5
- (Given : $F_{0.01}(2, 9) = 8.02$).

Sample 1	407	411	409		
Sample 2	404	406	408	405	402
Sample 3	410	408	406	408	

- (d) Calculate the mean, median, mode and standard deviation for the following data : 5

x	6	7	8	9	10	11	12
frequency	3	6	9	13	8	5	4

2. (a) Research has suggested a high rate of alcoholism among patients with primary unipolar depression. In 210 families of females with primary unipolar depression, they found that alcoholism was present in 89. Of 299 control families, alcoholism was present in 94. Do these data provide sufficient evidence for us to conclude that alcoholism is more likely to be present in families of subjects with unipolar depression? Let $\alpha = 0.05$. 6
- (b) Fit the curve $y = ax^b$ to the following data by the least square method. 6

x	1	2	3	4	5	6
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Officers

x_1

125

130

135

120

115

120

130

135

140

135

Clerks

x_2

120

122

115

110

125

122

120

120

126

120

Lab. Att.

x_3

120

115

115

130

120

125

122

115

126

118

Lab. Tech.

x_4

118

120

118

120

120

115

125

125

120

115

3. (a) 17 families participated in a training program. Before and after the training program the Behavioural Vignettes Test was administered to the primary parent in each family. A higher score indicates greater knowledge. The following are the pre-and post training scores made on the test :

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Pre	7	6	10	16	8	13	8	14	16
Post	11	14	16	17	9	15	9	17	20
Pre	11	12	13	9	10	17	8	5	
Post	12	14	15	14	15	18	15	9	

May we conclude, on the basis of these data, that the training program increases knowledge of behaviour principles ? Let $\alpha = 0.01$.

- (b) The face sheet of patients' records maintained in a local health department contains 10 entries. A sample of 100 records revealed the following distribution of erroneous entries :

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No. of erroneous entries out of 10

No. of records.

0	8
1	25
2	32
3	24
4	10
5 or more	1

Just the goodness of fit to the binomial distribution with $P = 0.20$.

- (c) The table shows the yields per acre of four different plant crops grown on lots treated with three different types of fertilizer. Test at 0.01 level of significance whether there is a significant difference in yield per acre due to fertilizers.

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	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

(Given : $F_{0.01}(2, 6) = 10.92$)

36 days with a standard deviation of 10 days. assume normally distributed populations. Construct 90, 95 and 99 percent confidence intervals for the difference between population means.

- (b) A sample of 500 college students participated in a study. The following table shows the students classified by major field of study and level of knowledge of the group of diseases :

Major	Knowledge of diseases	
	Good	Poor
Premedical	31	91
Others	19	359

Do these data suggest that there is a relationship between knowledge of the group of diseases and major field of study. Let $\alpha = 0.05$.

- (c) Define the following terms :—

- One and two tailed test
- Conditional probability
- Yate's correction
- Estimation.

5. (a) Arterial blood gas analyses performed on a sample of 15 physically active adult males yielded the following PaO_2 values :

75 80 80 74 84 78 89 72 83 76 75 87 78 79 88

Compute the 95 percent confidence interval for the population proportion.

- (b) In an air pollution study, a random sample of 200 households was selected from each of two communities. A respondent in each household was asked whether or not anyone was bothered by air pollution. The responses were as follows :

Community	Yes	No
I	43	157
II	81	119

Can the researchers conclude that the two communities differ with respect to the variable of interest ? Let $\alpha = 0.05$.

- (c) The following table shows the weights Z, heights X and ages Y of 12 boys.
- Find the least-squares regression equation of Z on X and Y.
 - Determine the estimated values of Z from the given values of X and Y.
 - Estimate the weight of a boy who is 9 years old and 54 inches tall.

Weight (Z)	Height(X)	Age(Y)
64	57	8
71	59	10
53	49	6
67	62	11
55	51	8
58	50	7
77	55	10
57	48	9
56	52	10
51	42	6
76	61	12
68	57	9

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6. (a) The probability that a person suffering from migraine headache will obtain relief with a particular drug is 0.9. Three randomly selected sufferers from migraine headache are given the drug. Find the probability that the number obtaining relief will be :
- (i) exactly zero
 - (ii) exactly one
 - (iii) more than one
 - (iv) two or fewer
 - (v) two or three

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- (b) Cardiac output (litres/minute) was measured by thermodilution in a simple random sample of 15 postcardiac surgical patients in the left lateral position. The results were as follows :

4.91 4.10 6.74 7.27 7.42 7.50
6.56 4.65 5.98 3.14 3.23 5.80
6.17 5.39 5.77

Can we conclude on the basis of these data that the population mean is different from 5.05 ? Use 5% LOS. Use Wilcoxon signed—Rank Test for Location. (Given : $T_{15} (0.05) = 25$).

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- (c) (i) Vital capacity values were recorded for a sample chronic airway obstruction. The variance was 0.75 for the 10 observations. test the null hypothesis that the population variance is 1. Let $\alpha = 0.05$.
- (ii) Glucose responses to oral glucose were recorded for 11 patients with Huntington's disease (group 1) and 13 control subjects (group 2). Results yielded the following sample variances : $s_1^2 = 105$, $s_2^2 = 148$. Construct the 95 percent confidence interval for the ratio of the two population variances. (Given $F_{.975} = 3.37$, $F_{.025} = 2.762$)

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7. (a) The following table shows the age distribution of cases of a certain disease during a year.

Age	No. of cases
5—14	5
15—24	10
25—34	120
35—44	22
45—54	13
55—64	5

For these data construct a cumulative frequency distribution, a relative frequency distribution, a cumulative relative frequency distribution, a histogram and a frequency polygon.

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- (b) Fifteen patient records from each of two hospitals were reviewed and assigned a score designed to measure level of care. The scores were as follows :

Hospital	A	99	85	73	98	83	88	
Hospital	B	78	74	69	79	57	78	
A	99	80	74	91	80	94	94	98
B	79	68	59	91	89	55	60	55

Would you conclude, at the 0.05 level of significance, that the two population medians are different ?

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- (c) A test designed to measure mothers' attitudes toward their labour and delivery experiences was given to two groups of new mothers. Sample 1 had attended prenatal classes. Sample 2 did not attend the classes. The sample sizes, means and standard deviations of the test scores were as follows :

Sample	n	\bar{x}	s
1	15	4.75	1
2	22	3.00	1.5

Do these data provide sufficient evidence to indicate that attenders, on the average, score higher than nonattenders ? Let $\alpha = 0.01$. Assume equal variances. Also construct a 95 percent confidence interval for the difference between the means of the population.