

(3 Hours)

[Total Marks : 80

- N.B. : (1) Question 1 is compulsory.
(2) Attempt any Three questions from Q2 to Q6

1. (a) Explain properties of 't' distribution?
(b) Suppose I want to estimate average level of some enzyme in certain population with $n=10$, $\bar{x} = 22$ and is normally distributed with a variance 45. We wish to estimate μ .
(c) If 10 coins are thrown at random. What is the probability of getting 7 heads?
(d) Given below is the distribution of 140 candidates obtaining marks X or higher in a certain examination. Calculate the mean, median and mode of the distribution

| | | | | | | | | | | |
|-----|-----|-----|-----|-----|----|----|----|----|----|-----|
| X | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| c.f | 140 | 133 | 118 | 100 | 75 | 45 | 25 | 9 | 2 | 0 |

2. (a) Explain properties of "t" distribution and use the "t" distribution to find the reliability factor for a confidence interval based on the following data:

| | A | B | C | D |
|------------------------|------|------|------|------|
| Confidence Coefficient | 0.95 | 0.99 | 0.90 | 0.95 |
| Sample Size | 15 | 24 | 8 | 30 |

- (b) Explain Bayes Theorem in detail.
(c) Millerand Vanhoutte (A-1) conducted experiments in which adult ovariectomized female mongrel dogs were treated with Estrogen, Progesterone or Estrogen plus Progesterone. Five untreated animals were served as controls. A variable of interest was concentration of progesterone in the serum of the animals 14 to 21 days after treatment. We wish to know if the treatments have different effects on the mean serum concentration of progesterone.

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(2)

| | Treatment | | |
|-----|-----------|----------|--------------|
| | Untreated | Estrogen | Progesterone |
| 117 | 440 | 605 | 2664 |
| 124 | 264 | 626 | 2078. |
| 40 | 221 | 385 | 3584 |
| 88 | 136 | 475 | 1540 |
| 40 | | | 1840 |

3 (a) The following table shows the weights X_1 to the nearest pound (lb), the heights X_2 to the nearest inch (in), and the ages X_3 to the nearest years of 12 boys. 8

| | | | | | | | | | | | | |
|--------------|----|----|----|----|----|----|----|----|----|----|----|----|
| Weight X_1 | 64 | 71 | 53 | 67 | 55 | 58 | 77 | 57 | 56 | 51 | 76 | 68 |
| Height X_2 | 57 | 59 | 49 | 62 | 51 | 50 | 55 | 48 | 52 | 42 | 61 | 57 |
| Age X_3 | 8 | 10 | 6 | 11 | 8 | 7 | 10 | 9 | 10 | 6 | 12 | 9 |

- (i) Find the Least Square Regression equation of X_1 on X_2 and X_3 .
- (ii) Find r_{12} , r_{23} , r_{13} .
- (iii) Find $R_{1.23}$, $R_{2.13}$, $R_{3.12}$

(b) If the Uric acid values in the normal adult males are approximately normally distributed with a mean and standard deviation of 5.7 mg percent and 1 mg percent respectively, find the probability that a sample of size 9 will yield a mean: 6

- (i) Greater than 6
- (ii) Between 5 and 6
- (iii) Less than 5.2

(c) The following are intraocular pressure (mm Hg) values recorded for a sample of 21 subjects: 6

14.5, 12.9, 14, 16.1, 12, 17.5, 12.9, 17.9, 12, 16.4, 24.2, 12.2, 14.4, 17, 10, 18.5, 20.8, 16.2, 14.9, 19.6, 14.4.

Can we conclude by 0.1 LOS that population mean is greater than 14?

4 (a) Fit the curve of the type $y = a x^2 + \frac{b}{x}$ to the following data: 6

| | | | | |
|-----|-------|------|------|------|
| x : | 1 | 2 | 3 | 4 |
| y : | -1.51 | 0.99 | 3.88 | 7.66 |

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(b) Explain the following terms:

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- (i) Skewness
- (ii) Coefficient of Dispersion
- (iii) Coefficient of Variation
- (iv) Quartile Deviation

(c) In answering a biostatistics question on a multiple choice test a student either knows the answer or he guesses. Let p be the probability that he knows the answer and $1-p$ be the probability that he guesses. Assume that a student who guesses at the answer will be correct with the probability $1/5$, where 5 is the number of multiple choice alternatives. What is the conditional probability that a student knew the answer to a question given that he answered it correctly? 6

5. (a) There are three main brands of medicines. A set of its 120 sales is examined and found to be allocated among four groups A, B, C, D and company names I, II and III as shown in table: 8

| Companies | Groups | | | |
|-----------|--------|----|----|----|
| | A | B | C | D |
| I | 0 | 4 | 8 | 15 |
| II | 5 | 8 | 13 | 6 |
| III | 18 | 19 | 11 | 13 |

Is there any significant difference in company preferences? Answer at 5% LOS using one way ANOVA Table. (Take 10 as the code value to subtract from all given values in your working) Given $F(3,8)_{0.05} = 8.85$

(b) Researchers the data collected is sufficient to indicate a difference in mean of Serum uric acid levels between normal and Downs syndrome subjects. The data consists of serum uric acid readings of 12 individuals with Down's syndrome & 15 normal individuals. The means are $\bar{x}_1 = 4.5$ mg / 100ml and $\bar{x}_2 = 3.4$ mg/ 100ml. Is there a difference between the means between individuals with Down's syndrome and normal individuals? 6

(c) Explain the properties of Chi-Square in detail. 6

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6. (a) The purpose of study by Crozier was to document that patients with motor complete injury but preserved pin appreciation in addition to light touch below the zone of injury have better prognosis with regard to ambulation than patients with only light touch preserved. Subjects were 27 patients with upper motor neuron lesions admitted for treatment within 72 hours of injury. They were divided into two types: Group 1 were patients who had touch sensation but no pain appreciation below the zone of injury. Group 2 were patients who had partial or complete pin appreciation and light touch sensation below the zone of injury. Table below shows the ambulatory status of these patients at time of discharge. We wish to know if we may conclude that patients classified as group 2 have a higher probability of ambulation at discharge than patients classified as group

Table: Ambulatory status at Discharge of Group 1

| Group | Total | Non-Ambulatory | Ambulatory |
|-------|-------|----------------|------------|
| 1 | 18 | 16 | 2 |
| 2 | 9 | 1 | 8 |
| Total | 27 | 17 | 10 |

1.

6. (b) Researchers wish to know if two populations differ with respect to the mean value of total Serum complement activity (C_{H50}). The data consists of C_{H50} determinations on $n_2=20$ apparently normal subjects and $n_1=10$ subjects with disease. The sample means and standard deviations are:

$$\bar{x}_1 = 62.6 \quad s_1 = 33.8$$

$$\bar{x}_2 = 47.2 \quad s_2 = 10.1$$

(c) Suppose that over a period of several years the average number of deaths from a certain non-contagious disease has been 10. If the number of deaths from this disease follows Poisson distribution, what is the probability that during the current year

- (i) Exactly 7 people will die from the disease?
- (ii) 10 or more people will die from the disease?