

NOTE:- 1) Attempt all questions.

2) Figures to the right indicate marks.

3) Use of calculator is allowed.

4) Statistical tables will be provided on request.

Q.1 a) If X follows rectangular distribution in interval (a,b) . Write down probability density function of X . Find its mean and variance. 6

b) For a continuous random variable with p.d.f. is

$$f(x) = \begin{cases} kx & 0 < x < 2 \\ = 0 & \text{otherwise} \end{cases}$$

Find k , the mean and variance of X . 6

OR

Q.1 a) Define a random variable X following an exponential distribution with parameter a . Find its mean and variance. 6

b) Determine cumulative distribution function $f(x)$ and $P[X < 1/2]$ for the following probability density function.

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

Also obtain the mean of the distribution. 6

Q.2 a) State probability density function of normal distribution with parameter μ and σ . Also state important properties of normal distribution. 6

b) If the marks in a particular subject are assumed to follow normal distribution with mean 40 and variance 9. Find how many out of 1000 students get marks

i) below 35 ii) between 43 and 46.

(Given area under standard normal curve between $t = 0$ and $t = 1.66$ is 0.4215.

between $t = 0$ and $t = 1$ is 0.3413, between $t = 0$ and $t = 2$ is 0.4772) 7

OR

Q.2 a) Define the following terms with an example.
i) Parameter ii) Statistic iii) Estimator. 6

b) Number of patients visiting a doctor's clinic follows Normal distribution with mean 50 and standard deviation 10. How many days of a month (26 working days) does doctor expect i) at least 60 patients ii) 35 to 50 patients.

(Given that for a standard normal variate t area between $t = 0$ and $t = 1$ is 0.3413,

between $t = 0$ and $t = 1.5$ is 0.4332) 7

- Q.3 a) Explain the following terms with suitable example. 6
- i) Null Hypothesis & alternative hypothesis.
 - ii) Type I error & Type II error.
 - iii) Level of significance & critical region.

- b) The mean lifetime of a sample of 100 fluorescent bulbs produced by a company is found to be 1570 hours with standard deviation of 120 hours. Test the hypothesis that the mean lifetime of a bulb produced by the company is 1600 hours against the alternative hypothesis that it is less than 1600 hours at 5% level of significance. 6

OR

- Q.3 a) Explain how would you arrive at the best decision criterion based on a large sample to test the hypothesis $H_0 : P = P_0$ against $H_1 : P \neq P_0$ where P_0 is specified population proportion under consideration if you use 5% level of significance. 6

- b) In a group of 121 boys obtained mean intelligence quotient (I.Q.) of 84 while a group of 81 girls obtained 80. If the standard deviation of I. Q. is given to be 10 can we conclude that there is significant difference between their performances? Use 5% level of significance. (Given $t_{1,2} = 10$). 6

- Q.4 a) Define chi-square variate with n degrees of freedom, and prove for 2 x 2 contingency table

| | |
|---|---|
| a | b |
| c | d |

$$\chi^2 = \frac{N(ad-bc)^2}{(a+b)(c+d)(a+c)(b+d)}$$

- b) Children having one parent of blood type M and the other type N will always be one of the three types M, MN, N and the average proportion of these will be 1 : 2 : 1 out of 300 children having one M parent and N parent, 30% were found to be of type M 45% of type MN and remaining of type N. Use χ^2 test to test these at 5% level of significance.
 (Table value of χ^2 at 5% are as follows. $\chi^2(1) = 3.84$, $\chi^2(2) = 5.99$ $\chi^2(3) = 7.82$
 $\chi^2(4) = 9.49$, $\chi^2(5) = 11.07$ $\chi^2(6) = 12.59$ 7

OR

- Q.4 a) Explain the concept of estimation. 6
- b) The following data shows classification of individuals with respect to sex and literacy for independence of attributes using test at 1% level of significance.

| | | | |
|--------|----------|------------|-----|
| | Literate | illiterate | |
| Male | 90 | 10 | 100 |
| Female | 75 | 25 | 100 |
| | 165 | 35 | 200 |

(Use with 1 d.f. at 1% = 6.63) 7