PG Even Semester Examination, September, 2023

STATISTICS

(4th Semester)

Course No: STSCC-404

(Industrial Statistics and Optimization Technique-II)

FM: 70
Pass Marks : 28
Time: 3 Hours

The figures in the right margin indicate full marks for the question.
Answer five questions, taking one from each unit.

UNIT-I

1. (a) Establish a relationship between reliability function and hazard function. 5

   (b) Define failure density function. Also derive a failure distribution modes. 2+7=9

2. (a) Obtain the expressions for reliability function, hazard rate and mean time to failure, if the failure distribution is assumed to be Gamma distribution. 7

   (b) If the failure distribution is Weibull, obtain the expressions for reliability function, mean time to failure and hazard function. What is the effect on shape of hazard rate cutve with the change in the value of shape parameter in this case? 7

UNIT-II

3. (a) Explain monotoncity property of failure rate. 3

   (b) Define an increasing failure rate. Assume that F has a density f with $F(0^-)=0$. Then prove that F is increasing failure rate iff hazard function is increasing. 7

   (c) Define structure function of a system. Write down the structure function of series and parallel system. 4

4. (a) If F is increasing failure distribution then prove that $[F(t)]^{1/t}$ is decreasing (increasing). Also show that-

   (i) $[F(x)] < [F(t)]^{x/t}$

   (ii) IFR distributions have finite moments of all orders. 3+1+2=6

   (b) Define Path and cuts for monotonic structures. Obtain the bounds or the reliability of monotonic structures with independent components. 8

UNIT-III

5. (a) Discuss the various characteristics of a queuing system. 7

   (b) Obtain the distribution of numbers for M/M/1 queuing system. Hence find the average number of customers in the queue. 7

6. (a) Derive the distribution of waiting time in queue for M/M/S model. 8

   (b) A TV repairman finds that the time spent on his jobs has an exponential distribution with mean 30 minutes. If he repairs sets in the order, in which they came in, and if the arrival of the sets is approximately Poisson with an average rate of 10 per, 8 hour day. What is repairman's expected idle time each day? How many jobs are ahead of the average set just brought in? What is the probability that an arriving set will be required to wait atleast 30 minutes before it is attended to by the repairman? 6

UNIT-IV

7. Describe the method and algorithm of random number generation (a) Convolution, (b) Acceptance-Rejection. 6+8=14

8. Describe the method of Monte-carlo. By using the uniform distribution generate Binomial (n=10, p=0.7) and obtain $E(p^3 - \frac{1}{p})$ through monte-carlo method. 5+9=14

UNIT-V

9. Describe the sequential sampling plan for attributes. 14

10. Describe the central chart for number of defects and fraction of defctives. 7+7=14

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