Roll No. .... Total Pages : 05

BT-7/D-13 **8703**

STATISTICAL MODELS FOR COMPUTER SCIENCE

CSE-405

Time : Three Hours] [Maximum Marks : 100

Note : Attempt *Five* questions in all, selecting at least *one* question from each of four Units.

Unit I

1. (a) Four components are inspected and three events are defined as follows :

A = "All four components are found defective"

B = "Exactly two components are found to be in proper working order"

C = "At most three components are found to be defective." **8**

(b) Explain concept of independence of events for 2 events and extend it for n events. **12**

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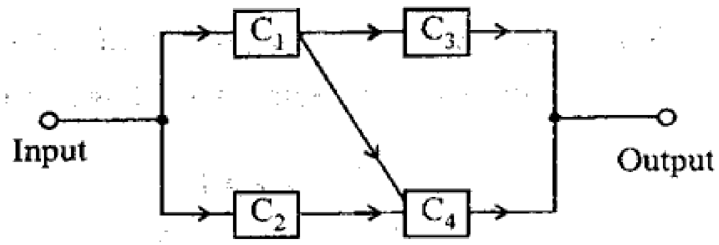
2. (a) Consider the non-series parallel system of following figure. The system is considered to be working properly if all components along at least one path from input to output are functioning properly. Determine expression for reliability of this system. **12**



(b) Out of every 100 jobs received at a computer center, 40 are of class 1, 25 are of class 2 and 35 of class 3. A sample of 30 jobs is taken with replacement.

(i) Find the probability that the sample will contain ten jobs of each class.

(ii) Find the probability that there will be exactly 12 jobs of class 2. **8**

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Unit II

3. (a) 1% of jobs arriving at a computer system need to wait until weekends for scheduling. Find the probability that among a sample of 200 jobs there are no jobs that have to wait until the weekend for scheduling. **8**

(b) Derive PGF for Poisson Discrete Random Variable. **4**

(c) Compute the pmf and CDF of max {X, Y} where X and Y are independent random variables such that X and Y are both Poisson distributed with parameter α. **8**

4. (a) Prove the memoryless property of exponential distribution. **8**

(b) Let X be an exponentially distributed random variable with parameter λ. Using $E[X]=\frac{1}{\lambda}$ and $f(x)=\lambda e^{-\lambda x}$ compute σ^2. **6**

(c) Define MTTF & briefly show its derivation. **6**

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Unit III

5. (a) Define :

(i) Stochastic process

(ii) Markov process

(iii) Bernoulli process

(iv) Poisson process. **12**

(b) Explain various generalizations of Bernoulli process. **8**

6. (a) Let number of events occurred in the interval $[0, t]$ be denoted by $N(t)$ with mean rate λ. Prove that this continuous parameter discrete state stochastic process is Poisson Process. Proof should be with the help of derivation of formula leading to Poisson distribution equation. **12**

(b) Explain concept of renewal density and key renewal theorem. **8**

Unit IV

7. (a) Consider a 2-state Markov chain with $a = 0$, $b = 1$. Find (i) which state is transient, (ii) which state is absorbing (iii) whether chain is irreducible or not ? **2+2+4=8**

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(b) Define discrete parameter birth-death process and derive the matrix notation of this process. Now compute the steady state probability vector v step by step. **12**

8. (a) Derive Kolmogorov's forward and backward equation for continuous parameter Markov chain. **10**

(b) Derive the equation and solution for pure birth process in a continuous parameter Markov chain. **10**