Roll No. .... Total Pages : 4

8903

BT-7/D09

STATISTICAL MODELS FOR COMPUTER SCIENCE

Paper : CSE-405

Time : Three Hours] [Maximum Marks : 100

Note : Attempt *five* questions in all, selecting at least *one* question from each unit.

UNIT–I

1. (a) What is Baye's rule ? The source of incoming jobs at a university computation centre is 15 percent from duke, 35 percent from North Carolina and 50 percent from North Carolina State. Suppose that the probabilities that a job is initiated from these Universities require set-up are 0.01, 0.05 and 0.02 respectively. Find the probability that a job chosen at random is a non-set-up job. Also find the probability that randomly chosen job comes from the University of North Carolina given that it is a non-set-up job. 10

(b) Define Probability axioms. Prove the following relation and generalized it to n-terms also :

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$ 10

2. (a) Define Bernoulli trial and generalized Bernoulli trial. Compute reliabilities of m-out-of-n system as a function of reliability R using $n = 3$ and $m = 1, 2, 3$. 10

(b) In three boxes there are capacitors as shown in the following table :

TYPE	Box No. 1	Box No. 2	Box No. 3
1.0 μF	10	90	25
0.1 μF	50	30	80
0.01 μF	70	90	120

Assuming that each box has the same probability of selection, compute the following :

(i) What is the probability of selecting 0.1 μF capacitor, given that Box no. 3 is chosen ?

(ii) If a 0.1 μF capacitor is chosen, what is the probability it came from Box no. 1 ?

UNIT–II

3. (a) Explain and derive the expression for negative binomial pmf. Show that the expression for its PGF is given by $[pz/1 - z(1 - p)]^r$. 10

(b) Define and explain exponential distribution. Discuss its Markov property in detail. 10

4. (a) Assuming that the life of a given subsystem in wear out phase is normally distributed with $\mu = 10{,}000$ hours and $\sigma = 1{,}000$ hrs., determine the reliability for an operating time of 500 hrs. given that (i) the age of component is 9,000 hours, and (ii) the age of the component is 11,000 hrs. 10

(b) Explain Erlang and Gamma distribution. Derive the equation for its expectation and variance. 10

UNIT–III

5. (a) Consider a stochastic process defined on a finite sample space with three sample points. Its description is provided by the specifications of three sample functions $X(t, s_1) = 3$ $X(t, s_2) = 3\cos(t)$ $X(t, s_3) = 4\sin(t)$ where $P(s_1) = P(s_2) = P(s_3) = 1/3$. Compute $E[X(t)]$ and the autocorrelation function $R(t_1, t_2)$. 10

(b) Given that $n \geq 1$ arrivals have occurred in the interval $(0, t]$. Show that conditional joint pdf of the arrival times $T_1, T_2 \ldots T_n$ is given by $x!/t^n$. 10

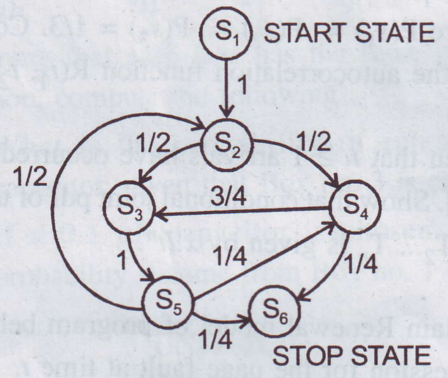
6. (a) Explain Renewal model of program behaviour. Derive expression for the page fault at time t. 10

(b) Explain the difference between Poisson process and Renewal counting process. Show that the autocorrelation function $R(t_1, t_2)$ of a strict stationary stochastic process depends only on the time difference $(t_2 - t_1)$ if exists. 10

UNIT–IV

7. (a) Explain the concept of memory interference in multiprocessor system using irreducible Markov chain. Derive the equation for average number of memory requests completed per memory cycle. 10

(b) Given the stochastic program flow graph shown in the figure, compute the average no. of times each vertex s_i is visited and assuming that the execution time of s_i is given by $t_i = 2i + 1$ time units, find the average total execution time τ of the program. 10



8. (a) Explain discrete parameter birth death process. Also compute the steady state probability vector v. 10

(b) Write short notes on the following :

(i) M/G/1 queuing system.

(ii) Non-birth death process.

(iii) M/M/m queuing system. 10