Roll No. ....

Total Pages : 5

Exam. Code
6027

8703

BT-7/M-11

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) Describe the Sample space for each of the following events :
   - (i) Three tosses of a coin.
   - (ii) Number of smokers in a group of 500 persons.
   - (iii) Tossing of a coin until a tail appears.
   - (iv) The number of incoming telephone calls to a telephone booth.
   - (v) Tossing of a coin and a die together.

   (b) Consider a pool of 6 I/O buffers. Assume that each buffer is just as likely to be available or occupied as any other buffer. Compute the probability associated with the following events :

   A = At least two but no more than 5 buffers occupied.

   B = At least three but no more than 5 buffers occupied.

   C = All buffers available or even number of buffers occupied. 10,10

2. (a) If $P(A \cup B) = 5/6$, $P(A \cap B) = 1/3$ and $P(\bar{A}) = 1/2$, find P(A) and P(B). Also show that A and B are independent.

http://www.kuonline.in

http://www.kuonline.in

   (b) A binary communication channel carries data as one of the two types of signals denoted by 0 and 1. Owing to noise, a transmitted 0 is sometimes received as 1 and a transmitted 1 is received as 0. For a given channel, assume the probability of 0.94 that a transmitted 0 is received correctly as 0 and a probability of 0.91 that a transmitted 1 is received as a 1. Also assume that 0.45 is the probability of transmitting a 0. Now a signal is sent, find
   - (i) The probability that a 1 is received.
   - (ii) The probability that a 0 is received.
   - (iii) Probability that a 0 was transmitted given that a 0 was received.
   - (iv) Probability that a 1 was transmitted given that a 1 was received.
   - (v) Probability of an error.
   - (vi) Probability of a correct reception. 8,12

UNIT–II

3. (a) Let x be a continuous random variable with probability density function

$$f(x) = \begin{cases} 6x(1-x) & , \quad 0 < x < 1 \\ 0 & , \quad \text{elsewhere.} \end{cases}$$

   - (i) Check that the above $f(x)$ is a legitimate p.d.f.
   - (ii) Find distribution function of random variable x.
   - (iii) Find its mean and variance.

   (b) Show that Poisson distribution is a limiting case of Binomial distribution. Also find first two moments of Poisson distribution. 10,10

http://www.kuonline.in

http://www.kuonline.in

4. (a) Suppose that X is p.d.f., $f(x)=\frac{8}{x^3}$, $x>2$. Let $W=\frac{X}{3}$. Evaluate E(W) using p.d.f. of W.

(b) The table given below shows the joint probability distribution of employment status (employed and unemployed) and education (no college degree and college degree) in an institute :

	Employed $x=0$	Unemployed $x=1$	Total
No college degree $y=0$	?	0.04	0.59
College degree $y=1$	0.39	?	?
Total	?	?	?

(i) Fill in the missing entries in the table.

(ii) A randomly selected worker is found to be unemployed. What is the probability that the person is a college graduate ? 10,10

UNIT–III

5. (a) What do you mean by Renewal model of program behaviour ? Explain in detail.

(b) Consider a computer system with Poisson job arrival stream at an average rate of 80 per hour. Determine the probability that the time interval between successing job arrivals is

(i) between two and eight minutes.

(ii) longer than five minutes.

(iii) shorter than ten minutes. 10,10

6. (a) Explain MTTF and MTTR. How availability analysis depends on these two factors ? Justify your answer with their expressions.

(b) Show that the time that a discrete parameter homogeneous Markov chain spends in a given state has a geometric distribution. 10,10

UNIT–IV

7. (a) Given a Two-state Markov chain with the transition probability matrix

$$P=\begin{bmatrix}1-a & a\\ b & 1-b\end{bmatrix},\ 0\le a,\ b\le 1,\ |1-a-b|<1.$$

Find P(n), n step transition probability matrix.

(b) Explain the following terms :

(i) Non-birth death process.

(ii) Average waiting time of M|G|1 queueing system. 10,10

8. (a) Draw State diagram corresponding to the following transition matrix :

$$\begin{array}{c} \\ A\\ B\\ C\\ D\end{array}\begin{array}{c}\begin{array}{cccc}A & B & C & D\end{array}\\ \begin{bmatrix}0.25 & 0.15 & 0.2 & 0.4\\ 0 & 0.5 & 0.5 & 0\\ 0 & 0 & 1.0 & 0\\ 0.3 & 0.4 & 0.1 & 0.2\end{bmatrix}\end{array}$$

(i) What is the probability of going from State A to State B in one step ?

(ii) What is the probability of going from State B to State C in one step ?

(b) Consider a system with two memory modules and two processors. Let the number of processors waiting or being served at module $i\ (i = 1, 2)$ be denoted by P_i, $P_i \geq 0$ and $P_1 + P_2 = 2$. For a discrete parameter queueing network of multiprocessor memory interference solve maximum value of total expectation E(B). 8,12

http://www.kuonline.in