Code: 1843

Roll No.......

M.Sc.(INFORMATICS) IV-Sem.-2018

Paper:43, Modeling, Simulation & Performance Evaluation

Time:3hrs

Max.Marks:75

Write your Roll No. on the top immediately on receipt of this question paper

Attempt five questions in all

Q.1 is compulsory

Q.1(a) An antivirus software reports that 3 folders out of 10 are infected. How many possibilities are there? (3)

(b) There are 20 computers in a store. Among them 15 are brand new and 5 are refurbished. Six computers are purchased for a student lab. From the first look, they are indistinguishable , so the six computers are selected at random. Compute the probability that among the chosen computers , two are refurbished. (4)

(c) Ninety percent of flights departs on time. Eighty percent of flights arrive on time. Seventy- five percent of flights depart on time and arrive on time. (6)

(*i*) You are meeting a flight that departed on time. What is the probability that it will arrive on time?

(*ii*) You have met a flight, and it arrived on time. What is the probability that it departed on time.

(*iii*) Are the events, departing on time and arriving on time , independent?

(d) Consider an experiment of tossing 3 fair coins and counting the number of heads. What is the probability of occurrence of 1, 2 , 3 and 0 heads. (2)

Q.2(a) A program consists of two modules. The number of errors X_1 in the first module has the pmf $P_1(x)$, and the number of errors X_2 in the second module has the pmf $P_2(x)$, independently of X_1, where

Table 1:

x	$P_1(x)$	$P_2(x)$
0	0.5	0.7
1	0.3	0.2
2	0.1	0.1
3	0.1	0

Find the pmf and cdf of $Y = X_1 + X_2$, the total number of errors. (6)

(b) An exciting computer game is released . Sixty percent of players complete all the levels. Thirty percent of them will then buy an advanced version of the game. Among 15 users, what is the expected number of people who will buy the advanced version? What is the probability that at least two people will buy it? (5)

(c) Customers of an internet service provider initiate new accounts at the average rate of 10 accounts per day. (Given that $F_X(8) = 0.333$, and $F_Y(16) = 0.221$. (4)

(i) What is the probability that more than 8 new accounts will be initiated today?

(ii) What is the probability that more than 16 accounts will be initiated within 2 days?

Q.3(a) The lifetime, in years, of some electronic component is a continuous random variable with density (5)

$$f(x) = \begin{cases} \frac{k}{x^3} & \text{for } x \geq 1 \\ 0 & \text{for } x < 1 \end{cases}$$

Find k, draw a graph of the *cdf* $F(x)$, and compute the probability for the lifetime to exceed 5 years.

(b) What do you understand by a uniform distribution in the interval (a, b). Find an expression for the mean and standard deviation for uniformly distributed random variable X. (5)

(c) It is said that " Exponential variables lose memory." What does it mean ? (5)

Q.4(a) Jobs are sent to a printer at an average rate of 3 jobs per hour. (i) What is the expected time between jobs? (ii) What is the probability that the next job is sent within 5 minutes? (4)

(b) Compilation of a computer program consists of 3 blocks that are processed sequentially, one after another. Each block takes Exponential time with the mean of 5 minutes, independently of other blocks. (i) Compute the expectation and variance of the total compilation time. (ii) Compute the probability for the entire program to be completed in less than 12 minutes. (6)

(c) A disk has free space of 330 megabytes . Is it likely to be sufficient for 300 independent images, if each image has expected size of 1 megabytes with standard deviation of 0.5 megabytes?Given that $\Phi(1.68) = 0.9535$. (5)

Q.5 (a) Consider the two -state chain with transition matrix (8)

$$T = \begin{bmatrix} 1-\alpha & \alpha \\ \beta & 1-\beta \end{bmatrix}, \quad 0 < \alpha, \beta < 1.$$

Find $\lim_{n \to \infty} T^n$.

(b) A three-state Markov chain has the transition matrix (7)

$$T = \begin{bmatrix} p & 1-p & 0 \\ 0 & 0 & 1 \\ 1-q & 0 & q \end{bmatrix}$$

where $0 < p < 1, 0 < q < 1$. Show that the state E_1 is persistent.

Q.6 (a)If λ and μ corresponds to arrival and departure rate in a queueing system, and if P_n denotes the probability of n customers in the system then deduce the stochastic difference equation in equilibrium of the arrival and departure process .(i) Find an expression for the average number L_q of customers in the queue .(ii) Find also an expression for waiting time of a customer in the queue. (9)

(b) Arrival at a telephone booth are considered to be Poisson with an average time of 12 minutes between one arrival and the next. The length of a phone call is assumed to be distributed exponentially. (i) What is the probability that a person arriving at the booth will have to wait in the queue? (ii) Estimate the fraction of the day when the phone will be in use. (iii) What is the average length of the queue that forms from time to time. (6)