CBCS SCHEME

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16/17SCS/SCN/SCE/SSE/LNI/SFC/SIT14

First Semester M.Tech. Degree Examination, June/July 2019
Probability, Statistics and Queuing Theory

Time: 3 hrs. Max. Marks: 80

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of statistical table allowed.

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

Module-1

1 a. What are the axioms of probability? State and prove Baye's theorem. **(08 Marks)**

b. For a certain binary communication channel the probability that a transmitted '0' is received as a '0' is 0.95 and the probability that a transmitted '1' is received as '1' is 0.90. If the probability that a '0' is transmitted is 0.4, find the probability that i) a '1' is received and ii) a '1' was transmitted given that a '1' was received. **(08 Marks)**

OR

2 a. What is a Random variable? Explain probability function, Pdf and Cdf. **(08 Marks)**

b. A random variable X has the following distribution.

X	-2	-1	0	1	2	3
P(x)	0.1	k	0.2	2k	0.3	3k

i) Find K
ii) Evaluate $P(x < 2)$
iii) $F(x)$ when $-1 \le x < 0$
iv) Evaluate mean of x. **(08 Marks)**

Module-2

3 a. Derive E(x) and Var(x) for binomial probability distribution function. **(08 Marks)**

b. The number of monthly break downs of the computer is a random variable having a Poisson distribution with mean equal to 1.8. Find the probability that this computer will function for a month i) Without a breakdown ii) With only one breakdown iii) With atleast one breakdown. **(08 Marks)**

OR

4 a. Define uniform, exponential, normal and standard normal continuous distributions. **(08 Marks)**

b. The time required, in hours, to repair a machine is exponentially distributed with parameter $\lambda = 1/2$.
i) What is the probability that the repair time exceeds 2h?
ii) What is the conditional probability that a repair takes at least 10h given that its duration exceeds 9h? **(08 Marks)**

Module-3

5 a. What is random process? How do you describe random process? What are the four types of random processes? **(08 Marks)**

b. Show that the random process $X(t) = A \cos(w_0 t + \theta)$ is wide sense stationary, if A and W_0 are constants and θ is a uniformly distributed random variable in $(0, 2\pi)$. **(08 Marks)**

OR

6 a. Define Poisson process. Show that the inter arrival time of a Poisson process with parameter λ has an exponential distribution with mean $1/\lambda$. **(08 Marks)**

b. Define Markov Chain. What is homogeneous Markov Chain. Consider a Markov Chain with three possible states 1, 2 and 3 and the following transition probabilities P

$$\begin{pmatrix} \frac{1}{4} & \frac{1}{2} & \frac{1}{4} \\ \frac{1}{3} & 0 & \frac{2}{3} \\ \frac{1}{2} & 0 & \frac{1}{2} \end{pmatrix}$$

i) Find $P(x_4 = 3 / x_3 = 2)$
ii) Find $P(x_3 = 1 / x_2 = 1)$
iii) If we know $P(x_0 = 1) = 13$, find $P(x_0 = 1, x_1 = 2)$
iv) If we know $P(x_0 = 1) = 13$, find $P(x_0 = 1, x_1 = 2, x_2 = 3)$ **(08 Marks)**

Module-4

7 a. What are the tests of significance used for large samples and their test statistic? **(08 Marks)**

b. What is the procedure for testing of hypothesis? A sample of 100 students is taken from a large population. The mean height of students is 160cm. Can it be reasonably regarded that, in the population, mean height is 165cm, and the SD is 10cm? (use $Z_\alpha = 2.58$). **(08 Marks)**

OR

8 a. What are the uses of t – and f – distributions? The mean lifetime of a sample of 25 bulbs is found is 1550 hours with SD of 120h. The company manufacturing the bulbs claims the average life of the bulbs is 1600h. Is the claim acceptable at 5% LOS (use $t_{0.05} = 1.71$). **(08 Marks)**

b. What are the properties of χ^2 distribution? What are the uses of χ^2 distribution? Explain χ^2 test of goodness of fit. **(08 Marks)**

Module-5

9 a. Explain Birth-Death process and obtain expression for steady state probabilities. What are the values of P_r and P_n for Poisson queue system? **(08 Marks)**

b. Arrivals at the telephone booth are considered to be Poisson with an average time of 12min between one arrival and the nest. The length of a phone call is assumed to be distributed exponentially with mean and 4min.:

i) Find the average number of persons waiting in the system
ii) What is the probability that a person arriving at the booth will have to wait in the queue?
iii) What is the probability that it will take him more than 10min altogether to wait for the phone and complete his call?
iv) Estimate the fraction of the day when the phone will be in use. **(08 Marks)**

OR

10 a. Explain symbolic representation a/b/c : d/e of the queuing model. Show that the average number of customers in the system M/M/1 : ∞ " FIFO is $\frac{\lambda}{\mu - \lambda}$. **(08 Marks)**

b. State the Little law. Give the proof for Little formulae. **(08 Marks)**

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