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Total Number of Pages: 2

MCA
MCC504

5th Semester Regular/Back Examination – 2015-16
QUANTITATIVE TECHNIQUES-II (MODELLING AND SIMULATION)
BRANCH(S): MCA
Time: 3 Hours
Max Marks: 70
Q.Code:T549

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

- Q1 Answer the following questions: (2 x 10)
- a) What is the difference between stationary and non-stationary Markov chain?
 - b) Under which conditions Markov chain reaches the steady-state condition?
 - c) Define transition probability.
 - d) What is a random number? What are the properties of a random number?
 - e) Define degrees of freedom.
 - f) Define continuous system.
 - g) When simulation is an appropriate tool and when it is not?
 - h) State acceptance and rejection technique.
 - i) What is Stratified sampling?
 - j) What is a system and what are the components of a system?

Q2 Define Markov chain. What are the fundamental properties of a finite state, first order Markov chains? Explain how decision tree helps to understand the problem of Markov chains? (10)

Q3 A manufacturing company has a certain piece of equipment that is inspected at the end of each day and classified as just overhauled, good, fair or inoperative. If the item is inoperative it is overhauled, a procedure that takes one day. The classifications are denoted as states 1, 2 3 and 4 respectively. Assume that the working condition of the equipment follows a Markov chain with the following transition matrix: (10)

$$P = \begin{matrix} & \begin{matrix} \text{Tomorrow} \\ 1 & 2 & 3 & 4 \end{matrix} \\ \begin{matrix} \text{Today} \\ 1 \\ 2 \\ 3 \\ 4 \end{matrix} & \begin{bmatrix} 0 & 3/4 & 1/4 & 0 \\ 0 & 1/2 & 1/2 & 0 \\ 0 & 0 & 1/2 & 1/2 \\ 1 & 0 & 0 & 0 \end{bmatrix} \end{matrix}$$

If it costs Rs. 125 to overhaul a machine on the average and Rs. 75 as production cost if a machine is found inoperative. Using the steady-state probabilities, compute the expected per day cost of maintenance.

- Q4 a) Explain the linear congruential method for generating random numbers and generate 10 random numbers using above method with $X_0 = 30, a = 15, c = 40$ and $m = 100$. (5)
- b) Using Kolmogorov-Smirnov test, find out whether the random numbers generated are uniformly distributed over the interval $[0, 1]$ can be rejected. Assume that $\alpha = 5\%$ and $D_\alpha = 0.565$. The random numbers are 0.54, 0.73, 0.98, 0.11, 0.68. (5)

- Q5 a) Use inverse transform techniques of producing random variates for exponential distribution. (5)
- b) Generate three Poisson variates with mean $\lambda = 0.2$. (5)

- Q6 a) With a suitable flow chart describe two server queue system. (5)
- b) Explain Discrete event simulation and steps in a simulation study. (5)

- Q7 Records pertaining to the monthly number of job related injuries in an underground coalmine were being studied by federal agency. The values of past 100 months are as follows: (10)

<i>Injury/month:</i>	0	1	2	3	4	5	6
<i>Frequency of occurrence:</i>	35	40	13	6	4	1	1

Apply the Chi-Square test to these data to test the hypothesis that the distribution is Poisson.

- Q8 a) Estimate $\theta = E[X] = \int_0^1 e^x dx$ by using control variate. (5)
- b) Explain Two-sample problem with example. (5)