Fifth Semester MCA Degree Examination, Dec.2014/Jan.2015
System Simulation and Modeling

Time: 3 hrs.   Max. Marks:100

Note: *Answer any FIVE full questions.*

1 a. When simulation is the appropriate tool and not appropriate tool, what are the advantages and disadvantages of simulation? **(10 Marks)**

   b. Students arrive at the university library counter with inter arrival times distributed as :

Time between arrival (minutes)	5	6	7
Probability	0.2	0.7	0.1

   The time for a service (transaction) at the counter is distributed as :

Service time minutes	2	3	4	5
Probability	0.15	0.6	0.15	0.1

   Simulate the operation for 10 new students. The "students" using the following random number for inter arrival time and service time IAT's (95, 76, 35, 21, 46, 87, 18, 65, 58) and ST's (85, 55, 78, 65, 45, 36, 28, 19, 65, 9). Find the average of IAT, waiting time (WT), spend in system time (SST) and probability of idle time. **(10 Marks)**

2 a. Explain the steps used in simulation study with a neat flow chart. **(10 Marks)**

   b. Using event scheduling/ time advance algorithm, given the following data, simulate the process till the clock read 30 minutes and find server busy time (B), maximum queue length (M_Q), given end time of system 60 minutes.

Inter arrival time (minutes)	1	1	6	3	7	5	2	4	1
Service time (minutes)	4	2	5	4	1	5	4	1	4

   (10 Marks)

3 a. The life time, in years of a satellite placed in orbit is given by the following pdf :

   $$f(x) = \begin{cases} 0.4e^{-0.4x}, & x \geq 0 \\ 0, & \text{otherwise} \end{cases}$$

   What is the probability that i) This satellite is still "alive" after 5 year? ii) The satellite dies between 3 and 6 years? **(06 Marks)**

   b. A production process manufactures compute chips on the average at 2% non conforming. Every day, a random sample of size 50 is taken from the process. Find the probability that i) No non – conforming chips ii) more than two non – conforming chips from the process. **(07 Marks)**

   c. The time in hours required to lead an ocean going vessel, x is distributed as N(12, 4). Find the probability that : i) the vessel loaded in less than 10 hours ii) more than 12 hours iii) between 10 and 12 hours will be required to load a ship. Given $\phi(0) = 0.500$, $\phi(1) = 0.8413$, $\phi(2) = 0.9772$. **(07 Marks)**

4   a.   Explain in detail the characteristics of queuing system. What does the format A | B | C | N | K represent?   **(10 Marks)**

     b.   Generate five random numbers (3 decimal) and hence test for uniformity by K – S test, 5% level of given that $x_0 = 2$, $a = 13$, $m = 2^6$ and the critical value $D_\alpha = 0.565$.   **(10 Marks)**

5   a.   Test whether the following sequence of numbers are auto correlated test at 5% level of significance where 3rd, 8th, 13th and so on. Given $z_{0.025} = 1.96$, 0.28, 0.89, 0.23, 0.12, 0.01, 0.64, 0.83, 0.28, 0.31, 0.93, 0.35, 0.99, 0.33, 0.15, 0.41, 0.91, 0.88, 0.27, 0.60, 0.75, 0.95, 0.68, 0.05, 0.49, 0.43, 0.87, 0.58, 0.36, 0.69, 0.19.   **(10 Marks)**

     b.   Give a step by step procedure to generate the random variates, using the inverse transforms technique for exponential distribution.   **(05 Marks)**

     c.   Using the acceptance – rejection technique, generate three Poisson variates with mean $\alpha = 0.02$ (given random numbers 0.4357, 0.4146, 0.8353, 0.9952, 0.8004).   **(05 Marks)**

6   a.   Write in detail of i) four steps in the development of a useful model of input data ii) parameter estimation.   **(10 Marks)**

     b.   The customers arriving at a busy bank counter in a 5 minute period between 10 am to 2 pm was recorded for a day given below :

Arrival/ period	0	1	2	3	4	5	6	7	8	9	10
Frequency	15	12	10	10	8	7	5	4	3	2	4

Use ψ^2 test goodness fit, to check whether the data follows Poisson distribution at 5% level of significance, given that, the critical value $\psi^2_{(0.05,6)} = 11.1$.   **(10 Marks)**

7   a.   Explain the types of simulation model with respect to output analysis.   **(08 Marks)**

     b.   Explain the statistical estimation of performance measures.   **(06 Marks)**

     c.   Explain initialization bias in steady state simulation.   **(06 Marks)**

8   a.   What is verification of simulation models? List the suggestions given for verification of model.   **(10 Marks)**

     b.   Explain briefly three – step approach to validation by nayler and finger.   **(10 Marks)**

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