



COLLEGE OF ENGINEERING, PUNE

(An Autonomous Institute of Government of Maharashtra.)
SHIVAJI NAGAR, PUNE - 411 005

END Semester Examination

Modeling and Simulation Techniques (ET-OE-14006)

Course: B.Tech

Branch: Electronics and TeleCommunication
Engineering

Semester: Sem VII

Year: 2014-2015

28 NOV 2014

Max.Marks:60

Duration: 3
Hours

Time:- 2 to 5 p.m.

Instructions:

MIS No.

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1. Figures to the right indicate the full marks.
2. Mobile phones and programmable calculators are strictly prohibited.
3. Writing anything on question paper is not allowed.
4. Exchange/Sharing of anything like stationery, calculator is not allowed.
5. Assume suitable data if necessary. Neat diagrams must be drawn whenever necessary.
6. Write your MIS Number on Question Paper

Q.1	(a) Discuss the simulation related features of ARENA software package in the context of (i) random number generation, (ii) input analysis, and (iii) animation support.	6																		
	(b) Every simulation must have a stopping time, which defines how long the simulation will run. Discuss principles used to stop a simulation.	3																		
	(c) What are the different tests for ensuring randomness in pseudorandom numbers?	3																		
Q.2	A dentist schedules per patient for 30 minutes appointments though some of the patients may take more time and others may take less time as compared to 30 minutes depending on the type of the work to be done. The following table shows the categories of the work the time actually needed to complete the work and their probabilities. <table border="1"><thead><tr><th>Work category</th><th>Filling</th><th>Crown</th><th>Cleaning</th><th>Extraction</th><th>Check-up</th></tr></thead><tbody><tr><td>Time (minutes)</td><td>45</td><td>60</td><td>15</td><td>45</td><td>15</td></tr><tr><td>Probability</td><td>0.35</td><td>0.10</td><td>0.20</td><td>0.10</td><td>0.25</td></tr></tbody></table> <p>The dentist offers service to all the patients who arrive within the stipulated time. Assume that all the patients reach the clinic at exactly their schedule arrival time starting at 8:00 AM. Use the following random numbers for handling the simulation. [36, 80, 13, 23, 60, 96, 17, 72].</p> <p>(i) Simulate the dentist's clinic for the customers who arrive between 8:00 AM and 11:30 AM</p>	Work category	Filling	Crown	Cleaning	Extraction	Check-up	Time (minutes)	45	60	15	45	15	Probability	0.35	0.10	0.20	0.10	0.25	12
Work category	Filling	Crown	Cleaning	Extraction	Check-up															
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	(ii) Determine the average waiting time for the patients (iii) Determine the idle time of the dentist. (iv) Plot the time graph showing Arrival / Departure events.																															
Q.3	(a) In a fast-food restaurant, customers arrive randomly. Some of the customers go to the sandwich counter, while the rest go to the soup counter. Queues are usually formed in front of both the counters having exponentially distributed service times. After the customers eat, all of them pay at a single cash counter, which again has an exponentially distributed service time. Queues are formed there as well. A customer leaves after the payment is made". Develop a simulation model for the fast-food restaurant using the block diagram in ARENA environment.	6																														
	(b) Discuss the statistical approach for selecting input probability distributions when sample input data are available.	3																														
	Table below gives the data for number of vehicles arriving at the traffic signal was collected for a 5 minute duration for a five workdays over 20 week period.	3																														
	<table border="1"> <thead> <tr> <th>Arrivals per period</th> <th>Frequency</th> <th>Arrivals per period</th> <th>Frequency</th> <th>Arrivals per period</th> <th>Frequency</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>12</td> <td>4</td> <td>10</td> <td>8</td> <td>5</td> </tr> <tr> <td>1</td> <td>10</td> <td>5</td> <td>8</td> <td>9</td> <td>3</td> </tr> <tr> <td>2</td> <td>19</td> <td>6</td> <td>7</td> <td>10</td> <td>3</td> </tr> <tr> <td>3</td> <td>17</td> <td>7</td> <td>5</td> <td>11</td> <td>1</td> </tr> </tbody> </table> <p>Compute the mean and variance for the above sample data. Which discrete probability distribution you will recommend for the above data. Justify your answer.</p>	Arrivals per period	Frequency	Arrivals per period	Frequency	Arrivals per period	Frequency	0	12	4	10	8	5	1	10	5	8	9	3	2	19	6	7	10	3	3	17	7	5	11	1	
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Q.4	On a network gateway, measurements show that the packets arrive at a mean rate of 125 packets per second (pps) and the gateway takes about 2 milliseconds to forward them. Using an M/M/1 model, (i) Analyze the gateway probability of n packets in gateway. (ii) What is the probability of buffer overflow if the gateway had only 13 buffers? (iii) How many buffers do we need to keep packet loss below one packet per million?	8																														
Q.5	(i) Write a C / C++ program to generate 25 random numbers with seed of 3459 using Mid-square algorithm.	5																														
	(ii) Though in terms of specifics, the simulation packages differ, generally they have many common characteristics. In this context, describe OPNET, ARENA and GPSS-H simulation packages.	3																														
Q.6	(a) You are given the multiplicative congruential generator $x_0=1$ and $x_{n+1}= 7 x_n$ (modulo 13), for $n=0,1,2,\dots$ (i) Calculate x_n for $n=1,2,\dots,12$ (ii) How often does each integer between 1 and 12 appear in the sequence in part (i) above? (iii) Without performing additional calculations, indicate how x_{13}, x_{14},\dots will compare with x_1, x_2,\dots, x_{12} .	6																														
	(b) What is the purpose of model verification in simulation exercise? Compare and contrast the issues involved in validation and verification.	2																														