



INSTITUTE OF INFORMATION TECHNOLOGY
^{1st} JAHANGIRNAGAR UNIVERSITY
3RD YEAR ~~2ND~~ SEMESTER B. SC. IN INFORMATION TECHNOLOGY

Final Examination 2018
Course Code: IT 3109
Course Title: Simulation and Modeling

Session 2015-2016
Time Allowed: 3 Hours
Full Marks: 60

Do not write anything in the question script.
There are **seven** questions. Answer any **five** of them.
Figures in the right margin indicate marks.

1. (a) What is simulation? Explain why do we need to use simulation? [4]
(b) Briefly state the procedure of simulation [4]
(c) Give some examples where simulation is used to conduct research or operations [4]
2. (a) When is a system called Single Queue Single Server System? Explain it with an example. [4]
(b) Suppose virtual customers are arrived with the following inter-arrival time and service time: [4]
 $A_1 = 0.4, S_1 = 2.0; \quad A_2 = 1.2, S_2 = 0.7; \quad A_3 = 0.5, S_3 = 0.2;$
 $A_4 = 1.7, S_4 = 1.1; \quad A_5 = 0.2, A_6 = 1.4, A_7 = 1.9$
If $Q(t)$ is the queue length at the time t and $B(t)$ is the busy function against t . Construction area under $Q(t)$ and $B(t)$.
(c) Calculate expected utilization of the server $u(n)$ and comment on the result. [4]
3. (a) Define Negative Binomial Distribution and geometric distribution. Write the application of these distribution in simulation. [4]
(b) Chi-square Goodness of fit test is widely use after a simulation performed, what are the processes of conduction this test and why do researchers use this test? [4]
(c) What are the application of Q-Q and P-P plot? Construct a Q-Q plots for the inter arrival time of customers 10, 12, 18, 22 in seconds. [4]
4. (a) What is Monte Carlo Simulation? Explain briefly three basic types of parameters to describe the distribution. [4]
(b) Explain method of moments and Maximum Likelihood Estimator. [4]
(c) Consider an M/M/1 queuing system with an inter arrival rate 0.03 and service rate 0.6. Compute the system load and show that the system is stable or not? [4]

5. (a) Consider the grocery store with one checkout counter. Prepare the simulation table for four customers and find out average delay in queue, the time-average number of customers in queue, and the proportion of time the server is busy. The inter arrival time (IAT) and the service time (ST) are given in minutes.
IAT: 0.4, 1.2, 0.5, 1.7, 0.2, 1.6, 0.2, 1.4, 1.9
ST: 2.0, 0.7, 0.2, 1.1, 3.7, 0.6
Assume first customer arrives at $t = 0$. [10]
- (b) For a single server queuing system, suppose that we did not want to estimate the expected average delay in queue; the model structure and parameters remain the same. Does this change the state variables? If so, how? [2]
6. (a) Describe the evaluation of the following queuing system by a Markov chain. [5]
i) M/M/∞ Queue ii) M/M/m Queue iii) M/M/m/m Queue
- (b) Consider a random variable X which takes on values 1 and 2 with probability 0.25 and 0.75, respectively (i.e., $Pr[x = 1] = 0.25$ and $Pr[x = 2] = 0.75$). Determine the mean and variance of X . Plot the probability density function (pdf) and probability distribution function (PDF) of X . [5]
- (c) What properties should random numbers have? [2]
7. (a) What is a confidence interval? How can the width of a confidence interval be reduced? [2]
- (b) Explain the following heuristic procedures for comparing fitted distributions with the true underlying distribution. [4]
i) Density-Histogram Plots
ii) Comparison Frequency
- (c) A professor wants to find out students' monthly income during summer vacation. Past year figures shows that the mean and variance are Tk.8000 and Tk.400 respectively. The professor thus hypothesizes the mean as Tk.8000, and Tk.400 respectively. [6]
After the vacation, the professor wants to verify if his hypothesis is correct, and adopts a significance level (α) of 0.05 in testing. He selects 100 students from population, and record down their salary. The sample mean among these 100 students is Tk. 7,800. (Consider, z (the number of S.D. deviated from the mean) = 1.96 for the value of 0.975). How do you test the hypothesis of the professor?