

INDIAN STATISTICAL INSTITUTE

MS QMS

TEST ON OPERATIONS RESEARCH II

Date: 04 May 2022

Time: 3 hours

Maximum Marks: 50

Answer as many questions as you can. The maximum you can score is only 50 marks

1.

- a. State some of the important distributions of arrival intervals and service times. Explain the M/G/1/FCFS queue system.
- b. In a railway station, only one train is handled at a time. The railway yard is sufficient for trains to wait while others are given the signal to leave the station. Trains arrive at a station at an average of 6 per hour and the railway station can handle them at an average rate of 12 per hour. Assuming Poisson arrival and exponential service distribution, find the probabilities for the number of trains in the system. Also, find the average waiting time in the stations of the new train coming into the yard.

[8 + 7]

2.

- a. Describe the basic characteristics of an inventory system.
- b. What are the costs that are involved in carrying inventory? Explain them briefly

[10 + 5]

3.

- a. Explain the Monto Carlo Simulation methodology? Give two applications of simulation explaining why simulation is appropriate under such scenarios?
- b. The inter arrival times of customers in a single technician beauty salon are normally distributed with a mean of 15 minutes and a standard deviation of 4 minutes. The technician serves the customers on a first come first serve basis and the time to serve a customer is uniformly distributed between 8 minutes to 15 minutes. The shop will remain open every day for 8 hours (480 minutes). Simulate the process for a day and compute the average waiting time of customers & the average idle time for the technician. The shop owner wants that the waiting time of 95 % of the customers need not exceed 5 minutes in a day. The shop owner also wants that the technician gets on an average 3 minutes of rest every hour. Is the process capable of meeting the aforementioned requirements? Justify.

[4 + 8]

4.

- a. Explain the weighted and preemptive methodologies for solving goal programming problems
- b. A multinational insurance company has outsourced the claim processing process to a BPO company in Bangalore. The BPO company processes only two types of claims namely accident claims and injury claims. The profit per processing an accident claim is \$10 and that of an injury claim is \$15. The cost of processing an accident claim is \$8 and that of an injury claim is \$12. The BPO company wants to achieve a profit of at least \$ 1500 per day with the cost of processing not exceeding \$1000 per day. Formulate the optimization problem as a goal programming problem to identify the optimum number of accident and injury claims that need to be processed per day to meet the goals of profit and cost. Achieving the profit goal is the priority for the BPO company. Provide the formulation for both the preemptive method and the weighted method. For the weighted method assume 1.3 and 1.0 as weights for profit and cost goals

[4 +8]