Daffodil International University

Department of Computer Science and Engineering
Faculty of Science & Information Technology

Final Examination | **Semester: Fall - 2019**
Course Code: CSE 414 | **Course Title: Simulation and Modeling**
Section: All | **Course Teacher: All**

Time: 2.0 hours | **Full Marks: 40**

Answer all of the following questions. Figures in the right-hand margin indicate full marks.

1. Consider about an Inventory Management System of a Car shop. Cars are delivered to stores when any order is placed. A manager checks the inventory position of the entities by weekly schedules, e.g., **Wednesday** and **Saturday**. The manager only makes an order in **Wednesday** if the cars quantity is not more than **7**, otherwise he orders cars in **Saturday** regularly. The car shop remains closed in **Monday**. So all transactions are closed on **Monday**. It is to be noted that the manager is allowed to order only once in a week. If the recorded quantity level (**n**) is below Maximum order level (**M**), then the manager will create an order to raise the inventory level to **M (= 14)**, else nothing will be done until the next review period arrives. Here the number of days between order and delivery is called lead time. Distribution of daily demand and lead time is shown in **Table 1.a** and in **Table 1.b**. The simulation will be started from **Sunday** with the beginning quantity level of **7 units** and an order of **7 units** scheduled to arrive with **lead time 1.**

Table 1.a Distribution of daily demand

Daily demand	Probability	Cumulative probability	Random digit
2	0.17	0.17	1-17
3	0.19	0.36	18-36
4	0.35	0.71	37-71
5	0.29	1.0	72-100

Random digits: , 81, 63, 40, 17, 37, 71, 16, 37, 54, 38, 47, 92, 70, 28

Table 1.b Distribution of lead time(day)

Lead time (days)	Probability	Cumulative probability	Random digit
2	0.26	0.26	1-26
3	0.24	0.50	27-50
4	0.38	0.88	51-88
5	0.12	1.0	89-100

Random digits: 20, 40, 68, 12, 16

Now answer the following questions:

a) Construct a **two** weeks simulation table for inventory system 08
b) Find out the average ending inventory and total number of shortage day 02

2. Consider a case of a transport attempting to deliver troops on a bright sunny day to Chittagong. There are total **nine** Lorries in Dhaka terminal to deliver the troops. The terminal has **three** loaders to load troops and **four** weigher to weigh. Once the Lorry is loaded with troops, it waits for the green signal to go for weighing. Both the loaders and weigher have a first-come first-served waiting line (or queue) for transports. After weighing, the Lorries travel to drop the troops at Chittagong and join again in terminal queue for next loading. It has been assumed that, **two** Lorries are in terminal to weigh and others **seven** Lorries are in terminals at loader to load **at time 0.**

The activity times are shown in **Table 2.**

Table 2: Activity Times (minutes)

Troops Loading Time	2 5 7 12 10 9 7 6 8 5 9 8 7
Troops Weighing Time	6 9 8 10 5 14 9 10 7 9 7 11
Lorries Travel Time	12 14 11 16 20 25 20

Now,

a) Simulate the system for at least **14 minutes.** 12

b) Find out the average utilization of both, the loader and the weigher. 03

3. For over 50 years Perten has been a leading supplier of advanced analytical instruments to the food and agricultural industries. It has a machine with **three** bearings that provide actual service. The cumulative distribution function of the life of each bearing is identical as shown in the **Table 1.1**. When a bearing fails, the mills stops, a repairperson is called, and a new bearing is installed. The delay time of the repairperson's arriving at the factory is also a random variable, with the distribution given in **Table 1.2**.

- Downtime for the factory is estimated at **৳45** per minute.
- The direct on site cost of the repairperson is **৳180** per hour.
- It takes **12** minutes to change one, **23** minutes to change two, and **34** minutes to change three bearings.
- It costs **৳162** to purchase one bearing. And there is an **offer**, that the Management can purchase a set of bearings (**three** bearing) at a cost of **৳350**.

A proposal has been made to replace all **three** bearings whenever a bearing fails. Management needs an evaluation of this proposal.

Table 1.1 Bearing life distribution

Life time (hrs)	Probability	Cumulative probability	Random digit
1000	0.26	0.26	1-26
1100	0.35	0.61	27-61
1200	0.14	0.75	62-75
1300	0.25	1.00	76-00
Random digit for bearing-1: 35, 43, 61, 72, 21, 57, 34, 90, 0, 23, 12			
Random digit for bearing-2: 50, 42, 35, 68, 79, 95, 13, 23, 12, 43, 72			
Random digit for bearing-3: 47, 46, 25, 44, 12, 9, 92, 12, 39, 42, 50			
Random digit proposal: 42, 35, 68, 79, 45, 58, 65, 40, 45, 61, 72			

Table 1.2 Delay time distribution

Delay time (min)	Probability	Cumulative probability	Random digit
6	0.5	0.5	1-5
9	0.4	0.9	6-9
12	0.1	1.0	10
Random digit for bearing-1: 2, 5, 8, 4, 3, 6, 9, 4, 6, 4, 7, 2			
Random digit for bearing-2: 8, 1, 2, 3, 4, 3, 3, 9, 2, 5, 4, 2			
Random digit for bearing-3: 2, 5, 7, 3, 1, 4, 9, 2, 5, 3, 2, 7			
Random digit proposal: 1, 4, 6, 8, 7, 3, 9, 10, 2, 6, 9, 3, 8			

Now, conduct a simulation of **9000** hours for:

a) Single bearing replacement once a bearing fails with current method. 05

b) Three bearings replacement once a bearing fails with proposed method. 04

c) Analyzing the costs of both, predict which method could be best in most times. 06