Final Exam, Summer 2021

CSE 413: Simulation and Modeling   **Section:**Eve-A

Total Marks: 40   **Total Time: 3.5 Hours**

1. The ACI company is the only authorized company that distributes Hexisol hand rub. Assume ACI **[14]** Hexisol factory's milling machine consists of **2 turbines**. The production of Hexisol stopped whenever anyone of the two turbines damaged. When it happens, one employee from ACI company goes to the workshop to return the damaged turbine and get a new one. There is an offer going on in the workshop, that is, **IF the factory returns the damage turbine to the workshop, factory can get BDT 1000 discount** on purchase of new turbine. Then he comes back to the factory along with a mechanic to install the new turbine, then the mechanic start installing the new turbine in the milling machine. And then the factory starts its production again.

Now assume the following thing:

➢ **Downtime for the factory is estimated at BDT 500 per minute.**

➢ **The service charge of the mechanic is BDT 5000 per turbine.**

➢ **The mechanic takes 2 hours to install one, and 3 hours to install two turbines.**

➢ **One turbine cost BDT 1,00,000**

A proposal has been made to replace both of the turbines whenever a turbine is damaged.

Here delay is two types:

Delay-1: from factory to the workshop

Delay-2: from workshop to the factory

Turbines life distribution and two types of delay time distributions of the employee is given below:

Turbine life Distribution				Delay-1 Distribution (from factory to the workshop)			Delay-2 Distribution (from workshop to the factory)		
Life time	Probab ility	Cumulative probability	Random digit	Delay time	Probabilit y	Random digit	Delay time	Probabilit y	Random digit
1200	0.25	0.25	01-25	10	0.6	1-6	8	0.6	1-5
1400	0.25	0.50	26-50	15	0.3	7-9	12	0.3	6-8
1600	0.25	0.75	51-75	20	0.1	0	15	0.1	9-0
1800	0.20	0.95	76-95						
2000	0.05	1.00	96-00						

RD for Turbine-1: 35, 42, 50, 68, 97, 79, 23, 13, 95
RD for Turbine-2: 63, 43, 00, 72, 21, 57, 34, 90, 13
RD for proposal: 44, 46, 47, 25, 11, 9, 39

Delay-1:
RD for Turbine-1: 2, 5, 8, 4, 3, 6, 9, 4
RD for Turbine-2: 1, 0, 7, 2, 8, 4, 9, 3
RD proposal: 1, 4, 6, 8, 7, 3, 9, 0, 2, 6

Delay-2:
RD for Turbine-1: 2, 5, 8, 4, 3, 6, 9, 4
RD for Turbine-2: 1, 0, 7, 2, 8, 4, 9, 3
RD proposal: 1, 4, 6, 8, 7, 3, 9, 0, 2, 6

Now implement a simulation **for 12,000 hours** for the **Current Method** as well as the **Proposal Method**, and mention which method better.

Use the following format for table creation in current method:

SL	RD for Life Hour	Life Hour	Accum Life Hour	RD for Delay-1	Lead Time	RD for Delay-2	Lead Time	RD for Life Hour	Life Hour	Accum Life Hour	RD for Delay-1	Lead Time	RD for Delay-2	Lead Time

2. Assume a telephone system. There are 7 telephones and 4 links to establish the calls in the system. Situation of the system at clock 10 is given below. Show the simulation until clock 130.
[10]

Next call to arrive

From	To	Length	A.Time
1	7	33	55
2	5	37	88

Next Call

From	To	Length
1	2	33

Arrival Time

55

Lines

1	0
2	0
3	0
4	0
5	0
6	1
7	1

Links

Max: 4

Used: 1

Clock: 10

Call in progress

From	To	End
7	6	61

Process	Complete	Blocked	Busy
13	6	3	4

3. A grocery store has one checkout counter. **Customers arrive** at this counter at random from **1 to 8 minutes apart with Equal Probability. The Service times vary from 1 to 5 minutes, with Equal Probability.**   **[2+2]**
Simulate the arrival of 9 customers and calculate the Table: **[9]**
Also answer the following questions

  a) Probability that a customer has to wait **b)** Probability of a server being idle **c)** Average
   service time.   **[3]**
   Use the following sequence of random numbers (RD):

								Last 3 digits of your ID		
RD for Inter-arrival time	302	441	48	803	102	500	650	258	700
RD for Service time	83	45	74	65	17	79	30	61	89	20