BE4-R3: PRINCIPLES OF MODELING AND SIMULATION

NOTE:

> 1.   Answer question 1 and any FOUR questions from 2 to 7.
> 2.   Parts of the same question should be answered together and in the same sequence.

Time: 3 Hours   **Total Marks: 100**

1.
a)   Define discrete and continuous systems? Explain it.
b)   What are the advantages and disadvantages of simulation?
c)   Define Poisson, Normal, Exponential and Weibull models.
d)   Write down all the queueing notations and their meaning. Also explain the meaning of M/M/1/∞ /∞ .
e)   Discuss the major concepts in discrete event simulation.
f)   Define point estimation and interval estimation.
g)   How are simulation softwares selected and evaluated?

(7x4)

2.
a)   What are the steps used in simulation studies?
b)   Draw the flow chart about the steps in simulation studies.
c)   Explain Lead-Time demand in an inventory system.

(9+6+3)

3.
a)   Use the linear congruential method to generate a sequence of random numbers with X_0=27, a= 17, c=43, and m=100.
b)   Based on runs up and runs down, determine whether the following sequence of 40 numbers is such that the hypothesis of independence can be rejected where α =0.05.
0.41, 0.68, 0.89, 0.94, 0.74, 0.91, 0.55, 0.62, 0.36, 0.27, 0.19, 0.72, 0.75, 0.08, 0.54, 0.02, 0.01, 0.36, 0.16, 0.28, 0.18, 0.01, 0.95, 0.69, 0.18, 0.47, 0.23, 0.32, 0.82, 0.53, 0.31, 0.42, 0.73, 0.04, 0.83, 0.45, 0.13, 0.57, 0.63, 0.29.
c)   The effect of a new treatment for a disease is summarized in the following table:

	Old Treatment	New Treatment	Total
Cured	8	18	26
Not cured	14	9	23
Total	26	27	49

Use a χ^2 test to judge the effect of a new treatment
i)   without Yate's correction
ii)   with Yate's correction.

(5+6+7)

4.

a)   Create simulation of M/M/1 queue using GPSS.

b)   What do you mean by server utilization? Explain it.

c)   The inter arrival times as well as the service times at a single chair unisex barbershop have been shown to be exponentially distributed. The value of λ and μ are 2 per hour and 3 per hour, respectively. And the service time averages 20 minutes, also distributed exponentially. Calculate the server utilization and the probabilities for 0, 1, 2, 3 and 4 or more customers in the shop. Also calculate time-average number of customers in the system and time average number in the queue.

(8+5+5)

5.

a)   Define:
   i)   High-Fidelity Simulation
   ii) Data Exchange standards

b)   Develop a procedure to obtain the value of π using Monte' Carlo method.

c)   Define single server queue simulation in C++, and design the overall structure of it.

(6+6+6)

6.

a)   How can we use inverse transformation techniques to sample from the exponential distribution? Explain step by step procedure used in this technique.

b)   Differentiate between calibration and validation of the model.

c)   What do you mean by discrete distribution? Explain it, and generate a random variable X having distribution $p(x) = 2x/k(k+1)$, $x=1,2,\dots k$.

(5+6+7)

7.

a)   Two workers are responsible for 10 milling machines. The machines run on the average for 20 minutes, and then require an average 5-minute service period, both times exponentially distributed. Determine the various measures of performance for this system.

b)   What do you mean by time-series input model? Explain both AR(1) and EAR(1) Model.

(8+10)