

MCA (Sem IV) System Modeling and Simulation
(CBGS)

18/5/2014

QP Code : 26715

(3 hours)

(Total marks 80)

- N.B. (1) Question No. 1 is compulsory and carries 20 marks.
(2) Attempt any four questions out of remaining six questions.
(3) Figures to the right indicate full marks.
(4) Use of calculator is allowed

1. a) Discuss simulation application in any one of the following system [10]
i) Book Counter analysis in a library
ii) Cash Counter analysis in Supermarket
iii) Customer flow analysis in a hotel

b) The sequence of numbers 0.54, 0.75, 0.98, 0.12, 0.68, 0.88, 0.41, 0.36, 0.27 and 0.91 has been generated. Use Kolmogrov-Smirnov test with $\alpha = 0.05$ to learn whether the hypothesis that the numbers are uniformly distributed on the interval $[0, 1]$ can be rejected. (Critical value $D_{\alpha} = 0.410$) [10]

2. a) Consider a single server system. Arrival is uniformly distributed between 1 and 8 minutes. Service distribution is as follows. [4+1+1+1+1=8]

Service Time (min)	1	2	3	4	5	6
Probability	0.17	0.15	0.32	0.20	0.06	0.10

Random digit for inter-arrival time and service are given below.

Customer No.	1	2	3	4	5	6	7	8	9	10
Random digit for interarrival time	--	751	303	406	94	606	747	339	877	454
Random digit for service time	74	52	16	82	94	61	87	35	29	99

- i. Develop the simulation table and analyze the system by simulating the arrival and service of 10 customers.
ii. What is the probability that the customer has to wait in queue?
iii. What is the average service time?
iv. What is the average waiting time?
v. What is the expected service time?
- b) What do you mean by simulation? Explain different types of simulation models. [7]
3. a) Assume that the weight of all students is normally distributed. A sample data of 20 student's weight in kg. is collected.

53.14	45.56	48.18	60.71	53.21	39.86	70.18	51.21	49.54	41.15
56.71	53.35	47.20	46.75	62.34	54.25	52.76	47.87	44.90	49.18

Determine the maximum-likelihood estimator μ and σ^2 [8]

- b) Write short notes on [7]
i. Properties of Random numbers
ii. Steps of simulation study

[TURN OVER]

4. a) Use combined linear congruential method to combine three multiplicative generators with $m_1 = 32363$, $a_1 = 157$, $m_2 = 31727$, $a_2 = 146$, $m_3 = 31657$, and $a_3 = 142$. Generate one random number with the combined generator using initial seeds $X_{i,0} = 100, 300, 500$ for the individual generators $i=1,2,3$. [8]
- b) Discuss types of simulation with respect of output analysis with examples [7]
5. a) Derive the inverse transformation method for Exponential distribution. Life of a computer IC is exponentially distributed with mean 4. Generate two life times from this distribution where $R_1 = 0.762$ and $R_2 = 0.389$. [8]
- b) Describe time series input models? [7]
6. a) A NGO collected the records of monthly number of job related accidental injuries at an underground coal mine for study. The records for the past 100 months are as follows:

Accidental injuries per month	0	1	2	3	4	5	6	7
Frequency	30	20	15	5	6	10	4	10

Use the chi square test to test hypothesis that the underlying distribution is poisson and $\chi_{0.05,4}^2 = 9.49$ [8]

- b) Mention the important points to be noted while collecting data. [7]
7. a) Consider the following sequence of 30 numbers [8]

0.22	0.11	0.33	0.38	0.99	0.41	0.74	0.38	0.93	0.03
0.09	0.25	0.43	0.45	0.01	0.51	0.70	0.37	0.85	0.98
0.78	0.59	0.15	0.53	0.05	0.68	0.29	0.46	0.79	0.97

Test whether the 2nd, 9th, 16th,numbers in the sequence are autocorrelated where $\alpha = 0.05$. (Given $Z_{0.025} = 1.96$)

- b) Explain Verification and Validation of Simulation Models. [7]