



**RAJARATA UNIVERSITY OF SRI LANKA  
FACULTY OF APPLIED SCIENCES**

**B. Sc (General) Degree**

**Third Year – Semester I Examination – February/March 2013**

**COM 3302 – COMPUTER SIMULATION**

**Answer THREE questions only.**

**Time allowed: Two hours.**

**Calculators are provided.**

**1.**

(a) Briefly explain the followings.

- (i) Simulation
- (ii) Computer simulation
- (iii) Endogens activities
- (iv) Exogenous activities

[20 marks]

(b) Explain following different types of systems using suitable examples.

- (i) Stochastic systems
- (ii) Deterministic systems
- (iii) Continuous systems
- (iv) Discrete systems

[20 marks]

(c) Explain why some simulation models need to run for several replications to predict the system behavior.

[15 marks]

(d) Provide one example of simulation model that need only a single run to predict the system behavior.

[15 marks]

(e) A banking system has modeled using simulation software. Bank manager is interested in average waiting time of customers for services provided by the bank. For 50 replications, 30s half-width of 95% confidence level observed for average waiting time. The bank expected to predict the value with 15s half-width for the same confidence level. How many replications are needed for this requirement?

[30 marks]

2.

a) Mention two reasons to introduce randomness in to a simulation model.

[10 marks]

b) What are the techniques used to generate true random numbers?

[10 marks]

c) Why do most of simulation systems use pseudo random numbers instead of true random numbers?

[10 marks]

d) A student wants to generate random numbers between 0 and 10. He decides to use the following equation used to generate next random number  $X_{i+1}$  using previous random number  $X_i$ :

$$X_{i+1} = (6 * X_i + 7) \bmod 11.$$

He selected 5 as the first random number. Generate first five random numbers according to the above method.

[20 marks]

e) Can you consider random numbers generated by the above method (part d)) as uniform integer random numbers between 0 and 10? Explain your answer.

[10 marks]

f) if answer for part e) is no, make modification to the above equation to produce uniform random number between 0 and 10. Clearly mention your modification and produce ten random numbers using modified equation.

[20 marks]

g) Random number generated from the above equation is totally depends on the only one previous random number. Provide a suitable equation such that random number depends on previous three random numbers to overcome this drawback.

[20 marks]

3.

a) Assume that you have been given generated N random numbers between 0 and 1. These numbers are categorized into equal 100 partitions lies between 0 and 1 (range of each partition is .01). Number of random numbers belongs to each category are  $n_1, n_2, n_3, \dots, n_{98}, n_{99}$  and  $n_{100}$ . Explain how you would you apply suitable test to check given random numbers are uniformly distributed. Clearly mention all steps using above mentioned values.

[30 marks]

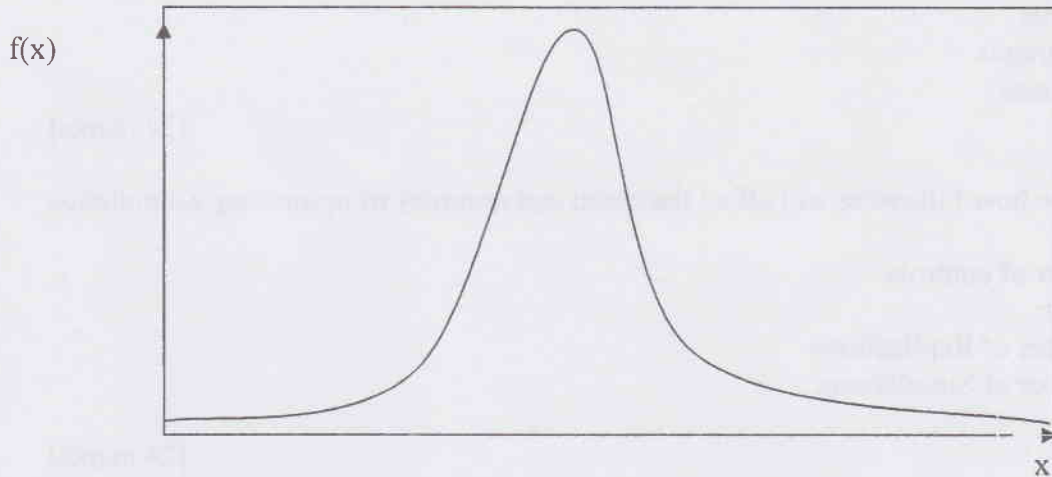
b) Mention two generic methods that can be used to generate random values in given probability distribution function (pdf).

[12 marks]

c) Select the suitable method from the above mentioned methods for each of following situations providing reason(s):

(i) Expensive true random numbers are used as uniform random number source.

- (ii) Getting the inversion of cumulative distribution function (cdf) is difficult.
- (iii) Pdf lies from negative infinity to positive infinity.
- (iv) Shape of pdf is given in **Figure 1** and uniform random number generation method is slow.



**Figure 1**

[28 marks]

- d) Clearly mention the steps of Inverse Transform method using an example.

[30 marks]

4.

- (a) In a simulation project, it is needed to get values for the number of people live in a house. Information gathered after a survey following information were gathered **Table 1**.

Number of peoples in the house	Number of houses
1	6735
2	12345
3	16765
4	4678
5	3456
6	1990
7	756

**Table 1**

- .23, .11, .56, .98, .33 are five uniform random numbers that lies between 0 and 1. Assuming above data given in **Table 1** do not fit with any known probability distributions, generate five values for number of peoples in a house according to above data.

[52 marks]

(b) Explain optimization techniques available in computer simulation software by providing a suitable example for a system with uncertainty with following features:

- (i) Assumptions
- (ii) Controls
- (iii) Constraints
- (iv) Response

[24 marks]

(c) Describe how following will affect the speed and accuracy of optimizing a simulation model:

- (i) Number of controls
- (ii) Bounds
- (iii) Number of Replications
- (iv) Number of Simulations

[24 marks]