

First Semester M.Tech. Degree Examination, June 2012
System Simulation and Modeling

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions.

- 1 a. Define simulation. List five simulations where simulation is appropriate to be used and another five simulations where it is not. (12 Marks)
- b. Taking the bank as system under study, name two each of the following:
 (i) Entities (ii) Their attributes (iii) Activities (iv) Events. (08 Marks)
- 2 a. With the aid of flow chart, explain the stages of a typical simulation study. (10 Marks)
- b. With suitable examples, contrast the following pairs of terms:
 (i) Exogenous and endogenous events
 (ii) Static and dynamic systems
 (ii) Time advance scheduling and next event scheduling. (10 Marks)
- 3 a. Clearly distinguish between:
 (i) A discrete random variable VS continuous random variable. (06 Marks)
 (ii) Probability distribution function VS cumulative probability function. (06 Marks)
- b. A bus arrives every 20 minutes to a bus stop, beginning from 6.40 Am and ending at 8.40 Am. A certain passenger, unaware of the schedule, arrives randomly (uniformly distributed) between 7.00 AM and 7.30 AM, every morning. What is the probability that he waits for more than 5 minutes for the bus? (06 Marks)
- c. Hurricanes hitting the east coast of India follow a poisson distribution with a mean of 0.5 per year. Determine:
 (i) The probability of more than 3 hurricanes hitting the coast in a year and
 (ii) The probability of zero hurricane during a year. (08 Marks)
- 4 a. Explain the queuing notational system for parallel server systems, suggested by Kendall. (06 Marks)
- b. State and explain the conservation equation for queuing systems. Use this to evaluate the long term server utilization in a G/G/1/∞/∞ queue. (06 Marks)
- c. Trucks arrive at a facility to be unloaded in a pattern, which can be characterized by poisson distribution. The average rate of arrivals is 36 per hour and the level of service is exponentially distributed with a mean service rate of 39 trucks per hour. Compute: (i) The no of trucks (average) in the system, (ii) The probability of a driver engaged, (iii) The average waiting time in the queue, (iv) Average no of persons in the queue and (v) Average waiting time in the system. Assuming the pay/hour for driver as Rs 9/, find the cost incurred because of their idleness during each visit. (08 Marks)
- 5 a. What are the desirable properties of a random number sequence? Why? (05 Marks)
- b. A random number generator has generated 100 random numbers, which may be classified in to 10 intervals of equal length. The average number of occurrences in each interval is given below:
- | | | | | | | | | | | | | |
|----------|---|---|---|---|----|---|----|---|----|----|----|----|
| Interval | } | → | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| no | } | → | 8 | 8 | 10 | 9 | 12 | 8 | 10 | 14 | 10 | 11 |
- Use χ^2 test to find out whether this sequence is acceptable, given X^2_0 for this sequence as 16.9. (10 Marks)

Important Note : 1. On completing your answer, you may draw a horizontal line across the page. 2. Any revealing of identification, appeal to evaluator and/or equations written eg. 42+8=50, will be treated as malpractice.

- c. Develop a random variate generator for X with the pdf, $f(x) = \begin{cases} \frac{3x^2}{2}, & \text{for } 0 \leq x \leq 1. \\ 0, & \text{otherwise} \end{cases}$. (05 Marks)
- 6 a. Briefly explain any five precautions to be kept in mind while collecting sample data for simulation studies. (10 Marks)
- b. Under what circumstances can models be built without input data? (05 Marks)
- c. Explain how kolmogorov–smirnov test can be used in the context of input modeling. (05 Marks)
- 7 a. Distinguish between verification and validation. (05 Marks)
- b. What factors should be kept in mind during verification? (10 Marks)
- c. Explain how turing test can be used to improve the process of model building. (05 Marks)
- 8 a. How are point estimates of discrete time data and continuous time data done? Why can't it be extended to quantile data? (06 Marks)
- b. How is the output analysis done for a steady–state system? On what factors does the actual length of run depends? Explain in detail. (14 Marks)
