

G 6280

M.E. DEGREE EXAMINATION, MAY/JUNE 2007.

Second Semester

Industrial Engineering

IE 1652 — SYSTEM SIMULATION AND MODELLING

(Regulation 2005)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

Use of Statistical Tables allowed.

PART A — (10 × 2 = 20 marks)

1. Define System.
 2. What are the advantages of simulation?
 3. What are the manual methods of generating random numbers?
 4. Why pseudo random numbers are called so?
 5. Give the expression used to generate uniform random variates.
 6. What is a simulation clock?
 7. In a queuing simulation if arrival and service completion are scheduled at the same clock time, which should be given priority? Why?
- List any four simulation languages.
- Explain the purpose of the following GPSS block :
- TRANSFER BOTH, ONE, TWO.
- What is use of STORAGE statement in GPSS?

PART B — (5 × 16 = 80 marks)

11. (a) Explain with suitable example when and how simulation can be used for decision making.

Or

- (b) (i) Explain various types of simulation models. (8)
(ii) How does one determine the run length of a simulation? (8)
12. (a) (i) Explain any two methods of generating random numbers with examples. (8)
(ii) Give the procedure to generate the following random variates and explain with examples. (1) Poisson (2) Binomial. (8)

Or

- (b) (i) What is the purpose of conducting Poker's test on random variates? (4)
(ii) Consider the following series of 2 digit numbers. Conduct runs test and check the independence of the series with a confidence level of 95%. (12)

79 75 45 29 41 07 86 34 82 83 80 68 78

60 29 92 06 21 35 04 62 06 45 85 35 57

63 04 77 20 62 31 82 23 42 62 81 63

52 61 97 26 98 85 70 41 83 76 29 10

13. (a) Discuss in detail the various steps in the design of simulation experiments.

Or

- (b) In an assembly shop there are three operators at a particular station. Subassembled parts are arriving from previous stations at the rate of one every 10 ± 2 seconds. The time taken by the operators at this station follows normal distribution with a mean of 20 seconds and a standard deviation of 5 seconds. Assuming serial allocation of operators, give the logical and program flow chart to simulate the system and collect all the relevant statistics.

4. (a) In a hospital, messages are sent from the emergency room to central supply. Replies are sent back to emergency room. Messages are created every 6 ± 3 minutes. They go through a pneumatic tube. Some 70% of the messages require reply. To prepare a reply it takes 2, 3 or 4 minutes with equal probabilities. Replies are also sent through the same tube. Only one message or reply can be carried through the tube at a time, which takes two minutes to transport. Give the GPSS block diagram and program to simulate 100 replies and collect all the relevant statistics. How will you find the number of replies waiting for the tube at the time when simulation is shut off?

Or

- (b) The inter arrival time of customers in a self service cafeteria follows uniform distribution with a mean of 35 seconds and a spread of 40 seconds. Forty percent of them go to the sandwich counter where one worker makes a sandwich in 60 ± 30 seconds. The rest go to the main counter, where one server serves the prepared food on to a plate in 54 ± 30 seconds. Afterwards all customers must pay a single cashier counter, who takes 25 ± 10 seconds. Then the customers, start eating which take 20 ± 10 minutes. After eating, 15% of the people go back for desert, spending an additional 10 ± 2 minutes (includes all times serving, paying and eating). Simulate until 100 non-desert customers have left the cafeteria. Give GPSS block diagram and program.

15. (a) Male and female customers are arriving at a counter manned by a single clerk. The interarrival follows uniform distribution with mean of 10 minutes and a spread of 4 minutes. Of the arriving customers 55% are male and the remaining females. There are two queues one for male and the other for female customers. When completing a service, if customers are waiting in both the queues, the clerk provides service on alternate fashion. The service time is also uniformly distributed at 12 ± 8 minutes.

- (i) Simulate the system for the service completion of 8 female customers or 10 customers in total whichever is latest. Show your working in the form of a table with all necessary details including the random number used. (10)

- (ii) Calculate all the statistics. (6)

Or

- (b) An appliance dealer has experienced the following demand for air conditioners during the past year.

Period	Demand
Jan, Feb, Mar	10 ± 3
Apr, May, Jun	50 ± 8
Jul, Aug, Sep	40 ± 10
Oct, Nov, Dec	25 ± 5

Order lead-time is 2 ± 1 month. The present inventory policy calls for the placement of an order for 36 air conditioning units whenever inventory position falls to 6 units or less. The inventory carrying charge is Rs. 90 per unit year. Stock-outs result in lost sales at a cost of Rs. 300 each. The ordering cost is Rs. 25. Give the flow chart to simulate the system and compute the total cost.