# Q 8199

M.E. DEGREE EXAMINATION, MAY/JUNE 2006.

Second Semester

Industrial Engineering

IE 1652 — SYSTEM SIMULATION AND MODELLING

(Regulation 2005)

Time : Three hours Maximum : 100 marks

Use of approved statistical table is permitted

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Name the entities, attributes, activities, events and state variable for the communication and cafeteria systems.

2. When the simulation is used as a decision making tool? Justify with example.

3. What are the consideration for generation of random numbers?

4. List out the steps involved in frequency test for testing the random number.

5. Distinguish between the verification and validation of models.

6. The pilot simulation experiment of a production system is run for 20 days and the production rate has been observed to be 3000 units a day with a standard deviation of 200 units. What should be the simulation run, so that the output rate obtained is within ±10 of the mean? at

   (a) 90% confidence level

   (b) 95% confidence level.

7. Write the desirable features of simulation software.

8. Draw the GPSS block diagram for QUEUE and DEPART.

9. Define the terms balking and Reneging.

10. What are the basic parameters to be considered for developing simulation model of aircraft missiles?

PART B — (5 × 16 = 80 marks)

11. Draw the GPSS block diagram and write program for the following :

(i) Ships arrive at a harbor at the rate of one every $1 \pm \frac{1}{2}$ hrs. There are six berths to accommodate them. They also need the services of a crane for unloading and there are fine granes. After unloading, 10% of the ships stay to refuel before leaving; the other leave immediately. Ships do not need the crane for refueling. Simulate the queues for berths and cranes assuming it takes $7\frac{1}{2} \pm 3$ hours to unload $1 \pm \frac{1}{2}$ hrs to refuel. Simulate for 100 ships to clear the harbor. (9)

(ii) Customers arrive at a single server counter with an average inter–arrival time of $20 \pm 10$ seconds. They purchase from 1 to 4 items with the following probabilities.

| | |
|---|---|
| 1 | 0.5 |
| 2 | 0.2 |
| 3 | 0.2 |
| 4 | 0.1 |

It takes 5 seconds to purchase each item. Tabulate the distribution of time for serving the first 100 customers. (7)

12. (a) Describe the concept and framework for the development of simulation models with suitable example.

Or

(b) What are the step–by–step procedures involved in simulation study. Explain in detail.

13. (a) Why do the random numbers generated by computer are called pseudo random numbers. Demonstrate the mid–square random number generation method, taking the following numbers as seeds. Generate 20 random numbers in each case.

(i) 2061

(ii) 1357

(iii) 1379.

Or

(b) A sequence of 10,000 random number, each of four digits has been generated. This sequence is to be tested for independence using Poker test. The analysis of the numbers reveals that in 5120 numbers all four digits are different, in 4230, there is one pair in each number, in 560, these are two pairs, while in 75, there are three digits of a kind and in 15 cases all four digits are same. Determine, if the random numbers pass test for independence at $\alpha = 0.05$.

(a) Explain the following with respect to simulation :

(i) Face validity (6)

(ii) Validation of assumptions (5)

(iii) Output data validation. (5)

Or

(b) Draw a flow process chart and flow diagram of your morning activities from the time you get up until you leave the house on a typical day.

15. (a) Develop the simulation model of inventory system with suitable example.

Or

(b) A piece of equipment contain four identical vacuum tubes and can function only if all the four are in working order. For each tube the operating time until failure has approximately uniform distribution from 1000 to 2000 hours. The present practice is to replace a tube only when it fails. This results in very frequent shut downs. An alternative proposal has been made that all the four tubes be replaced whenever any one of them fails.

The equipment must be shut down for one hour to replace one tube (or) for two hours to replace all the four tubes. The shut down and replacement of the tube costs Rs. 200 per hour, while each tube costs Rs. 100. Simulate the alternative maintenance polices for about 10,000 hours and determine the better of the two.

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