C 3320

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2007.

Fifth Semester

Mechatronics Engineering

MH 1303 — MODELLING AND SIMULATION

(Regulation 2004)

Time : Three hours   Maximum : 100 marks

Use of Statistical Tables permitted.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1.   Define Simulation.

2.   Give one example each for discrete and continuous systems.

3.   State any two important properties of random numbers.

4.   State the purpose of Pokers test applied to random number testing.

5.   What is the difference between random number and random variate?

6.   Give the expression used to generate exponential random variates.

7.   How is 'degrees of freedom' for Chi Square test determined?

8.   What is simulation clock?

9.   What are possible activates that can be performed using PROCESS block of Arena?

10. Explain the use of START statement of GPSS.

PART B — (5 × 16 = 80 marks)

11. (a) Two types of products are moving on a conveyor to the packing section, which is manned by a single worker. After reaching the packing point the products are collected in two different containers. The packer takes products on alternate fashion in case both the types of products are waiting for packing. It takes 5 ± 2 minutes for packing a product immaterial of the type of the product. The inter arrival times of the two types of products are 10 ± 5 minutes and 15 ± 4 minutes respectively. Simulate the system for the packing of 10, type 1 products and calculate all the statistics. Show your working in the form of a table with all necessary details including the random numbers used.

Or

(b) Discuss the application of simulation in reducing the product design and development cost.

12. (a) (i) What are the manual methods of generating random numbers? (2)

(ii) State the computer algorithms used for the generation of random numbers and explain any three in detail. (14)

Or

(b) Consider the following series of 2 digit numbers. Conduct Run test and check the independence of the numbers of the series with a confidence level of 95%.

67 91 3 89 72 19 59 49 95 13 64 85 72 11 1 69 88 20 92 53

76 7 32 13 48 71 17 44 95 59 81 61 92 94 65 48 23 29 50 52

98 73 60 43 38 29 17 50 49 58 67 77 1 31 79 8 74 99 64 30

54 63 74 1 8 20 67 52 85 43 46 44 52 50 10 89 38 98 86 37

29 82 69 26 72 6 72 6 72 8 89 13 71 92 39 56 19 64 45 6

13. (a) Explain the following methods of generating random variates with suitable examples :

(i) Inverse transform technique.

(ii) Acceptance rejection technique.

Or

(b) Explain the methods of generating :

    (i)   Gamma and

    (ii)   Normal random variates.

14.   (a)   Write short notes on :

    (i)   Data Collection.

    (ii)   Fitting distributions.

    (iii)   Goodness of fit tests.

Or

(b)   (i)   What is the three-step approach to validate a simulation model?

    (ii)   A simulation model of a job shop was developed to investigate different scheduling rules. To validate the model the currently used scheduling rule was incorporated into the model and the resulting output is compared to observed system behaviour. From the previous year's records it was estimated that the average number of jobs in the shop was 22.5 on a given day. Seven independent replications of the model were run, each of 30 days duration with the following results for average number of jobs in the shop :

18.9, 22.0, 19.4, 22.1, 19.8, 21.9, 20.2

Develop and conduct a statistical test to determine if the model output is consistent with system behavior. Use a level of significance $\alpha = 0.05$. $(t_{0.025, 6} = 2.45)$.

15.   (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 3 ± 1 minutes. 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 (or) Arena block diagram to simulate 100 replies and collect all the relevant statistics.

Or

(b) Television sets arrive at the inspection station every 5.5 ± 2 min. There is only one inspector and he requires 9 ± 3 min. to inspect a set. About 85% of the sets pass inspection and move on to the packing section while the others are sent to the adjustment station, which is manned by a single worker. It requires 30 ± 10 min. to adjust a set. After adjustment the set is sent back to the inspection station where it is again tested by the inspector. Give the GPSS (or) Arena block diagram to simulate the process for 100 hours.

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