Reg. No. : ⎕⎕⎕⎕⎕⎕⎕⎕⎕⎕⎕

J 3331

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2009.

Fifth Semester

Mechatronics Engineering

MH 1303 — MODELLING AND SIMULATION

Time : Three hours   Maximum : 100 marks

Use of Statistical Tables permitted

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. List the components of a System.

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

3. State any two important properties of good random numbers.

4. State null hypothesis of chi square test with respect to testing of random numbers.

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

6. Give expression to generate Uniform random variates.

7. What is use of histogram in identifying the distribution?

8. What is simulation clock?

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

10. What is the use of STORAGE statement in GPSS?

11. (a) Male and female customers are arriving at a counter manned by a single clerk. The inter arrival 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, Simulate the system for the service completion of 8 female customers or 10 customers in total whichever is late and calculate all the statistics. Show your working in the form of a table with all necessary details including the random number used.

Or

(b) Discuss the steps in the design of simulation experiments in detail.

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	7
29	82	69	26	72	6	72	6	72	8	89	13	71	92	39	56	19	64	45	6

13. (a) Explain the inverse transform technique for generating

(i) Exponential and

(ii) Triangular random variates.

Or

(b) (i) Give the procedure for the generation of Poisson random variates.

(ii) The random variables K1, K2 and K3 are distributed as follows :

$K1 \sim 20 \pm 10$; $K2 \sim 12 \pm 10$; $K3 \sim$ Poisson with mean 5 generate 5 values of random variate

$M = \dfrac{2K1 + K2}{K3}$ and compute the average value. What is the expected value M?

14. (a) For a job shop, four sets of input data were collected over four different 10-day periods, together with the average number of jobs in the shop (Zi) for each period. The input data were used to drive the simulation model for four runs of 10 days each, and model predictions of average number of jobs in the shop (Yi) were collected, with these results:

i	1	2	3	4
Z_i	21.7	19.2	22.8	19.4
Y_i	24.6	21.1	19.7	24.0

Conduct a statistical test to check the consistency of system output and model output. Use a level of significance of $\alpha = 0.05$.

Or

(b) What is the difference between validation and verification of simulation model? Explain in detail the methods employed for validation and verification of simulation model.

15. (a) In a factory the assembly line consists of a round turn table which carries work past three work stations. A part can be machined at any one of the stations. Parts are placed on the table and they take 120 seconds to reach the first station. If the station can accept the job the part will be processed. If it is busy, the part is carried to the second station, where it arrives after 120 seconds. Again the part is accepted if possible otherwise the table caries the part to the III work station, which again takes 120 seconds. A'so in the third station the part is accepted if possible otherwise the table carries the part back to the first workstation for another pass. Assume that not more than six parts can be placed on the table at any time and that should that condition be reached the in coming part is rejected. The pads arrive at the rate of one every one minute and it takes 40±20 seconds for machining at any one of the stations. Give the GPSS or Arena block diagram to simulate the system for machining 200 parts.

Or

(b) Write Short Notes on

(i) Advantages simulation Languages.

(ii) Application of Simulation in Mechatronics.

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