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Register Number:…….

B.E DEGREE EXAMINATIONS: NOV/DEC 2014

(Regulation 2009)

Seventh Semester

MECHATRONICS ENGINEERING

MCT 142: Modeling and Simulation

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Identify continuous system from the following
   a) Number of defective components in a lot
   b) Transport system
   c) Wind speed
   d) Banking system
2. Example of endogenous event is _____
   a) Weather conditions
   b) Arrival of a customer to a queue
   c) Cost of raw materials
   d) Government policy change
3. Random numbers are used to _____
   a) Create post simulation report
   b) Create error messages
   c) Model interactions
   d) Model the events
4. The limitation of chi-square test is _____
   a) It requires sufficient sample size
   b) It cannot detect randomness
   c) It is insensitive to sample size
   d) It cannot detect uniformity
5. Weibull random variates are used to model _____
   a) Failure of electronic components
   b) Room temperature
   c) Pressure in a hydraulic circuit
   d) Line current
6. The use of acceptance and rejection technique to generate random variate is justified when _____
   a) Cumulative distribution function (CDF) does not exist in closed form
   b) CDF is sum of different distributions
   c) Efficient algorithm for random variate generation is required
   d) Data is from normal distribution

7. Model validation results are compared with _____

a) Verification results
b) Previous run results
c) Data collected
d) Warmup run results

8. Which one of the following is true?

a) Simulation allows "what-if?" type of questions.
b) Simulation can usually be performed by hand or using a small calculator.
c) Simulation interferes with the real-world system.
d) Simulation is easy and least expensive.

9. The first step in simulation is to

a) set up possible courses of action for testing.
b) Construct a numerical model.
c) Validate the model.
d) Define the problem.

10. Which of the following are disadvantages of simulation?

a) inability to analyze large and complex real-world situations
b) "time compression" capability
c) could be disruptive by interfering with the real-world system
d) is not usually easily transferable to other problems

PART B (10 x 2 = 20 Marks)

11. List any two situations when simulation is not appropriate tool.
12. Define attribute.
13. What do you mean by pseudo random number?
14. Write short notes on poker test.
15. What is application of Weibull distribution in simulation?
16. Differentiate random number and random variate.
17. When the selection of triangular distribution is justified for modelling input data?
18. Compare the chi – square goodness of fit test with Kolmogorov – Smirnov test.
19. Name any five blocks in GPSS.
20. List any four important features of Arena simulation language.

PART C (5 x 14 = 70 Marks)

21. a) Consider two service channels for supplying food to the cars. Cars arrive in the manner as given below and the service times (in minutes) of two channels are

also indicated.

Time between arrivals	Probability	Service time of A	Probability	Service time of B	Probability
1	0.25	3	0.35	3	0.30
2	0.40	4	0.25	4	0.30
3	0.20	5	0.2	5	0.25
4	0.15	6	0.2	6	0.15

Develop a simulation for 20 service completions with the condition A gets the first order if A and B are idle. Determine the average waiting time of the customer, busy periods of the two persons and number of persons waiting in the queue. Take the following

Random digits for inter-arrival time: 26, 98, 90, 28, 42, 74, 80, 68, 22, 48, 34, 45, 24, 35, 63, 38, 81, 43, 56, 93.

Random digits for service: 95, 21, 51, 92, 89, 38, 13, 61, 50, 49, 39, 53, 88, 01, 81, 53, 84, 64, 11, 67.

(OR)

b) Explain with neat sketch the various steps involved in the simulation study.

22. a) (i) Using multiplicative congruential method, generate random numbers to complete cycle. Explain maximum density and maximum period. A = 11, m = 16, $X_0 = 7$. (10)

(ii) List the limitations of linear congruential generator. (4)

(OR)

b) On the basis of the length of runs up and down and significance level $\alpha = 0.05$ establish the hypothesis that the following numbers cannot be rejected:

0.99, 0.17, 0.99, 0.46, 0.05, 0.66, 0.10, 0.42, 0.18, 0.49, 0.37, 0.51, 0.54, 0.01, 0.81, 0.28, 0.69, 0.34, 0.75, 0.49, 0.72, 0.43, 0.56, 0.97, 0.30, 0.94, 0.96, 0.58, 0.73, 0.05, 0.06, 0.39, 0.84, 0.24, 0.40, 0.64, 0.40, 0.19, 0.79, 0.62, 0.18, 0.26, 0.97, 0.88, 0.64, 0.47, 0.60, 0.11, 0.29, 0.78

23. a) Suggest a step by step procedure to generate random variates using inverse transform technique for exponential distribution.

(OR)

b) What is acceptance – rejection technique? Generate three poisson variates with mean $\alpha = 0.2$.

24. a) What do you mean by verification and validation of simulation models? Explain calibration and validation of models with the help of diagram.

(OR)

b) Records pertaining to the monthly number of job related injuries at an underground coal mine were being studied by federal agency. The values of past 100 months are as follows:

Injuries per month	0	1	2	3	4	5	6
Frequency	35	40	13	6	4	1	1

Apply the chi square test to these data to test the hypothesis that the distribution is Poisson with mean 1.0 and $\alpha = 0.05$ and $\chi_{0.05,3} = 7.81$.

25. a) List and explain the significance of various factors involved in the selection of simulation software.

(OR)

b) Discuss the development of simulation model for the queueing system using Arena simulation language.

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