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B. Tech.

(SEM. VIII) THEORY EXAMINATION 2010-11

SIMULATION AND MODELING

Time : 3 Hours   *Total Marks : 100*

Note : Attempt **all** questions.

I.   **Attempt any four parts of question :**   (5×4=20)

   (a) A simulation of a major traffic intersection is to be
        conducted with the objective of improving the current traffic
        flow. Provide three iterations in increasing order of
        complexity, in the simulation process.

   (b) Distinguish between entities, attributes, events and state
        variables. Give an example.

   (c) Distinguish between Deterministic Vs. Probabilistic
        simulation models. Give an example.

   (d) Distinguish between Discrete and Continuous systems.

   (e) What are the advantages and limitations of simulation ?

   (f) In what ways and at what steps might a personal computer
        be used to support the simulation process ?

2. Attempt any **four parts of question :**   (5×4=20)

   (a) What are the major steps in the simulation process ?

   (b) What is Monte Carlo simulation ? What principles underlie its use, and what steps are followed in applying it ?

   (c) Why is a computer necessary in conducting a real world simulation ?

   (d) Write a program to generate and print 5,000 uniformly distributed random numbers between .000 and .999 (3 significant digits).

   (e) Use the linear congruential method to generate a sequence of random numbers with $x_0=27$, $a=17$, $c=43$, and $m=100$.

3. Attempt any **four parts of question :**   (5×4=20)

   (a) Write a program to generate uniformly distributed random numbers between 0 and 1 (with as many significant digits as your computer word can hold).

   (b) Write a function subprogram for Exponential distribution. The pdf is

$$\int(x)=\begin{cases}\lambda e^{-\lambda x}, & x\geq 0 \\ 0 & \text{otherwise}\end{cases}$$

   (c) Write a function subprogram for normal distribution.

(d) The Probability mass function of a Poisson distribution is given by

$$p(x) = \begin{cases} \dfrac{e^{-x}\alpha^x}{x!}, & x = 0, 1, 2, \dots \\ 0 & \text{elsewhere} \end{cases}$$

If $\alpha = 2$ customer per hour what is the probability of three customer per hour ($x = 3$).

(e) Use the constant multiplier technique with $K = 3987$ and $X_0 = 7223$ to obtain a sequence of four digit random numbers.

(f) What is the purpose of computing length of simulation run ? Write the formula used for computation of static simulation run when steady state is reached and samples are not correlated.

4. Attempt any four parts of question : (5×4=20)

(a) Name some of the tests that are performed to check the randomness of random number.

(b) What is the purpose of output analysis and how it is done ?

(c) Identify six different problems from your experience that you think should be solved using digital simulation.

(d) What is third order Delay ? Explain with a flow diagram.

(e) What is a system ? Distinguish between open and feedback loops ? Give example.

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(f) Simulate the flow chart given below for ten iterations. Given DT = 2 days, DI = Desired Inventory = 6,000, OR is order rate units/week, AT = Adjustment Time = 5 weeks, I = Inventory = 1,000 units, DT = Simulation time = 2 weeks total simulation run for 10 periods.
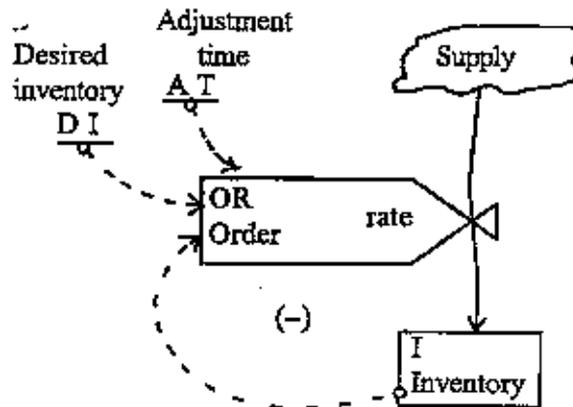
5. Attempt any four parts of the following :   (5×4=20)

(a) Why would an analyst prefer a general purpose language such as FORTRAN or BASIC in simulation when there are advantages to using special purpose languages such as GPSS or SIMSCRIPT ?

(b) What is the role of random numbers in a Monte Carlo simulation ?

(c) Why do the results of a simulation differ each time you make a run ?

(d) Why is validation of simulation models are needed ?

(e) The STELLA software is needed for simulating which types of model. Give its use for a simple model you are aware of.

(f) Write and equation of a model using DYNAMO language.