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5)

### Random Numbers

- Random Number are the numbers generated by the system which can't be predicted for its generation.
- Random Number Properties
  - . Independence Property  
It states that in any given series or any given sequence of random numbers should not depend on any of the previous random number that was generated.
  - . Uniformity Property  
It states that if we were to divide all the set of random numbers into several numbers of class interval then number of samples in each

class that should be same.

If number "n" of random sample divided into "k" class interval then expected number of samples is equal to  $= N/k$ .

- Maximum Cycle

It states that the random number generated should be allowed to repeat itself after interval of time.

- Maximum Density

It states that a large number of random numbers should be generated in a given range.

Subject:

Subject Code:

Ans

Subject Code:

Subject

Page No. 3

Date 1 2 2021

4) b)

Network Simulation is done by the system to check the connection load, the latency between the nodes, the rate of transfer and also simulating the heavy load on the network.

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Ans

Subject :

Subject Code :

Page No. 4

Date 1 2 2021

3>

a> Event Scheduling

v/s Times Advance

- The event scheduling algorithm is the modelling over time of a system whose state changes ~~at once~~ at the discrete points in time.
- The model used in discrete system simulation has a number of numbers to represent the state of a system, the discrete event simulation proceeds by producing a sequence of system snapshot that represents the evolution of the system through time.
- A given snapshot at a given time includes system state at time  $t$  & future event list.

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Subject :

Subject Code:

Page No. 5

Date 1 2 2021

- Every change in the system is called an event eg: Arrival departure of customer.  
After the system takes a snapshot at simulation time  $\text{clock} = t$  has been updated, the clock is advanced to simulation time  $\text{clock} = t_1$ .  
The subsequences of actions that a simulator must perform to advance the clock & build a new system snapshot is called as the Event scheduling time advance algorithm.

Absorbed Matrix

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Subject :  
Subject Code

Page No. 6  
Date 1 2 2021

- 3>
- b) Random Number Generate
- There are four methods to generate random number :-
  - Linear Congruential Method
  - Combined Linear Congruential Generators
  - Feedback Shift Register Generators
  - Random-Number Streams

⇒ Linear Congruent Method

It yields a sequence of randomized numbers calculated with a discontinuous piecewise linear equation.

$$X_{n+1} = (aX_n + c) \bmod m$$

where,

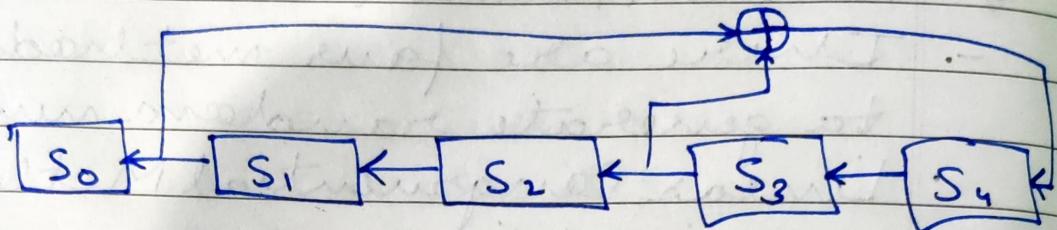
- $X$  is sequence
- $m, 0 < m$  is a modulus
- $a, 0 < a < m$  is multiplying
- $c, 0 \leq c < m$  is increment

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## ⇒ Feedback Shift Register Generator



- LFSR is applied in generating pseudo-random number.
- To obtain a sequence of  $l$ -bit integers  $y_1, y_2, \dots$  the sequence produced by (3) is used to fill the first leftmost bit of the integers being formed.

$$M_i = \frac{W_i}{2^k}$$

$$W_i = W_{i-q} \oplus W_{i-q}$$

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a) Simulation in Business

- Simulation in business can create virtual environment for the business and we put and use various cases and see how our business will perform.
- In manufacturing line we can simulate it for the best optimization and we can reduce the time of manufacturing line.
- We can also simulate the warehouse stock management, how we can still keep the stock in check.

b)

Simulation not required

- We don't have to use simulation in ~~cases~~ every cases, like
- When problem can be solved analytically.

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Subject :

Page No. 9

Subject Code :

Date 12/2021

- It need lot of data to run, and obtain a relevant result, then ~~use~~ if we don't have data it will not be useful.
- When the cost of simulation is large for small organization on a budget project it is not relevant to use.

### C) Inventory Management System

- Raw Material - Raw materials are used either or should be available in the inventory, to be used when required.
- Work-in-progress - This inventory includes items that are currently being processed. It includes raw material and components that are used in manufacturing.

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Subject:

Subject (ode):

Page No. 10

Date 1 2 2021

d) Pseudo Random Number

- The set of values that is statistically random, but it is derived from a known starting point and it repeated.
- Pseudo random numbers provide necessary values for processes that required randomness.

- c) We will use Poisson distribution for simulating the arrival of customers and services times.

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