Ajay Kumar Garg Engineering College, Ghaziabad

Department of MCA

Sessional Test-2 Solution

Course:	MCA	Semester:	V
Session:	2017-18	Section:	MCA-1 & 2
Subject:	Simulation and Modeling	Sub Code:	NMCA-E32
Max Marks:	50	Time:	2 hour

Note: Answer **all** the sections.

Section-A

Ques-1 Define System simulation.

Sol System simulation is a numerical technique for conducting experiments on a digital computer, which involves certain types of mathematical & logical models over extended period of real time.

Ques-2 What do you mean by distributed lag model?

Sol. Models that have the properties of changing only at fixed intervals of time, and of basing current values of the variables on other current values and values that occured in previous intervals, are called distributed lag models.

Ques-3 Name two system simulation technique.

Sol. 1) Numerical computation technique for continuous models
2) Numerical computation technique for discrete model.

Ques-4. Differentiate between Monte-Carlo simulation and stochastic simulation.

Sol. Monte Carlo Simulation

1) It is used when the problem is too difficult to solve analytically & too hazardous & time consuming to solve experimentally.
2) This method is used when random numbers are used to solve problem that are inherently deterministic.

Stochastic Simulation

1) It is used when the simulation is not clear
2) This method is used when random numbers are used to solve problems that are inherently stochastic.

Ques 5. Write the equation for generating Linear Congruential Generators (LCG).

Sol. $Z_i = (aZ_{i-1} + c) \pmod m$

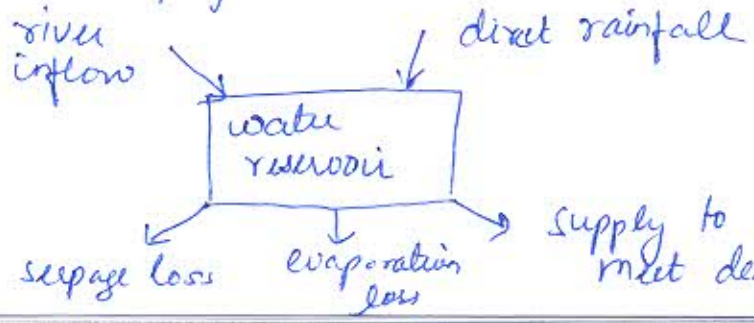
where, $m \rightarrow$ modulus, $a \rightarrow$ multiplier
$c \rightarrow$ increment, $Z_0 \rightarrow$ seed value.

Section - B

Ques 6. Simulate water reservoir system.

Sol. It is used to construct a dam across a river to create a reservoir. The curve of the project demand for the water from the reservoir has been determined from the expected growth pattern and the seasonal fluctuation.

Input → river inflow and rainfall
Output → seepage & evaporation loss, water supplied to meet project demand.



The basic procedure follows the following steps:

1) For the current M of the current year IY determine the total amount of river inflow and total rainfall directly over the reservoir.

   VIN = RAIN + RFLOW

2) Add input volume VIN to the volume left over at the end of last month.

   GROSSV = VIN + VOL(m-1).

3) On the basis of last month's volume calculate this month's seepage and evaporation losses.

   TLOSS = SEEP + EVAP

4) From demand curve, determine the current month demand DEM.

5) If TLOSS ≥ GROSSV, then reservoir runs dry without supplying any water and shortage, SHORT = DEM., VOL(m) = 0, SPILL = 0 else, If TLOSS < GROSSV, then net water volume available to satisfy demand is VNET = GROSSV − TLOSS.

6) If DEM ≥ VNET then SHORT = DEM − VNET, SPILL = 0 else if DEM < VNET, then DIFF = VNET − DEM is water left over.

7) If DIFF > CAP then SPILL = DIFF − CAP and VOL(m) = CAP else if DIFF ≤ CAP then SPILL = 0 and VOL(m) = DIFF

8) Print SPILL & SHORT for this month and move to next month. If the period exceeds the intended simulation length stop, else go to step 1.

Qus-7. Differentiate

1) Simulation & Analytical methods
2) Analog simulation & digital simulation.

Sol. 1) Simulation

i) It gives specific solution
ii) Each execution of simulation tells only whether a particular set of conditions are successful or not
iii) Wide range of problems can be solved

Analytical methods

i) It produces general solution
ii) All the conditions involved to solve a problem are considered.
iii) Range of problems to be solved are limited.

2) Analog Simulation

i) The accuracy of analog simulation depends on the accuracy of components being used.
ii) Magnitude scaling and time scaling are required.
iii) It provides higher speed of simulation.

Digital simulation

i) The results from digital simulation is more accurate
ii) Floating point arithmetic solves the magnitude scaling problem
iii) Speed is slow.

Qus-8. What are the different methods for test of randomness? Explain any one.

Sol The basic property that we need to test random numbers are:-

1) uniformity
2) Independence

Uniformity test

Uniformity test counts how often numbers in a given range occur in the sequence to ensure that the numbers are uniformly distributed.

Two methods are

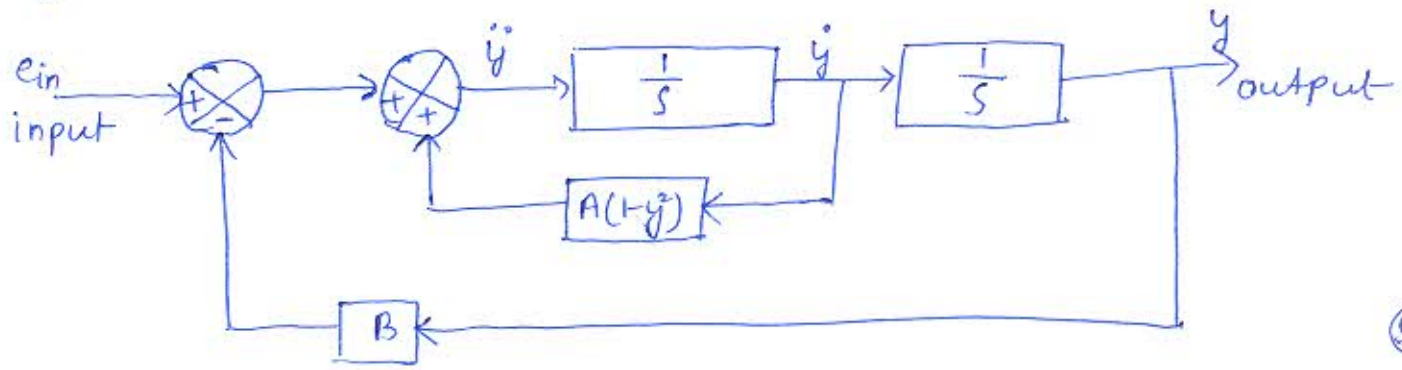
1) Frequency test
2) Chi-square test.

Frequency test: it counts how often numbers in a given range occur in the sequence to ensure that the numbers are uniformly distributed.

Eg: if we have a sequence of 5000 3digit numbers (000 to 999), we should expect that in the range 00 to 99 there are about 500 numbers, similarly in the range 100 to 199 there should be about 500 numbers. and so...on. We do not expect that there should be 500 numbers in each of the 10 ranges.

Ques 9. Discuss the simulation of servo system.

Sol. A very important application of continuous system simulation is in design & analysis of control systems. Servo system is a second-order nonlinear feedback system represented by the block diagram.



The system is described by following differential equation:

$$\ddot{y} = A(1-y^2)\dot{y} - By + e_{in}$$

In case of zero input signal,

$$\ddot{y} = A(1-y^2)\dot{y} - By$$

The second order differential equation can be written as a set of two simultaneous equation of first order.

$$\dot{y}_1 = y_2$$

$$\dot{y}_2 = A(1-y_1^2)y_2 - By_1$$

Let constant, $A = 0.1$, $B = 1.0$ and let initial conditions be

$$y_1(0) = 1.0$$

$$y_2(0) = 0.$$

We use fourth-order Runge-Kutta method to obtain values of y_1 and y_2 as a function of time.

Qun 10. Draw a cobweb model for the following market:

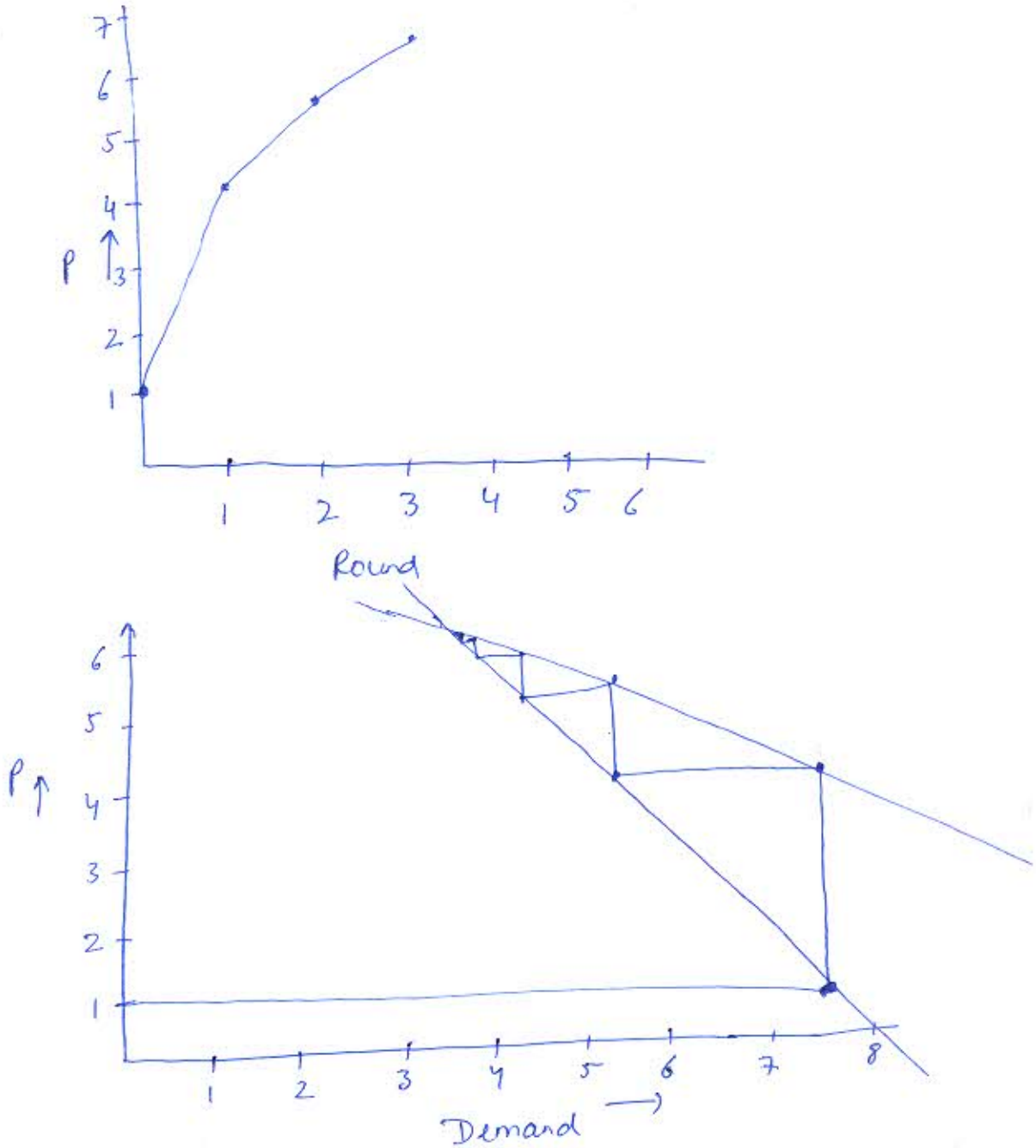
$$D = 12.4 - 1.2P$$

$$S = 8.0 - 0.6P_{-1}$$

$$P_0 = 1.0$$

Sol:

Round	P_{-1}	D	S	P
1	1	7.4	7.4	4.16
2	4.16	5.5	5.5	5.75
3	5.75	4.55	4.55	6.58
4	6.58	4.1	4.1	6.9



Section C

Ques 11 Explain in brief:

i) Real time simulation ii) Hybrid simulation

iii) Event-to-event model.

Sol: i) Real time simulation :→ In real-time simulation, actual devices are used in conjunction with either digital or hybrid computer to provide simulation of the parts of the system that do not exist or that cannot conveniently

be used in an experiment. These actual devices used in experiment should be the part of the desired system. It involves interaction with human being, and so avoid designing of human model.

ii) Hybrid simulation :- Hybrid computer is a combination of traditional analog-computer elements and digital computer. Hybrid computers may be used to simulate systems that are mainly continuous but have some digital element also. They can be arranged to carry out large portion of the study without human intervention. Hybrid simulation uses hybrid computer to combine discrete-continuous simulation.

iii) Event-to-event model :- In event-to-event model, the simulation clock is initialized to zero and the time of occurence of future events are determined. The simulation clock is then advanced to the time of occurence of the first event, at which point the state of the system is updated. Then the simulation clock is advanced to next time event. This process continues until eventually some prespecified stopping condition is satisfied.

Ques-12. Compute the following parameters for a single server queuing system. The inter arrival time and service time are given:

Customer	Interarrival time	Service time
1	0	20
2	10	15
3	15	10
4	35	5
5	30	15
6	10	15

i) Average waiting time of customers
ii) Average time customer spends in the system
iii) Average time between arrivals.
iv) Probability of the server being busy.

Sol.

Customer	AT_i	CAT	ST_i	Time service begin	Time service end	Waiting time	Time spend in system
1	0	0	20	0	20	0	20
2	10	10	15	20	35	10	25
3	15	25	10	35	45	10	20
4	35	60	5	60	65	0	5
5	30	90	15	90	105	0	25
6	10	100	15	105	120	5	20

i) Average waiting time of customers $= \frac{25}{6} = 4.16$ min
ii) Average time customer spends in system $= \frac{115}{6} = 19.16$ min
iii) Average time between arrivals $= \frac{100}{5} = 20$ min
iv) Probability of the server being busy $= \frac{120-40}{120} = \frac{80}{120} = .66$