

**BE INDUSTRIAL ENGINEERING (FT) – VII SEMESTER
IE 9402 SIMULATION MODELLING & ANALYSIS
END SEMESTER EXAMINATION – NOVEMBER 2011**

Time: 3 Hours

Max Marks: 100

Instructions

- 1) Answer ALL the questions
- 2) Give table of Definitions, GPSS Block Diagram and Program for GPSS problems.
- 3) Use of Statistical Tables allowed

PART A (10 X 2= 20 Marks)

1. What is the difference between deterministic and stochastic model?
2. State any five applications of simulation.
3. Generate three random numbers using additive congruential method. Assume 4 initial seeds.
4. What is a random variate ?
5. In a queuing simulation if arrival and service completion occur at the same time which should be given priority ? Why ?
6. What is meant by variable time increment of simulation clock?
7. State the advantages of simulation languages over general purpose languages.
8. Give any two industrial situations that require the use of 'TRANSFER BOTH' block.
9. Comment on the following GPSS blocks:
 - i) TRANSFER 0.3, ONE, TWO
 - ii) GENERATE 10, 5, 3, 1
10. With an example show how TERMINATE block can be used to control simulation run length.

PART B (5 X 16 = 80 Marks)

11. Garage has space for only three cars in its workshop. Cars are brought for service at the rate of one every 20 ± 5 minutes. If there is no space, the car is sent to another workshop where it will wait as long as necessary for service. The time taken to service a car in first workshop is 120 ± 40 minutes whereas it is 190 ± 40 minutes in the II work shop. Simulate the above system for service completion of 10 cars at the first work shop, and compute all the relevant statistics. Show your calculations in the form of a table.

- 12a. Consider the following series of 2 digit numbers. Conduct Chi Square Test to verify the uniform distribution of the series with a confidence level of 95%

22	3	52	12	88	36	23	7	4	67	7	38	85	69	26	67	81	76	17	66
36	28	45	97	7	26	15	12	3	27	79	75	83	85	50	43	1	59	53	86
35	9	55	37	66	87	87	95	53	42	10	60	55	4	91	21	32	99	77	88
32	68	5	65	94	69	60	26	65	74	4	72	12	39	33	75	42	18	72	8
23	10	70	22	14	2	37	84	35	31	20	36	13	85	65	4	12	85	49	66

(OR)

- 12b. Consider the following series of 2 digit numbers. Conduct Run test and check whether the numbers are independent with a confidence level of 95%

62	48	86	22	32	58	53	19	35	24	72	58	69	47	95	65	22	66	54	85
73	95	48	79	42	46	47	81	7	18	81	49	75	94	13	13	41	59	11	48
40	76	20	21	9	60	39	66	61	55	64	71	11	63	86	12	11	66	95	37
64	89	5	89	12	47	15	25	73	84	31	79	10	14	92	51	75	27	12	4
87	95	94	46	78	70	47	26	56	9	16	93	3	81	35	67	42	63	76	77

- 13a. Different types of vehicles are moving from city A to city B at the rate of one every 5 minutes. There are two routes R1 and R2 connecting the two cities. The distance between A & B is 500 km through R1 and 600 km through R2. Of the total vehicles moving, 35 % are cars, 40 % are busses and the remaining are trucks. The speed range maintained by the vehicles is as follows:

Cars	60 to 80 km/hr
Busses	50 to 60 km/hr
Trucks	40 to 55 km/hr

All the vehicles prefer route R1. However 5% of the cars pass through R2 to visit some places of interest en route. Also 25% of the buses are sent through R2 to serve the passengers in that region. There is a 10% possibility of rain in R1 due to which the travel time is increased by 5 minutes. Give the logical and program flow chart to simulate the system and collect all the necessary statistics.

(OR)

- 13b. In the drilling bay of a job shop, two types of drilling machines (D1 & D2) are available. Two types of parts A & B are arriving for drilling. The inter arrival times of part A & B are 10 ± 3 minutes and 3 ± 2 minutes respectively. B-type parts, workers choose an idle machine, or if both drills are busy, they choose a machine at random and stay with their choice. A-type parts require machine D1 only and hence if D1 is available, it is used; otherwise the part goes to the head of the line for the D1 drill. All jobs take 4 minutes to complete drilling. Give the logical and program flow chart to simulate the system and collect all the necessary statistics.

- 14a. In an internet browsing center there are four computers and six chairs. Inter arrival time of customers follow uniform at 4 ± 2 minutes. Service time is 60 ± 10 minutes. When a customer arrives, if all the computers are busy, 50% of the customers leave. If a vacant chair is available the remaining customers wait for their turn, otherwise they also leave. Once in 10 hours computers break down. It takes 45 minutes to repair these break downs. Simulate the system for 200 balking customers. Give the GPSS block diagram and program.

(OR)

- 14b. Consider a Kanban based production system with three work stations. Orders arrive at one every 10 ± 2 hours. The process time and Kanban size in each station is given below:

Station	Process Time	Kanban Size
1	4 ± 2 hours	NIL
2	6 ± 2 hours	3
3	3 ± 2 hours	2

Give the GPSS Block Diagram and program to simulate the system for 100 order completions.

- 15a. Write Short Notes on
- Random Number Generation
 - Pokers Test
 - Input Phase of GPSS

(OR)

- 15b. Discuss the application of simulation in Supply chain management.