(3 Hours) **[Total Marks: 80]**

N.B. : 1) Question No. 1 is compulsory.
2) Attempt any THREE questions out of remaining FIVE questions.
3) Assume suitable data wherever necessary.

QNo.1 Solve any **FOUR** questions: 5*4=20

a) Explain Simplex Method of solving Linear Programming problem .

b) Generate a sequence of five two digit random numbers using mixed congruence generator with a= 21, b=53, seed = 46 and m=100 .

c) Briefly explain the reasons for replacement of the equipments

d) What are the various customers behavior while joining queue ?

e) What is float? What are different types of floats?

QNo.2 a) Solve by Simplex method the following L.P. problem : 10

Minimize $Z = x_1 - 3x_2 + 3x_3$,

Subject to :

$3x_1 - x_2 + 2x_3 \leq 7$,

$2x_1 + 4x_2 \geq -12$,

$-4x_1 + 3x_2 + 8x_3 \leq 10$,

$x_1, x_2, x_3 \geq 0$

b) Solve by Big M method 10

Maximize $Z = 3x_1 - x_2$,

Subject to

$2x_1 + x_2 \leq 2$,

$x_1 + 3x_2 \geq 3$;

$x_2 \leq 4$,

$x_1 , x_2 \geq 0$;

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QNo.3 a) Reduce the following game by dominance and find the game value . 10

		Player B			
		I	II	III	IV
Player A	I	3	2	4	0
	II	3	4	2	4
	III	4	2	4	0
	IV	0	4	0	8

b) Solve the following assignment problem . 10

	I	II	III	IV	V
1	11	17	8	16	20
2	9	7	12	6	15
3	13	16	15	12	16
4	21	24	17	28	26
5	14	10	12	11	13

QNo.4 a) The company manufacturers 30 items per day . The sale of these items depends upon demand which has the following distribution : 10

Sales (Units)	Probability
27	0.1
28	0.15
29	0.2
30	0.35
31	0.15
32	0.05

The production cost and sale price of each unit are Rs 40 and Rs 50 respectively .Any unsold product is to be disposed of at a loss of Rs 15 per unit. There is a penalty of Rs 5 per unit, if the demand is not met .Using the following random numbers estimate total profit/Loss for the company for next 10 days :

10, 99, 65, 99, 95, 01, 79, 11, 16, 20

If the company decides to produce 29 items per day ,what is the advantage or disadvantage to the company ?

b) Solve the following transportation problem where cell entries are unit costs. 10

	D1	D2	D3	D4	D5	Available
O1	68	35	4	74	15	18
O2	57	88	91	3	8	17
O3	91	60	75	45	60	19
O4	52	53	24	7	82	13
O5	51	18	82	13	7	15
Required	16	18	20	14	14	82/82

QNo.5 a) Solve the following problem by Dual Simplex method: 10

Minimize $Z = 2x_1 + 2x_2 + 4x_3$,

Subject to :

$2x_1 + 3x_2 + 5x_3 \geq 2$,

$3x_1 + x_2 + 7x_3 \leq 3$,

$x_1 + 4x_2 + 6x_3 \leq 5$,

$x_1, x_2, x_3 \geq 0$

b) The owner of a chain of four grocery store has purchased six crates of fresh strawberries . The following table gives the estimated profits at each store when it is allocated various number of boxes : 10

	Stores			
Number of Boxes	1	2	3	4
0	0	0	0	0
1	4	2	6	2
2	6	4	8	3
3	7	6	8	4
4	7	8	8	4
5	7	9	8	4
6	7	10	8	4

The owner does not wish to split crates between stores .But is willing to make zero allocation. Find the allocation of the six crates so as to maximize the profit.

QNo.6 a) Estimated time for the jobs of a project are given below : 10

Jobs	A	B	C	D	E	F	G	H	I	J	K	L
Time (Weeks)	13	5	8	10	9	7	7	12	8	9	4	17

The constrains governing the jobs are as follows :

A and B are start jobs ; A controls C, D and E ;

B controls F and J ; G depends upon C ; H depends upon D;

E and F controls I and L; K follows J ;

L is also control by K; G ,H, I and L are the last jobs.

i) Draw the network

ii) Determine float for each activity

iii) Project duration and the critical path.

b) The time estimates (in weeks) for the activities of a PERT network are given below : 10

Activity	t_0	t_m	t_p
1-2	1	1	7
1-3	1	4	7
1-4	2	2	8
2-5	1	1	1
3-5	2	5	14
4-6	2	5	8
5-6	3	6	15

i) Draw the project network and identify all the paths through it.

ii) Determine the expected project length .

iii) Calculate the standard deviation and variance of the project length.