1604M025   Candidate's Seat No : _____

Integ. M.Sc DS Semester-6 Examination
CC-311
Operation Research

Time : 2-30 Hours]   April-2024   [Max. Marks : 70

Instructions: All questions are compulsory. Use of non-programmable scientific calculator is allowed.

Q.1 **(a)** Maximise $z = 10x_1 + x_2 + 2x_3$
Subject to $x_1 + x_2 - 2x_3 \leq 10$; $4x_1 + x_2 + x_3 \leq 20$ and $x_1, x_2, x_3 \geq 0$

(b) Use the graphical method to find minimum value of $z = 20x_1 + 10x_2$, Subject to the constraints $3x_1 + x_2 \geq 30$; $x_1 + x_2 \leq 40$; $4x_1 + 3x_2 \geq 60$ and $x_1, x_2 \geq 0$

OR

(a) An agriculturist has a farm with 126 acres. He produces radish, pea and potato. What he raises is fully sold in the market. He gets Rs. 5 for radish per kg, Rs. 4 for pea per kg and Rs. 5 for potato per kg. The average yield is 1500 kg of radish per acre, 1800 kg of pea per acre, 1200 kg potato per acre. To produce each 100 kg of radish and pea and to produce each 80 kg of potato, a sum of Rs. 12.50 has to be used for manure. Labour required for each acre to raise the crop is 6-man days for radish and potato each and 5-man days for pea. A total of 500-man days of labour at a rate of Rs. 40 per man day are available. Formulate this problem as an LP model to maximize the agriculturist's total profit.

(b) Use Simplex method to find Maximise $z = 5x_1 + 4x_2$
Subject to $4x_1 + 5x_2 \leq 10$; $3x_1 + 2x_2 \leq 9$, $8x_1 + 3x_2 \leq 12$ and $x_1, x_2 \geq 0$

Q.2 **(a)** Find initial basic feasible solution of following transportation problem by using NWC, LCM and VAM.

	M₁	**M₂**	**M₃**	**M₄**	**M₅**	**Supply**
W₁	4	7	3	8	2	4
W₂	1	4	7	3	8	7
W₃	7	2	4	7	7	9
W₄	4	8	2	4	7	2
Demand	8	3	7	2	2	

(b) Determine optimal basic feasible solution and minimum cost of given assignment problem.

	1	2	3	4	5	6
A	9	22	58	11	19	27
B	43	78	72	50	63	48
C	41	28	91	37	45	33
D	74	42	27	49	39	32
E	36	11	57	22	25	18
F	3	56	53	31	17	28

P.T.O

OR

a) Find the initial basic feasible solution of given transportation problem by using VAM **(07)** method and check optimality by using MODI method.

				Supply
	26	23	10	61
	14	13	21	49
	16	17	29	90
Demand	52	68	80	

b) The assignment cost of assigning any one operator to any one machine is given below. **(07)** Find the minimum cost for this given problem.

	A	B	C	D	E
A	10	12	15	12	8
B	7	16	14	14	11
C	13	14	7	9	9
D	12	10	11	13	10
E	8	13	15	11	15

(07)

Q.2 a) Draw a network diagram for the following project.

Activity	Predecessors
A	-
B	-
C	-
D	A
E	B, C
F	A
G	C

Activity	Predecessors
H	D, E, F
I	D
J	G
K	G
L	H, J
M	K
N	I, L

b) **(07)**

Activity	A	B	C	D	E	F	G	H	I	J	K	L	M
Procedure	-	-	B	C	A, D	D	A, D	E	G, H	I	G	J,K	L
Duration	6	5	2	2	2	1	6	5	6	2	4	3	1

Find the critical path and duration of the project.

OR

a) Draw a network diagram for the following project. **(07)**

Activity	Predecessors
A	-
B	-
C	B
D	A, C
E	B
F	D, E
G	D, E

Activity	Predecessors
H	D, E
I	G
J	F, I
K	G
L	H
M	J, K, L

2

(b) Find the critical path and estimated time for given project.

Activity	Predecessors	Optimistic time	Pessimistic time	Most likely time
A	-	2	4	3
B	-	8	8	8
C	A	7	11	9
D	B	6	6	6
E	C	9	11	10
F	C	10	18	14
G	C,D	11	11	11
H	F,G	6	14	10
I	E	4	6	5
J	I	3	5	4
K	H	1	1	1

Q.4 **(a)** Derive EOQ model with shortages.

(b) An item is produced at the rate of 50 items per day. The demand occurs at the rate of 25 items per day. If the set-up cost is Rs.100 per set-up and holding cost is Rs.0.01 per unit of item per day, find the economic lot size for one run, assuming that shortages are not permitted. Also find the time of cycle, minimum cost for one run and manufacturing time.

OR

(a) Derive basic EOQ Model.

(b) A dealer supplies the following information in connection with a product.
Annual demand = 5,000 units
Buying cost = Rs.250 per order
Inventory carrying cost = 30% per year
Price = Rs.100 per unit
The dealer is considering the possibility of allowing back orders to occur for the product. He has estimated that the annual cost of back ordering (allowing shortages) the product will be Rs.10 per unit.
(a) What should be the optimum number of units of the product he should buy in one lot?
(b) What quantity of the product should he allow to be back ordered?
(c) How much additional cost will he have to incur on inventory if he does not permit any back ordering?

Q.5 Attempt any **SEVEN** out of **TWELVE:**
(1) Define: Free float and Total float
(2) Find the assignment value of the given cost.

	A	B	C	D
A	40	45	42	39
B	38	45	46	40
C	42	46	46	43
D	41	44	42	44

(3) What is unbalanced transportation problem and how to make them balanced problem
(4) Write down general formulation of Linear Programming Problems.
(5) What is transportation problem? Give two real life applications of it.

(6) Define expected time and variance in PERT.

(7) Define: Shortage cost and order cost

(8) Define feasible solution for linear programming problems.

(9) What is the difference between PERT and CPM?

(10) A shopkeeper has uniform demand of an item at the rate of 600 items per year. He buys from a supplier at a cost of Rs.8 per item and the cost of ordering is Rs.12 each time. If the stockholding costs are 20% per year of stock value, how frequently should he replenish his stocks?

(11) Describe total inventory cost.

(12) Write down formula for order quantity of EOQ for lot size production.

**** ****