S.No. 9545 D **DOR 2**

(For candidates admitted from 2006-2007 onwards)

DIPLOMA EXAMINATION, NOVEMBER 2020.

Operations Research

OPERATIONS RESEARCH – II

Time : Three hours Maximum : 100 marks

PART A — ($10 \times 2 = 20$)

Answer ALL the questions.

1. Define Triangular matrix.

2. Write the dual of the following transportation problem.

$$\text{Min } z = \sum_i \sum_j x_{ij} c_{ij}$$

Subject to the constraints

$$\sum_i x_{ij} = a_i, \sum_j x_{ij} = b_j$$

$$x_{ij} \geq 0 \forall i = 1,2...m$$

$$j = 1,2...n$$

3. Explain Unbalanced Transportation problem.

4. Write the procedure for stepping stone solution method.

5. Explain Assignment Problem.

6. Solve the Assignment problem

	A	B	C	D
1	5	3	2	8
2	7	9	2	6
3	6	4	5	7
4	5	7	7	8

7. Write a Mathematical formulation of Travelling Salesman problem.

8. Write a special cases of an Assignment Problem.

9. Define State of Nature.

10. Write a short notes on Maximax criterion.

PART B — ($5 \times 6 = 30$)

Answer ALL the questions, choosing either (a) or (b).

11. (a) Write an algorithm for North West corner rule.

Or

(b) Obtain an IBFS to the following T.P. using the matrix minimal method:

	D_1	D_2	D_3	D_4	Supply
O_1	1	2	3	4	6
O_2	4	3	2	0	8
O_3	0	2	2	1	10
Demand	4	6	8	6	

12. (a) A company manufacturing air-coolers has two plants located at Mumbai and Calcutta with a weekly capacity of 200 units and 100 units respectively. The company supplies air coolers to its 4 showrooms situated at Ranchi, Delhi, Lucknow and Kanpur which have a demand of 75,100, 100 and 30 units respectively. The cost of transportation per unit (in Rs.) is shown in the following table.

	Ranchi	Delhi	Lucknow	Kanpur
Mumbai	90	90	100	100
Calcutta	50	70	130	85

Find the optimum transportation problem so as to minimize the total cost.

Or

(b) Solve the following transportation problem:

	A	B	C	Available
I	50	30	220	1
II	90	45	170	3
III	250	200	50	4
Requirement	4	2	2	

13. (a) Solve the following assignment problem:

	I	II	III	IV
A	2	10	9	7
B	15	4	14	8
C	13	14	16	11
D	4	15	13	9

Or

(b) Solve the following Assignment problem:

	A	B	C	D
	10	25	12	20
2	15	30	5	15
3	35	20	12	24
4	17	25	24	20

14. (a) Solve the following assignment problem to find the maximum total expected sale

	I	II	III	IV
A	42	35	28	21
B	30	25	20	15
C	30	25	20	15
D	24	20	16	12

Or

(b) MCS Inc is a software company that has three projects of Y2K with the departments of health, education and housing of Maharashtra Government. Based on the background and experiences of the project leaders, they differ in terms of their performance at various projects. The performance score matrix is given below:

Project leaders	Projects		
	Health	Education	Housing
P_1	20	26	42
P_2	24	32	50
P_3	32	34	44

Determine the optimal assignment that maximizes the total performance score.

15. (a) A business man has three alternatives open to him each of which can be followed by any of the four possible events. The conditions payoffs (in Rs.) for each action-event combination are given below:

Alternative	Payoffs conditional on events			
	A	B	C	D
X	8	0	–10	6
Y	–4	12	18	–12
Z	14	6	0	8

Determine which alternative should the businessman choose, if he adopts the maximin criterion.

Or

(b) Explain in detailed about EVPI.

PART C — ($5 \times 10 = 50$)

Answer ALL the questions, choosing either (a) or (b).

16. (a) Obtain an IBFS to the following T.P using the Vogel's approximation method:

Warehouse	Stores				Availability
	I	II	III	IV	
A	5	1	3	3	34
B	3	3	5	4	15
C	6	4	4	3	12
C	4	–1	4	2	19
Requirement	21	25	17	17	80

Or

(b) Determine an IBFS to the following T.P. using (i) row minima method (ii) Vogel's approximation method.

	1	2	3	4	Availability
1	20	22	17	4	120
2	24	37	9	7	70
3	32	37	20	15	50
Requirement	60	40	30	110	240

17. (a) Consider the following T.P.

	1	2	3	4	5	6	Availability
A	7	5	7	7	5	3	60
B	9	11	6	11	–	5	20
C	11	10	6	2	2	8	90
D	9	10	9	6	9	12	50
Demand	60	20	40	20	40	40	

It is not possible to transport any quantity from B to 5.

Determine (i) Initial solution by VAM.

(ii) Optimum Basic Feasible solution.

(iii) Is the optimum solution unique? If not find the alternative optimum basic feasible solution.

Or

(b) Solve the Transportation problem.

	D_1	D_1	D_1	D_1	Available
O_1	10	0	20	11	15
O_2	1	7	9	20	25
O_3	12	14	16	18	5
Required	12	8	15	10	45

18. (a) A company wishes to assign 3 jobs to 3 machines in such a way that each jobs is assigned to some machine and no machine works on more than one job. The cost of assigning job i to machine j is given by the matrix below.

$$\text{Cost matrix} \begin{pmatrix} 8 & 7 & 6 \\ 5 & 7 & 8 \\ 6 & 8 & 7 \end{pmatrix}$$

Draw the associated network. Formulate the network LPP and find the minimum cost of making the assignment.

Or

(b) Solve the Assignment problem.

	M_1	M_2	M_3	M_4
J_1	5	8	3	2
J_2	10	7	5	8
J_3	4	10	12	10
J_4	8	6	9	4

19. (a) Solve the following Travelling salesman problem.

	A	B	C	D	E
A	–	3	6	2	3
B	3	–	5	2	3
C	6	5	–	6	4
D	2	2	6	–	6
E	3	3	4	6	–

Or

(b) Kapil Airlines that operates seven days a week has a time-table as shown below. Crews must have a minimum layover of 5 hours between flights. Obtain the pairing of flights that minimizes layover time away from home. For any given pairing, the crew will be based at the city that results in the smaller layover.

Delhi-Jaipur			Jaipur-Delhi		
Flight No.	Depart	Arrive	Flight No.	Depart	Arrive
1	7.00 AM	8.00 AM	101	8.00 AM	9.15 AM
2	8.00 AM	9.00 AM	102	8.30 AM	9.45 AM
3	1.30 PM	2.30 PM	103	12.00 PM	1.15 PM
4	6.00 PM	7.30 PM	104	5.30 PM	6.45 PM

For each pair also mention the town where the crew should be based.

20. (a) A wholesaler of sports goods has an opportunity to buy 5,000 pairs of skills that have been declared surplus by the government. The wholesaler will pay Rs. 50 per pair and can obtain Rs. 100 a pair by selling skiis to retailers. The price is well-established, but the wholesaler is in doubt as to just how many pairs he will be able to sell, any skiis left over, he can sell to discount outlets at Rs. 20 a pair. After a careful consideration of the historical data, the wholesaler assigns probabilities to the demand as follows:

Retailer's demand	Probability
1,000 pairs	0.6
3,000 pairs	0.3
5,000 pairs	0.1

(i) Compute the conditional monetary and expected monetary values.

(ii) Compute the expected profit with a perfect predicting device.

(ii) Compute the EVPI.

Or

(b) Your company manufactures goods for a market in which the technology of the products is changing rapidly. The research and development department produced a new product which appears to have potential for commercial exploitation. A further Rs. 60,000 is required for development testing. As a result of previous experience of this type of market, it has been possible to derive a probability distribution relating to the proportions of customers who will buy the product, as follows:

Proportion of customers :	0.04	0.08	0.12	0.16	0.20
Probability:	0.1	0.1	0.2	0.4	0.2

Determine the expected opportunity losses, given no other information than that stated above, and state whether or not the company should develop the product.

———————