MANIPAL ACADEMY of HIGHER EDUCATION

Question Paper - Report

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Question Paper

MANIPAL ACADEMY OF HIGHER EDUCATION

VI Sem BTech Mid-Term Examinations
Data Science and Engineering
OPERATIONS RESEACH [HUM 3252]

Marks: 30 **Duration: 120 mins.**

A

Answer all the questions. Section Duration: 20 mins

Select the correct answer for the following questions
Missing Data if any may be suitably assumed

1) Based on the final table of the simplex algorithm, LPP is said to have an alternate solution if in the C_j-Z_j row: (0.5)

Below a non-basic variable, there is a zero | One or more basic variables have a zero value | Entering variable has a negative coefficient | The optimum function value is zero

2) While solving an LPP using the graphical approach, the solution value can be found at _____. (0.5)

All the given options are correct | Along the boundaries of the feasible region | The corner points of the feasible region | Inside the feasible region

3) Which statement characterizes a typical form of a linear programming problem? (0.5)

Constraints are given by inequalities of any type | Constraints are given by a set of linear equations | Constraints are given only by inequalities of >= type | Constraints are given only by inequalities of < = type

4) In the graphical method to solve LPP, the restriction on the number of constraints is _____. (0.5)

None of the options are correct | 2 | 3 | Not more than 3

5) While maximizing the profit using the transportation algorithm, the incoming cell is the one with _____. (0.5)

Highest positive cell improvement index | Highest negative cell improvement index | Lowest negative cell improvement index | Zero cell improvement index

6) For a maximization problem in LPP, the objective function coefficient for an artificial variable is ___. (0.5)

-M +M 0 None of the options are correct

7) Suppose a particular route needs to be blocked while formulating a transportation problem (shipment problem), and this is done by making the cost of that particular route 'M'. To make the analysis simple, M must assume an _____. (0.5)

Very high negative value Zero Very high positive value None of the options are correct

8) The allocations made into a dummy destination in the final optimal table represent _____. (0.5)

Surplus at the supplying source Shortages at the receiving destination The actual demand being met at the destination None of the options are correct.

9) The number of dummy allocations € one would have to make to resolve degeneracy is _____. (0.5)

As many as to resolve degeneracy 1 One more than the number of rows and columns Two less than the product of the number of rows and columns

10) When the constraint imposed on LP is a linear equation in terms of decision variable, then, while solving the same using the simplex algorithm, we may have to add an _____. (0.5)

Artificial variable Slack variable Surplus variable Decision variable

B

Answer all the questions. Section Duration: 100 mins

Any missing data can be assumed suitably.

11) A solicitor's firm employs typists on an hourly piece-rate basis for their daily work. There are five typists, and their charges and speeds are different. According to an earlier understanding, only one job is given to one typist and the typist is paid for a full hour even if he works for a fraction of an hour. Find the least cost allocation for the following data. Use the assignment algorithm. (4)

Typist	Rate per Hour	No. of pages typed per hour
A	5	12
B	6	14
C	3	8
D	4	10
E	4	11

Job	No. of Pages
P	199
Q	175
R	145
S	298
T	178

12) Three warehouses supply five stores. The table indicates the cost of shipment per unit between the warehouses and stores. However, a major bridge has been damaged preventing deliveries from Warehouse A to Store 5, Warehouse B to Store 2 and from Warehouse C to Store 4. Formulate the problem as a transportation problem and generate the basic feasible solution using the least cost method.

		Warehouse			Demand
		A	B	C	
Stores	1	2	4	6	75
	2	3	8	7	345
	3	4	3	8	180
	4	4	6	3	90
	5	2	6	5	210
Supply		850	300	450	

(3)

13) Optimize the above basic feasible solution (for the five stores and three warehouses problem) using the Modified Distribution Method. (4)

14) A factory manufactures three products, A, B, and C, for which the data is given below. The profit per unit is Rs.32, Rs.30 and Rs.40 for products A, B and C respectively. Also given below is the final production plan (optimal solution), with reference to the same answer to the following questions: (3)

Resource	Product			Resource Availability
	A	B	C	
Raw Materials	5	4	3	2500
Machine Hours	2	3	1	1275
Labor Hours	3	2	4	2100

Profit/ Unit	Basic variable	C_j	32	30	40	0	0	0
		Q	X_1	X_2	X_3	S_1	S_2	S_3
0	S_1	175	3/2	0	0	1	-1	-1/2
30	X_2	300	½	1	0	0	2/5	-1/10
40	X_3	375	1/2	0	1	0	-1/5	3/10
	Z_j	24000	35	30	40	0	4	9
	C_j-Z_j		-3	0	0	0	-4	-9

While implementing the production plan, 500 raw materials units must be scrapped as they don't meet the quality specifications. Your regular vendor has assured you with 200 units. How many units of raw materials you will have to arrange from a new vendor to implement the pre-determined production plan?

15) A firm manufactures three products A, B and C. Time to manufacture A is twice that of B and thrice that of C, and if the entire labour is engaged in the production of A, 1600 units of this product can be produced. The products are to be produced in the ratio 3:4:5. The demand for at least 300, 250 and 200 units of products A, B and C and the profit earned per unit is Rs.90, Rs.40 and Rs.30 respectively. Formulate the problem as a linear programming problem. (3)

Raw Material	Requirement per unit of product (kg)			Total Availability (Kg)
	A	B	C	
P	6	5	2	5000
Q	4	7	3	6000

16) An intermediate simplex table of an LPP profit maximization case is shown below. Check the intermediate solution for optimality and generate the optimal solution. (3)

C_j	4	3	0	0	0	0
Q	X_1	X_2	S_1	S_2	S_3	S_4
200	0	1	1	0	-2	0
200	0	0	-1	1	1	0
400	1	0	0	0	1	0
500	0	0	-1	0	2	1

17) A firm manufactures two products, A and B, which use three resources. The unit profit generated by the products, maximum availability of the resources, and requirement of each resource to manufacture one unit of product are shown in the table. The optimal production plan (final simplex table) that maximizes the profit is also given. Based on the optimum production plan, answer the following questions. Assume that the firm operates one shift a day.

	Resource consumption per unit of		**Maximum available per week**
	A	**B**	
Raw Material	2	4	48
Labor	5	2	40
Machine Hours	4	4	52
Unit Profit (Rs)	50	60	

(3)

Profit per unit	**Basis**	C_j	50	60	0	0	0
		Q	X_1	X_2	S_1	S_2	S_3
60	X_2	11	0	1	½	0	-1/4
0	S_2	8	0	0	3/2	1	-2
50	X_1	2	1	0	-1/2	0	1/2
	Z_j	760	50	60	5	0	10
			0	0	-5	0	-10

a. If the machines break down during production, what is the maximum time the maintenance personnel can take to repair the machine?

b. Workers are demanding a day's leave to attend a local festival. Is it possible to sanction leave for a day without altering the production plan?

18) You have reported at XYZ Ltd as an operations manager which manufactures two types of leather belts. Your predecessor had started preparing the production plan for the next planning period before he was relieved from duty. The plan is as shown below:

Profit/ unit	Sol Var	Cj	4	3	0	0	0	0
		Q	X_1	X_2	(Time) S_1	(Leather) S_2	(Buckle) S_3	(Buckle) S4
0	S1	1000	2	1	1	0	0	0
0	S2	800	1	1	0	1	0	0
0	S3	400	1	0	0	0	1	0
0	S4	700	0	1	0	0	0	1
	Zj	0	0	0	0	0	0	0
	Cj-Zj		4	3	0	0	0	0

(2)

Before you decide on any course of action, you would like to verify if your predecessor was right in quantifying the problem. Formulate the problem as an LPP from the above set of data and describe it qualitatively.

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