(6 pages)

MAY 2023 **P/ID 77931/RMB2G**

Time : Three hours Maximum : 80 marks

PART A — ($10 \times 2 = 20$ marks)

Answer any TEN questions.

1. What are the features of operation research?

2. Write down different model of operation research.

3. State the components of LP model.

4. Mention the possible combinations of Primal and Dual properties.

5. What are five steps to test Unused squares with the Stepping stone method?

6. Give the simplex procedure to solve the Linear Programming Problem.

7. In what ways a transhipment problem different from a transportation problem?

8. Define a game. What are the properties of a game?

9. What are pure and mixed strategies and how do they differ?

10. What is a sequencing problem?

11. Describe various types of replacement problems.

12. Discuss the variations in assignment problem.

PART B — ($5 \times 6 = 30$ marks)

Answer any FIVE questions.

13. Comment on the following statements:

(a) Operations Research is the art of winning war without actually fighting it.

(b) Operations Research is the art of finding bad answers where worse answers exist.

14. A firm manufacturers headache pills in two sizes A and B. Size A contains I grains of aspirin, 5 grains of bicarbonate and 1 grain of codeine. It is found by uses that it requires at Least 12 grains of aspirin, 74 grains of bicarbonate and 24 grains of codeine for providing immediate effect. It is required to determine the least number of pills a patient should take to get immediate relief. Formulate the problem as a standard LPP.

15. Use simplex method to solve:

Maximize $Z = 2x_1 + 3x_2 + 4x_3$

$$x_1 + x_2 + x_3 \geq 1$$

$$x_1 + x_2 + 2x_3 = 2$$

$$2x_1 + 2x_2 + x_3 \geq 4$$

with all variables non-negative

16. Determine whether a dummy source or a dummy destination is required to balance the model given

(a) Supply $a_1 = 15, a_2 = 5, a_3 = 4, a_4 = 6$

Demand $b_1 = 4, b_2 = 15, b_3 = 6, b_4 = 10$

(b) Supply $a_1 = 27, a_2 = 13, a_3 = 10$

Demand $b_1 = 30, b_2 = 10, b_3 = 6, b_4 = 10$

(c) Supply $a_1 = 2, a_2 = 3, a_3 = 5,$

Demand $b_1 = 3, b_2 = 2, b_3 = 2, b_4 = 2, b_5 = 1$

17. A firm plans to begin production of three new products. They own three plants and wish to assign one new plant. The unit cost of producing i at plant j is Cij as given by the following matrix. Find the assignment that minimizes the total unit cost.

		Plants		
		P_1	P_2	P_3
Products	A	10	8	12
	B	18	6	14
	C	6	4	2

18. Find the optimal sequence that minimizes the total elapsed time required to complete the following jobs.

Job	1	2	3	4	5	6
Machine 1	4	6	6	10	5	8
Machine 2	6	7	9	2	4	11

19. Give any four applications of MMl queuing model.

PART C — ($3 \times 10 = 30$ marks)

Answer any THREE questions.

20. An electrical appliance manufacturer wishes to know what the economic quantity should be for a plastic impeller when following information is available:

The average daily requirement is 120 units and the company has 250 working days a year, so that the total yearly requirement is approximately 30,000 units a year. The manufacturing cost is 50 paise per part. The sum of annual rate is, interest, insurance, taxes and so forth, 20% of the unit cost and the cost of preparation is Rs.50 per lot.

21. Customers arrive at a window in a bank, according to a Poisson distribution with mean 10 per hour. Service time per customer is exponential with mean 5 minutes. The space in front of the window including that for the serviced customers can accommodate a maximum of three customers. Other customers can wait outside this space

(a) What is the probability that an arriving customer can go directly to the space in front of the window?

(b) What is the probability that an arriving customer will have to wait outside the indicated space?

(c) How long is an arriving customer expected to wait before being served?

22. Use graphical method in solving the following game and find the value of the game.

		Player B			
		B_1	B_2	B_3	B_4
Player A	A_1	0	5	-2	3
	A_2	2	3	4	1

23. A computer centre has four expert programmers and needs to develop four application programmes. The head of the computer Centre, estimates the computer time (in minutes) required by the respective experts to develop the application programmes as follows:

	Programmes			
Programmers	120	100	80	90
	80	90	110	70
	110	140	120	100
	90	90	80	90

Fine the assignment patterns that minimize the time required to develop the application programmes.

24. State the Comparison between Maximisation case and Minimisation case in operation research models.

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