Indian Maritime University

(A Central University, Govt of India)

Supplementary Examinations – September/October 2024

Programme Name: BBA (LRE)

Semester: III

Subject Code: UG31T3305

Subject Name: Operation Research for Business

Date: 23.09.2024	Max Marks: 70
Duration: 03 Hrs	Pass Marks: 35

General Instructions

(i) All Sections (A, B & C) are to be attempted.
(ii) Options, if any, are specified in respective section.

Section A

Ten MCQs/Fill in the Blanks of 01 Mark each – Choose the correct answer as applicable.

1. A Constraint in an LPP restricts
   a) An equation with = sign
   b) Inequality with ≥ sign
   c) Inequality with ≤ sign
   d) Any of the above.

2. Which of the following is NOT correct about LPP?
   a) All constraints must be a linear relationship
   b) The objective function must be linear
   c) All the constraints and decision variables must be of either '≤' or '≥' type.
   d) All decision variables must be non-negative.

3. The initial solution of a T.P. can be obtained by applying any known method. However, the only condition is that
   a) The solution must be optimum
   b) the solution should be non-degenerate
   c) The rim conditions are satisfied
   d) All of the above

4. An assignment problem is considered a particular case of transportation problem, because
   a) All rim conditions are 1.
   b) All x_{ij} are either 1 or 0

c) The number of rows equals to column
d) All of the above

5. Queue can form only when
   a) Arrivals exceed service capacity
   b) Arrivals equals service capacity
   c) The service facility is capable of serving all the arrivals at a time
   d) There are more than one service facility

6. Priority Queue discipline may be classified as
   a) Finite or infinite
   b) Limited or unlimited
   c) Pre-emptive or non pre-emptive
   d) All of the above

7. A type of decision-making environment is
   a) Certainty
   b) Uncertainty
   c) Risk
   d) All of the above

8. The minimum expected opportunity loss (EOL) is equal to
   a) EMV
   b) EVPI
   c) Minimum regret
   d) Both b and c

9. For a two-person zero-sum game, the value of the game can be
   a) Determined only if the pay-off matrix has a saddle point
   b) Positive, negative, or zero
   c) Determined only if the game is fair
   d) None of the above

10. The term commonly used for activity slack time is
   a) Free float
   b) Independent float
   c) Total float
   d) All of the above.

Section B

Five Questions of 02 Marks each

11. A company has three operational departments (Weaving, processing, and packing) with a capacity to produce three different types of clothes namely suiting,

shirting, and woollens yielding a profit of Rs.2, Rs. 4, and Rs. 3 per meter respectively. One meter of suiting requires 3 minutes in weaving, 2 minutes in processing, and 1 minute in packing. Similarly, one minute of shirting requires 4 minutes in weaving, 1 minute in processing, and 3 minutes in packing. One meter of woollen requires 3 minutes in each department. In a week, the total run time of each department is 60, 40, and 80 hours for weaving, processing, and packing respectively. Formulate the linear programming problem to find the product mix to maximize the profit.

12. Solve the following Transportation problem using North West Corner Method

Source	**Destination**				**Available**
	1	**2**	**3**	**4**	
1	21	16	25	13	**11**
2	17	18	14	23	**13**
3	32	27	18	41	**19**
Requirement	6	10	12	155	**43**

13. Customers' arrival rate at a public telephone booth follows Poisson distribution, with an average time of 10 minutes between one customer and the next. The phone call duration is assumed to follow an exponential distribution, with a mean time of 3 minutes. What is the probability that a person arriving at the booth will have to wait?

14. Draw a network diagram for the following data:

Activity	:	A	B	C	D	E	F	G	H	I	J
Preceding Activities	:	None	A	A	B	A	B,E	C	D,F	G	H,I

15. Two firms are competing for business under the condition that one firm's gain is another firm's loss. Firm A's payoff matrix is given below.

		Firm B		
		No Ad B1	Medium ad B2	Heavy ad B3
Firm A	No Advertising A1	10	5	-2
	Medium Advertising A2	13	12	15
	Heavy Advertising A3	16	14	10

Suggest optimum strategies for the two firms and the net outcome thereof.

Section C

Seven Questions of 10 Marks each of which any 05 questions to be answered.

16. Max Z= 4x1 + 3x2

Subject to constraints:

$2x1 + x2 \leq 1,000$

$X1 + x2 \leq 800$

$X1 \leq 400$, $x2 \leq 700$ x1 and $x2 \geq 0$ solve graphically.

17. Use the Simplex method to solve

Min Z = x2 – 3x3 +2x5

Subject to the constraints:

$3x2 - x3 + 2x5 \leq 7$

$-2x2 + 4x3 \leq 12$

$-4x2 + 3x3 + 8x5 \leq 10$; x2,x3,x5 ≥ 0

18. Find an initial basic feasible solution to the following Transportation problem using Vogel's Approximation Method.

Factories	Warehouses					Availability
	W1	W2	W3	W4	W5	
F1	20	28	32	55	70	50
F2	48	36	40	44	25	100
F3	35	55	22	45	48	150
Requirements	100	70	50	40	40	300

19. A pharmaceutical company produces a single product and sells it through five agencies located in different cities. All of a sudden, there is a demand for the product in another five cities not have any agency of the company. The company is faced with the problem of deciding on how to assign the existing agencies to despatch the product to needy cities in such a way that the traveling distance is minimized. The distance between the surplus and deficit cities(in Km) is given in the following table.

Surplus cities	**Deficit cities**					
		a	b	c	d	e
	A	85	75	65	125	75
	B	90	78	66	132	78
	C	75	66	57	114	69
	D	80	72	60	120	72
	E	76	64	56	112	68

20. On average 96 patients per 24-hour day require the service of an emergency clinic. Also on average, a patient requires 10 minutes of active attention. Assume that the facility can handle only one emergency at a time. Suppose that it costs the clinic Rs. 100 per patient treated to obtain an average servicing time of 10 minutes and that each minute of decrease in this average time would cost Rs. 10 per patient treated. How much would have to be budgeted by the clinic to decrease the average size of the queue from $1\frac{1}{3}$ patients to $\frac{1}{2}$ a patient?

21. Given the following information:

Activity	0-1	1-2	1-3	2-4	2-5	3-4	3-6	4-7	5-7	6-7
Duration (in days)	2	8	10	6	3	3	7	5	2	8

a) Draw the arrow diagram
b) Identify critical path and find the total project duration
c) Determine total, free, and independent floats.

22. The research department of Hindustan Unilever has recommended to the marketing department to launch a shampoo of three different types. The marketing manager has to decide one of the types of shampoo to be launched under the following estimated payoffs for various levels of sales:

Types of Shampoo	**Estimated levels of sale(unit)**		
	15,000	**10,000**	**5,000**
Egg Shampoo	30	10	10
Clinical Shampoo	40	15	5
Delux shampoo	55	20	3

What will be the marketing manager's decision if (i) Maximin, (ii) Minimax (iii) Maximax, and (iv) Laplace