Name: Enrolment No:	

UPES

End Semester Examination, Dec 2024

Course: Optimization Techniques — **Semester: III**

Program: BBA All/ Int. BBA MBA — **Time: 03 hrs.**

Course Code: DSIT2012 — **Max. Marks: 100**

Instructions: 1. Attempt all the questions.
2. Simple calculator is allowed.

SECTION A
10Qx2M=20Marks

S. No.		Marks	CO
Q 1	Multiple Choice Questions.		CO1
i.	The objective function of a linear programming problem is: A. a constraint B. function to be optimized C. A relation between the variables D. None of these	2	
ii.	The linear inequalities or equations or restrictions on the variables of a linear programming problem are called: A. a constraint B. Decision variables C. Objective function D. None of the above	2	
iii.	The transportation problem is basically a A. Maximization model B. Minimization model C. Transshipment problem D. Iconic model	2	
iv.	In a transportation problem where the demand or requirement is equal to the available resource is known as A. Balanced transportation problem B. Regular transportation problem C. Resource allocation transportation problem D. Simple transportation model	2	
v.	A time series consists of: A. Short-term variations B. Long-term variations	2	

	C. Irregular variations D. All of the above		
vi.	For the LP problem Minimize z = 2x + 3y the coordinates of the corner points of the bounded feasible region are A(3, 3), B(20,3), C(20, 10), D(18, 12) and E(12, 12). The minimum value of z is A. 49 B. 15 C. 10 D. 05	**2**	
vii.	The purpose of simple linear regression analysis is to: A. Predict one variable from another variable B. Replace points on a scatter diagram by a straight-line C. Measure the degree to which two variables are linearly associated D. Obtain the expected value of the independent random variable for a given value of the dependent variable	**2**	
viii.	If the two series move in reverse directions and the variations in their values are always proportionate, it is said to be: A. Negative correlation B. Positive correlation C. Perfect negative correlation D. Perfect positive correlation	**2**	
ix.	Which term is most closely associated with simple exponential smoothing? A. seasonal relative B. moving average C. trend D. predictor variable	**2**	
x.	Which of the following is not an integer linear programming problem? A. pure integer B. Mixed Integer C. 0-1integer D. Continuous	**2**	
SECTION B **4Qx5M= 20 Marks**			
			CO2
2	A manufacturer has employed 5 skilled men and 10 semi-skilled men and makes two models A and B of an article. The making of one item of model A requires 2 h work by a skilled man and 2 h work by a semi-skilled man. One item of model B requires 1 h by a skilled man and 3 h by a semi-skilled man. No man is expected to work more than 8 h per day. The manufacturer's profit on an item of model A is Rs. 15 and on an item of model B is Rs. 10. How many items of each model should be made per day to maximize daily profit? Formulate and identify the key components of the above LPP.	**5**	
3	How is linear programming used in supply chain management? Give an example of a supply chain decision that can be modeled as an LPP.	**5**	

	OR What is simulation in supply chain management? Briefly describe, what are the common types of simulations used in SCM?		
4	Corner points of the bounded feasible region for an LP problem are (0, 4), (6, 0), (12, 0), (12, 16) and (0, 10). Let z=8x + 12y be the objective function. Calculate the following: (i) Minimum value of z occurs at _____ (ii) Maximum value of z occurs at _____ (iii) Maximum of z is _____ (iv) Minimum of z is _____	**5**	
5	Find the trend of production by method of a five-yearly period of moving average for the following data: Year: 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 Production (000): 125 120 135 155 150 134 152 156 162 170 182 178	**5**	
	SECTION-C **3Qx10M=30 Marks**		
			CO3
6	Solve the following LPP graphically: Minimize Z = 5x + 10y subject to the constraints $x + 2y \leq 120$ $x + y \geq 60$, $x - 2y > 0$ and $x, y \geq 0$. **OR** Solve the following IPP by cutting plane method: Maximize z = x1 + x2 subject to $3x1 + 2x2 \leq 5$ $x2 \leq 2$ x1, x2 ≥ 0 and are integers.	**10**	
7	Find the initial basic feasible solution of the following transportation problem: I II III Demand A 1 2 6 7 B 0 4 2 12 C 3 1 5 11 Supply 10 10 10 Using (i) Vogel's approximation method (ii) Least Cost Method **OR** A logistics company plans to establish warehouses to serve customers. The warehouse capacity is limited, and customer demands vary. Costs include	**10**	

fixed setup costs for warehouses and transportation costs per unit demand.

Warehouse	Fixed Cost (Rs.)	Capacity (Rs.)
W1	100000	500
W2	120000	700

Customer	Demand	Distance to W1	Distance to W2
C1	300	20	15
C2	400	25	10

Use the concept of Facility Location Problem and solve the given question.

8 A coffee shop chain wants to understand how different factors impact its monthly sales. They collect data over a 12-month period on:
1. Advertising Spend (X): The amount spent each month on advertising (in thousands of dollars).
2. Monthly Sales (Y): The monthly revenue from sales (in thousands of dollars).
Find the correlation between these two variables and comment on it.

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Month	Advertising Expenditure (X)	Monthly Sales (Y)
1	5	20
2	10	24
3	15	27
4	20	30
5	25	36
6	30	40
7	35	44
8	40	47
9	45	50
10	50	55
11	55	58
12	60	62

SECTION-D
2Qx15M= 30 Marks

CO4

9 A manufacturing company produces two types of products, Product A and Product B. Each unit of Product A generates a profit of $30, while each unit of Product B generates a profit of $40. The company wants to maximize its total profit by determining the optimal production quantities for Product A and Product B. However, production is limited by the availability of three key resources: labor hours, raw materials, and machine time. The Resource Constraints are as follows:
1. Labor Hours: Each unit of Product A requires 3 hours of labor, and each unit of Product B requires 2 hours. The company has a total of 600 labor hours available.

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2. Raw Materials: Each unit of Product A requires 3 units of raw materials, and each unit of Product B requires 5 units. The company has a total of 800 units of raw materials available.
3. Machine Time: Each unit of Product A requires 5 hours of machine time, and each unit of Product B requires 6 hours. The company has a total of 1100 hours of machine time available.

Formulate LPP and solve it using simplex method.

10 The following table gives the number of small-scale units registered with the Directorate of Industries between 2005 and 2012. Fit a straight-line trend by the method of least squares.

Year	2005	2006	2007	2008	2009	2010	2011	2012
No. of Units (in '000)	12	20	30	55	50	34	52	56

OR

A factory works a 24-hour day, 7-day week in producing four products. Since only one product can be produced at a time the factory operates a system where, throughout one day, the same product is produced (and then the next day either the same product is produced, or the factory produces a different product). The rate of production is:

Product	1	2	3	4
No. of units produced per hour worked	100	250	190	150

The only complication is that by changing from producing product 1 one day to producing product 2 the next day five working hours are lost (from the 24 hours available to produce product 2 that day) due to the necessity of cleaning certain oil tanks. To assist in planning the production for the next week the following data is available:

Product	Current stock (units)	Demand (units) for each day of the week						
		1	2	3	4	5	6	7
1	5000	1500	1700	1900	1000	2000	500	500
2	7000	4000	500	1000	3000	500	1000	2000
3	9000	2000	2000	3000	2000	2000	2000	500
4	8000	3000	2000	2000	1000	1000	500	500

Product 3 was produced on day 0. The factory is not allowed to be idle (i.e. one of the four products must be produced each day). Stockouts are not allowed. At the end of day 7 there must be (for each product) at least 1750 units in stock. If the cost of holding stock is £1.50 per unit for products 1 and 2 but £2.50 per unit for products 3 and 4 (based on the stock held at the end of each day) formulate and solve the problem of planning the production for the next week as an integer program in which all the constraints are linear.

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