Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

III SEMESTER M.C.A

END SEMESTER EXAMINATIONS, JANUARY 2021

SUBJECT: OPTIMIZATION TECHNIQUES [MCA 5040]

REVISED CREDIT SYSTEM

(06 / 01 /2021)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.

1A. Solve the following LPP using Simplex method: **5**

Maximize $Z = 5x1 + 4x2$

subject to: $6x1 + 4x2 \leq 24$

$x1 + 2x2 \leq 6$

$x2 - x1 \leq 1$

$x2 \leq 2$

$x1, x2 \geq 0$

1B. Using Analytic Hierarchy Process method, determine the best rank for Praneeth Jayram to choose the internship options. Draw the hierarchy chart and the final ranking thereafter. Praneeth is an excellent student who has bagged internship offers in three companies: C1, C2 and C3. He wishes to select one of these as his choice but not after he decides based on the criteria for selection: Internship to placement conversion and Location. He prioritizes conversion over location with the weight of 83% and 17%. Calculate the composite weight based on the chart you design to arrive at the final choice. **3**

Criterion	**C1**	**C2**	**C3**
Conversion	54.5	27.3	18.2
Location	12.9	22.7	59.4

1C. Use the Dominance property to simplify the following payoff matrix. **2**

		Player B			
		B1	**B2**	**B3**	**B4**
Player A	**A1**	18	4	6	4
	A2	6	2	13	7
	A3	11	5	17	3
	A4	7	6	12	2

2A. Farmer Whitfield is interested in planting either wheat or barley. The probabilities that the next harvest prices of these commodities increase, decrease and remain the same are 0.25, 0.45 and 0.30 respectively. If there is a price increase, wheat will fetch him a net profit of Rs. 30,000 and barley will fetch him a net profit off Rs. 10,000. If the prices remain the same, Whitfield will not benefit much whereas if the prices reduce, he will incur losses of Rs. 35,000 and Rs. 5000 for wheat and barley respectively. **5**

For the above scenario:

i. Design the decision Tree

ii. Calculate expected value for both crops and help Mohan decide which crop to plant.

2B. Solve the following LPP using graphical method: **3**

$$Z = 6x_1 + 5x_2$$

Subject to: $x_1 + x_2 \leq 5$

$$3x_1 + 2x_2 \leq 12$$

$$x_1, x_2 \geq 0;$$

2C. Write the approximation algorithm for Vertex Corner Problem. **2**

3A. Activities of a project are listed below. **5**

Activity	Time (in days)		
	Optimistic	Most likely	Pessimistic
1-2	4	6	8
1-3	2	3	10
1-4	6	8	16
2-4	1	2	3
3-4	6	7	8
3-5	6	7	14
4-6	3	5	7
4-7	4	11	12

5-7	2	4	6
6-7	2	9	10

i. Draw the project network

ii. Find the critical path.

iii. Calculate the variance and standard deviation of the project length. What is the probability that the project is completed in 19 days?

3B. Four algorithms are to be implemented on four different computers/ The cost (in rupees) of running the i^{th} job on the j^{th} machine is given below. Assign the algorithms to the different computers to minimize the cost. **3**

Algorithms/Computers	**C1**	**C2**	**C3**	**C4**
A1	15	11	13	15
A2	17	12	12	13
A3	14	15	10	14
A4	16	13	11	17

3C. Identify saddle point and value of game for the following 2-person zero sum game. Payoff is for player A. **2**

		Player B			
		B1	B2	B3	B4
Player A	A1	8	6	2	8
	A2	8	9	4	5
	A3	7	5	3	5

4A. Solve the given Allocation Problem: Sam, the proprietor of 4 stores, has purchased six boxes of fresh oranges. The estimated probability distribution of potential sales of these oranges before spoilage is different for each of the four stores. The table given below shows the estimated total expected profit at each store, when it is allocated various number of boxes. Also, note for easy administration, Sam does not want to split the boxes between stores, but is willing to distribute zero boxes to any of his stores. Find the allocation of six boxes *to maximise profit.* **5**

No. of crates	**1**	**2**	**3**	**4**
0	0	0	0	0
1	4	2	6	2
2	6	4	8	3
3	7	6	8	4

4	7	8	8	4
5	7	9	8	4
6	7	10	8	4

4B. Discuss the steps of the Evolutionary Algorithm. **3**

4C. Differentiate between setup and holding costs in an inventory model. **2**

5A. **5**

i. Describe the Laplace and Hurwicz criterion under decision making.

ii. Apply both the methods to decide which of the following companies would be needed for a person to invest to gain a maximum estimated profit:

Alternatives	**Estimated Profit**		
	Company A	**Company B**	**Company C**
A1	8000	3500	5000
A2	4500	4500	5000
A3	2000	5000	4000

5B. Company X transports a commodity from three production plants to four warehouses. The supply and the demand together with the unit transportation costs per truckload on different routes are given below. Apply ***Least Cost Rule method*** to determine the initial basic feasible solution. **3**

	W1	W2	W3	W4	**Supply**
P1	4	6	8	8	**40**
P2	6	8	6	7	**60**
P3	5	7	6	8	**50**
Demand	**20**	**30**	**50**	**50**	

5C. Differentiate between optimistic and pessimistic time estimates in PERT. **2**

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