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Second Semester MBA Degree Examination, Dec.2023/Jan.2024 Operations Research

Time: 3 hrs.

Max. Marks: 100

- Note: 1. Answer any FOUR full questions from Q.No.1 to Q.No.7.
2. Question No. 8 is compulsory.
3. M : Marks , L: Bloom's level , C: Course outcomes.
4. Use of Normal distribution table is permitted.*

			M	L	C																																										
Q.1	a.	List out the various phases of operation research.	03	L1	CO1																																										
	b.	A publisher of text books is in the process of presenting a new book to the market the book bind either cloth or hard paper. The each cloth binding book contributes Rs.30 and each paper binding book contributed Rs.25 towards profit. It takes 8 minutes to bind a cloth cover and 6 minutes to bind a paper back, the total time available for binding is 800 hours. After market survey, it is predicted that the cloth cover sales will be atleast 2000 copies but the paper back will be atleast 5000 copies, but the paper back will be atleast 5000 copies. Formulate the above problem in LPP.	07	L2	CO3																																										
	c.	Enumerate the application of operations research.	10	L1	CO1																																										
Q.2	a.	What is linear programming?	03	L2	CO1																																										
	b.	From the following game by using minimax and maximin whose pay of matrix given below also find value of game. Does the game have a saddle point? <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tr> <td colspan="2"></td> <td colspan="5" style="text-align: center;">Player B</td> </tr> <tr> <td style="text-align: center;">Player A</td> <td></td> <td style="text-align: center;">B₁</td> <td style="text-align: center;">B₂</td> <td style="text-align: center;">B₃</td> <td style="text-align: center;">B₄</td> <td style="text-align: center;">B₅</td> </tr> <tr> <td style="text-align: center;">A₁</td> <td></td> <td style="text-align: center;">-2</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">5</td> <td style="text-align: center;">3</td> </tr> <tr> <td style="text-align: center;">A₂</td> <td></td> <td style="text-align: center;">3</td> <td style="text-align: center;">2</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> <td style="text-align: center;">2</td> </tr> <tr> <td style="text-align: center;">A₃</td> <td></td> <td style="text-align: center;">-4</td> <td style="text-align: center;">-3</td> <td style="text-align: center;">0</td> <td style="text-align: center;">-2</td> <td style="text-align: center;">6</td> </tr> <tr> <td style="text-align: center;">A₄</td> <td></td> <td style="text-align: center;">5</td> <td style="text-align: center;">3</td> <td style="text-align: center;">-4</td> <td style="text-align: center;">2</td> <td style="text-align: center;">6</td> </tr> </table>			Player B					Player A		B ₁	B ₂	B ₃	B ₄	B ₅	A ₁		-2	0	0	5	3	A ₂		3	2	1	2	2	A ₃		-4	-3	0	-2	6	A ₄		5	3	-4	2	6	07	L3	CO3
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c.		Minimize $z = 2x_1 + 3x_2$ Subject to the constraints : (i) $x_1 + x_2 \leq 30$ (ii) $x_2 \geq 3$ (iii) $0 \leq x_2 \leq 12$ (iv) $0 \leq x_1 \leq 20$ (v) $x_1 - x_2 \geq 0$ and $x_1, x_2 \geq 0$	10	L3	CO3																																										
Q.3	a.	What do you understand by Decision Tree?	03	L3	CO1																																										
	b.	Determine the initial basic feasible solution for the following transportation problem using Vogel Approximation Model (VAM). <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tr> <td></td> <td style="text-align: center;">D₁</td> <td style="text-align: center;">D₂</td> <td style="text-align: center;">D₃</td> <td style="text-align: center;">D₄</td> <td style="text-align: center;">Supply</td> </tr> <tr> <td style="text-align: center;">S₁</td> <td style="text-align: center;">2</td> <td style="text-align: center;">3</td> <td style="text-align: center;">11</td> <td style="text-align: center;">7</td> <td style="text-align: center;">6</td> </tr> <tr> <td style="text-align: center;">S₂</td> <td style="text-align: center;">1</td> <td style="text-align: center;">0</td> <td style="text-align: center;">6</td> <td style="text-align: center;">2</td> <td style="text-align: center;">1</td> </tr> <tr> <td style="text-align: center;">S₃</td> <td style="text-align: center;">5</td> <td style="text-align: center;">8</td> <td style="text-align: center;">3</td> <td style="text-align: center;">2</td> <td style="text-align: center;">10</td> </tr> <tr> <td style="text-align: center;">Demand</td> <td style="text-align: center;">7</td> <td style="text-align: center;">5</td> <td style="text-align: center;">3</td> <td style="text-align: center;">2</td> <td style="text-align: center;">17</td> </tr> </table>		D ₁	D ₂	D ₃	D ₄	Supply	S ₁	2	3	11	7	6	S ₂	1	0	6	2	1	S ₃	5	8	3	2	10	Demand	7	5	3	2	17	07	L2	CO3												
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c.		Briefly discuss the Operations Research models.	10	L2	CO3																																										

Q.4	a.	What are the objectives of Game Theory?	03	L3	CO3																																				
	b.	In a game of matching coins Player-A wins Rs.8 if both the coins shows heads and Rs.1 if both are tails. Player-B wins Rs.3 when one coin do not match given the choice of being Player-A or Player-B. Find the best strategies and value of the game.	07	L3	CO3																																				
	c.	Determine the initial basic feasible solutions to the following transportation problem by using (i) NWCM (ii) LCM. <table border="1" data-bbox="316 405 890 629"> <thead> <tr> <th>Destination</th> <th>D₁</th> <th>D₂</th> <th>D₃</th> <th>Supply</th> </tr> </thead> <tbody> <tr> <th>Source</th> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>S₁</td> <td>6</td> <td>4</td> <td>1</td> <td>50</td> </tr> <tr> <td>S₂</td> <td>3</td> <td>8</td> <td>7</td> <td>40</td> </tr> <tr> <td>S₃</td> <td>4</td> <td>4</td> <td>2</td> <td>60</td> </tr> <tr> <td>Demand</td> <td>20</td> <td>95</td> <td>35</td> <td></td> </tr> </tbody> </table>	Destination	D ₁	D ₂	D ₃	Supply	Source					S ₁	6	4	1	50	S ₂	3	8	7	40	S ₃	4	4	2	60	Demand	20	95	35		10	L2	CO3						
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Q.5	a.	What is meant by unbalanced transportation problem? How to solve unbalanced transportation problem?	03	L2	CO1																																				
	b.	A department of a company has 5 employees with 5 jobs to be performed the time (in hours) that each man takes to perform each job is given in the effectiveness matrix. <p style="text-align: center;">Employees</p> <table border="1" data-bbox="331 913 746 1128"> <thead> <tr> <th></th> <th>I</th> <th>II</th> <th>III</th> <th>IV</th> <th>V</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>10</td> <td>5</td> <td>13</td> <td>15</td> <td>16</td> </tr> <tr> <td>B</td> <td>3</td> <td>9</td> <td>18</td> <td>13</td> <td>6</td> </tr> <tr> <td>Jobs C</td> <td>10</td> <td>7</td> <td>2</td> <td>2</td> <td>2</td> </tr> <tr> <td>D</td> <td>7</td> <td>11</td> <td>9</td> <td>7</td> <td>12</td> </tr> <tr> <td>E</td> <td>7</td> <td>9</td> <td>10</td> <td>4</td> <td>12</td> </tr> </tbody> </table> <p>How should the jobs be allocated one per employee, so as to maximize the total man-hours?</p>		I	II	III	IV	V	A	10	5	13	15	16	B	3	9	18	13	6	Jobs C	10	7	2	2	2	D	7	11	9	7	12	E	7	9	10	4	12	07	L2	CO3
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c.	Listed in the table are the activities and sequencing necessary for a maintenance job in the heat exchangers in a refinery. <table border="1" data-bbox="320 1263 1193 1697"> <thead> <tr> <th>Activity</th> <th>Description</th> <th>Predecessor Activity</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>Dismantle pipe connections</td> <td>-</td> </tr> <tr> <td>B</td> <td>Dismantle heats, closure and floting front</td> <td>A</td> </tr> <tr> <td>C</td> <td>Remove tube bundle</td> <td>B</td> </tr> <tr> <td>D</td> <td>Clean Bolts</td> <td>B</td> </tr> <tr> <td>E</td> <td>Clean heater and floating head front</td> <td>B</td> </tr> <tr> <td>F</td> <td>Clean tube bundle</td> <td>C</td> </tr> <tr> <td>G</td> <td>Clean shell</td> <td>C</td> </tr> <tr> <td>H</td> <td>Replace tube bundle</td> <td>k, g</td> </tr> <tr> <td>I</td> <td>Prepare shell pressure test</td> <td>D, E, H</td> </tr> <tr> <td>J</td> <td>Prepare tube pressure test and reassemble</td> <td>I</td> </tr> </tbody> </table> <p>Draw a network diagram of activities for the project.</p>	Activity	Description	Predecessor Activity	A	Dismantle pipe connections	-	B	Dismantle heats, closure and floting front	A	C	Remove tube bundle	B	D	Clean Bolts	B	E	Clean heater and floating head front	B	F	Clean tube bundle	C	G	Clean shell	C	H	Replace tube bundle	k, g	I	Prepare shell pressure test	D, E, H	J	Prepare tube pressure test and reassemble	I	10	L4	CO4				
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Q.6	a.	Define PERT & CPM.	3	L4	CO2																																				
	b.	Describe the phases of project management.	7	L4	CO2																																				

	c.	Solve the following transportation problem, using LCM for IBFS and use modified distribution method to check, whether solution is optimal or not. Destination	10	L3	CO3																																				
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Q.7	a.	What do you understand by saddle point?	03	L1	CO1																																				
	b.	Find the optimal strategy and value of the game using dominance rule for the following game:	07	L3	CO3																																				
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	c.	Describe the characteristics of operations research.	10	L1	CO2																																				
Q.8		Case Study (Compulsory) : Solve the transportation when unique transportation cost, demand and supply is given below.	20	L3	CO3																																				
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