

# CBCS SCHEME

USN

--	--	--	--	--	--	--	--	--	--

22MBA24

## 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																																										
<b>Q.1</b>	<b>a.</b>	List out the various phases of operation research.	03	L1	CO1																																										
	<b>b.</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																																										
	<b>c.</b>	Enumerate the application of operations research.	10	L1	CO1																																										
<b>Q.2</b>	<b>a.</b>	What is linear programming?	03	L2	CO1																																										
	<b>b.</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?  <div style="text-align: center; margin: 10px 0;"> <table border="1" style="margin: auto;"> <tr> <td colspan="2"></td> <td colspan="5">Player B</td> </tr> <tr> <td>Player A</td> <td></td> <td>B<sub>1</sub></td> <td>B<sub>2</sub></td> <td>B<sub>3</sub></td> <td>B<sub>4</sub></td> <td>B<sub>5</sub></td> </tr> <tr> <td>A<sub>1</sub></td> <td></td> <td>-2</td> <td>0</td> <td>0</td> <td>5</td> <td>3</td> </tr> <tr> <td>A<sub>2</sub></td> <td></td> <td>3</td> <td>2</td> <td>1</td> <td>2</td> <td>2</td> </tr> <tr> <td>A<sub>3</sub></td> <td></td> <td>-4</td> <td>-3</td> <td>0</td> <td>-2</td> <td>6</td> </tr> <tr> <td>A<sub>4</sub></td> <td></td> <td>5</td> <td>3</td> <td>-4</td> <td>2</td> <td>6</td> </tr> </table> </div>			Player B					Player A		B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>	B <sub>4</sub>	B <sub>5</sub>	A <sub>1</sub>		-2	0	0	5	3	A <sub>2</sub>		3	2	1	2	2	A <sub>3</sub>		-4	-3	0	-2	6	A <sub>4</sub>		5	3	-4	2	6	07	L3	CO3
			Player B																																												
Player A		B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>	B <sub>4</sub>	B <sub>5</sub>																																									
A <sub>1</sub>		-2	0	0	5	3																																									
A <sub>2</sub>		3	2	1	2	2																																									
A <sub>3</sub>		-4	-3	0	-2	6																																									
A <sub>4</sub>		5	3	-4	2	6																																									
<b>c.</b>	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																																											
<b>Q.3</b>	<b>a.</b>	What do you understand by Decision Tree?	03	L3	CO1																																										
	<b>b.</b>	Determine the initial basic feasible solution for the following transportation problem using Vogel Approximation Model (VAM).  <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <tr> <td></td> <td>D<sub>1</sub></td> <td>D<sub>2</sub></td> <td>D<sub>3</sub></td> <td>D<sub>4</sub></td> <td>Supply</td> </tr> <tr> <td>S<sub>1</sub></td> <td>2</td> <td>3</td> <td>11</td> <td>7</td> <td>6</td> </tr> <tr> <td>S<sub>2</sub></td> <td>1</td> <td>0</td> <td>6</td> <td>2</td> <td>1</td> </tr> <tr> <td>S<sub>3</sub></td> <td>5</td> <td>8</td> <td>3</td> <td>2</td> <td>10</td> </tr> <tr> <td>Demand</td> <td>7</td> <td>5</td> <td>3</td> <td>2</td> <td>17</td> </tr> </table>		D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>	Supply	S <sub>1</sub>	2	3	11	7	6	S <sub>2</sub>	1	0	6	2	1	S <sub>3</sub>	5	8	3	2	10	Demand	7	5	3	2	17	07	L2	CO3												
		D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>	Supply																																									
S <sub>1</sub>	2	3	11	7	6																																										
S <sub>2</sub>	1	0	6	2	1																																										
S <sub>3</sub>	5	8	3	2	10																																										
Demand	7	5	3	2	17																																										
<b>c.</b>	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.	10	L2	CO3																																				
		<table border="1"> <thead> <tr> <th>Destination</th> <th>D<sub>1</sub></th> <th>D<sub>2</sub></th> <th>D<sub>3</sub></th> <th>Supply</th> </tr> </thead> <tbody> <tr> <th>Source</th> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>S<sub>1</sub></td> <td>6</td> <td>4</td> <td>1</td> <td>50</td> </tr> <tr> <td>S<sub>2</sub></td> <td>3</td> <td>8</td> <td>7</td> <td>40</td> </tr> <tr> <td>S<sub>3</sub></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 <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	Supply	Source					S <sub>1</sub>	6	4	1	50	S <sub>2</sub>	3	8	7	40	S <sub>3</sub>	4	4	2	60	Demand	20	95	35										
Destination	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	Supply																																					
Source																																									
S <sub>1</sub>	6	4	1	50																																					
S <sub>2</sub>	3	8	7	40																																					
S <sub>3</sub>	4	4	2	60																																					
Demand	20	95	35																																						
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.	07	L2	CO3																																				
	c.	Listed in the table are the activities and sequencing necessary for a maintenance job in the heat exchangers in a refinery.	10	L4	CO4																																				
		<p>Employees</p> <table border="1"> <thead> <tr> <th></th> <th>I</th> <th>II</th> <th>III</th> <th>IV</th> <th>V</th> </tr> </thead> <tbody> <tr> <th>A</th> <td>10</td> <td>5</td> <td>13</td> <td>15</td> <td>16</td> </tr> <tr> <th>B</th> <td>3</td> <td>9</td> <td>18</td> <td>13</td> <td>6</td> </tr> <tr> <th>C</th> <td>10</td> <td>7</td> <td>2</td> <td>2</td> <td>2</td> </tr> <tr> <th>D</th> <td>7</td> <td>11</td> <td>9</td> <td>7</td> <td>12</td> </tr> <tr> <th>E</th> <td>7</td> <td>9</td> <td>10</td> <td>4</td> <td>12</td> </tr> </tbody> </table> <p>Jobs</p> <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	C	10	7	2	2	2	D	7	11	9	7	12	E	7	9	10	4	12			
	I	II	III	IV	V																																				
A	10	5	13	15	16																																				
B	3	9	18	13	6																																				
C	10	7	2	2	2																																				
D	7	11	9	7	12																																				
E	7	9	10	4	12																																				
		<table border="1"> <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 floating 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 floating 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						
Activity	Description	Predecessor Activity																																							
A	Dismantle pipe connections	-																																							
B	Dismantle heats, closure and floating 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																																							
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.	10	L3	CO3																																										
		<table border="1"> <thead> <tr> <th colspan="2"></th> <th colspan="3">Destination</th> <th></th> </tr> <tr> <th colspan="2"></th> <th>D<sub>1</sub></th> <th>D<sub>2</sub></th> <th>D<sub>3</sub></th> <th>Supply</th> </tr> </thead> <tbody> <tr> <th rowspan="4">Sources</th> <th>S<sub>1</sub></th> <td>8</td> <td>6</td> <td>10</td> <td>300</td> </tr> <tr> <th>S<sub>2</sub></th> <td>12</td> <td>16</td> <td>10</td> <td>400</td> </tr> <tr> <th>S<sub>3</sub></th> <td>14</td> <td>10</td> <td>12</td> <td>300</td> </tr> <tr> <th>Demand</th> <td>450</td> <td>150</td> <td>200</td> <td></td> </tr> </tbody> </table>			Destination						D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	Supply	Sources	S <sub>1</sub>	8	6	10	300	S <sub>2</sub>	12	16	10	400	S <sub>3</sub>	14	10	12	300	Demand	450	150	200													
		Destination																																													
		D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	Supply																																										
Sources	S <sub>1</sub>	8	6	10	300																																										
	S <sub>2</sub>	12	16	10	400																																										
	S <sub>3</sub>	14	10	12	300																																										
	Demand	450	150	200																																											
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																																										
		<table border="1"> <thead> <tr> <th colspan="2"></th> <th>B<sub>1</sub></th> <th>B<sub>2</sub></th> <th>B<sub>3</sub></th> </tr> </thead> <tbody> <tr> <th>A<sub>1</sub></th> <td></td> <td>4</td> <td>6</td> <td>8</td> </tr> <tr> <th>A<sub>2</sub></th> <td></td> <td>-3</td> <td>-3</td> <td>4</td> </tr> <tr> <th>A<sub>3</sub></th> <td></td> <td>2</td> <td>-3</td> <td>4</td> </tr> </tbody> </table>			B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>	A <sub>1</sub>		4	6	8	A <sub>2</sub>		-3	-3	4	A <sub>3</sub>		2	-3	4																									
		B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>																																											
A <sub>1</sub>		4	6	8																																											
A <sub>2</sub>		-3	-3	4																																											
A <sub>3</sub>		2	-3	4																																											
	c.	Describe the characteristics of operations research.	10	L1	CO2																																										
Q.8		<p>Case Study (Compulsory) :</p> <p>Solve the transportation when unique transportation cost, demand and supply is given below.</p> <table border="1"> <thead> <tr> <th colspan="2"></th> <th>D<sub>1</sub></th> <th>D<sub>2</sub></th> <th>D<sub>3</sub></th> <th>D<sub>4</sub></th> <th>Supply</th> </tr> </thead> <tbody> <tr> <th>A<sub>1</sub></th> <td></td> <td>6</td> <td>1</td> <td>9</td> <td>3</td> <td>70</td> </tr> <tr> <th>A<sub>2</sub></th> <td></td> <td>11</td> <td>5</td> <td>2</td> <td>8</td> <td>65</td> </tr> <tr> <th>A<sub>3</sub></th> <td></td> <td>10</td> <td>12</td> <td>4</td> <td>7</td> <td>70</td> </tr> <tr> <th>Demand</th> <td></td> <td>85</td> <td>35</td> <td>50</td> <td>45</td> <td>205</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>215</td> </tr> </tbody> </table>			D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>	Supply	A <sub>1</sub>		6	1	9	3	70	A <sub>2</sub>		11	5	2	8	65	A <sub>3</sub>		10	12	4	7	70	Demand		85	35	50	45	205							215	20	L3	CO3
		D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>	Supply																																									
A <sub>1</sub>		6	1	9	3	70																																									
A <sub>2</sub>		11	5	2	8	65																																									
A <sub>3</sub>		10	12	4	7	70																																									
Demand		85	35	50	45	205																																									
						215																																									

\*\*\*\*\*