



CBCS SCHEME

MBA204

Second Semester MBA Degree Examination, Dec.2025/Jan.2026 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.

			M	L	C																													
Q.1	a.	What are the advantages of OR models?	3	L1	CO1																													
	b.	Solve the problem using Graphical method: Minimize $Z = 20x_1 + 10x_2$ Subject to the constraints: - $x_1 + 2x_2 \leq 40$ $3x_1 + x_2 \geq 30$ $4x_1 + 3x_2 \geq 60$ where $x_1, x_2 \geq 0$	7	L3	CO2																													
	c.	The manager of a flower shop promises its customers delivery within four hours on all flower orders. All flowers are purchased on the previous day and delivered to manager by 8.00 am the next morning. The daily demand for roses is as follows : <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <tr> <td style="padding: 2px;">Dozens of roses :</td> <td style="padding: 2px;">7</td> <td style="padding: 2px;">8</td> <td style="padding: 2px;">9</td> <td style="padding: 2px;">10</td> </tr> <tr> <td style="padding: 2px;">Probability :</td> <td style="padding: 2px;">0.1</td> <td style="padding: 2px;">0.2</td> <td style="padding: 2px;">0.4</td> <td style="padding: 2px;">0.3</td> </tr> </table> The manager purchases roses for Rs 10 per dozen and sells them for Rs 30. All unsold roses are donated to a local hospital. How many dozens of roses should manager order each evening to maximize its profits? What is the optimum expected profit?	Dozens of roses :	7	8	9	10	Probability :	0.1	0.2	0.4	0.3	10	L3	CO3																			
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Q.2	a.	What is degeneracy in transportation problem?	3	L1	CO1																													
	b.	Briefly discuss the phases in the (methodology) operation research.	7	L1	CO1																													
	c.	Solve the LPP by simplex method Max $z = 3x_1 + 2x_2$ STC: $x_1 + x_2 \leq 4$ $x_1 - x_2 \leq 2$ where $x_1, x_2 \geq 0$	10	L3	CO2																													
Q.3	a.	Elaborate on different types of decision-making environments.	3	L1	CO1																													
	b.	Solve the transportation problem by LCM & VAM. <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <tr> <td></td> <td style="padding: 2px;">D1</td> <td style="padding: 2px;">D2</td> <td style="padding: 2px;">D3</td> <td style="padding: 2px;">D4</td> <td style="padding: 2px;">Supply</td> </tr> <tr> <td style="padding: 2px;">S1</td> <td style="padding: 2px;">19</td> <td style="padding: 2px;">30</td> <td style="padding: 2px;">50</td> <td style="padding: 2px;">10</td> <td style="padding: 2px;">7</td> </tr> <tr> <td style="padding: 2px;">S2</td> <td style="padding: 2px;">70</td> <td style="padding: 2px;">30</td> <td style="padding: 2px;">40</td> <td style="padding: 2px;">60</td> <td style="padding: 2px;">9</td> </tr> <tr> <td style="padding: 2px;">S3</td> <td style="padding: 2px;">40</td> <td style="padding: 2px;">8</td> <td style="padding: 2px;">70</td> <td style="padding: 2px;">20</td> <td style="padding: 2px;">18</td> </tr> <tr> <td style="padding: 2px;">Demand</td> <td style="padding: 2px;">5</td> <td style="padding: 2px;">8</td> <td style="padding: 2px;">7</td> <td style="padding: 2px;">14</td> <td style="padding: 2px;">34</td> </tr> </table>		D1	D2	D3	D4	Supply	S1	19	30	50	10	7	S2	70	30	40	60	9	S3	40	8	70	20	18	Demand	5	8	7	14	34	7	L2
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	c.	Enumerate the Applications of OR models.	10	L3	CO1																													

Q.4	a.	What are the limitations in LPP?	3	L1	CO1																									
	b.	<p>A machine operator has to perform 2 operations, turning and threading, on a number of different jobs. The time required to perform these operations (in minutes) for each job is known. Determine the order in which the jobs should be processed in order to minimise the total time required to turn out all the jobs. Also find the total processing time and idle times for turning and threading operations.</p> <table border="1" data-bbox="336 474 1081 845"> <thead> <tr> <th>Job</th> <th>Time for Turning (in minutes)</th> <th>Time for Threading (in minutes)</th> </tr> </thead> <tbody> <tr><td>1</td><td>3</td><td>8</td></tr> <tr><td>2</td><td>12</td><td>10</td></tr> <tr><td>3</td><td>5</td><td>9</td></tr> <tr><td>4</td><td>2</td><td>6</td></tr> <tr><td>5</td><td>9</td><td>3</td></tr> <tr><td>6</td><td>11</td><td>1</td></tr> </tbody> </table>	Job	Time for Turning (in minutes)	Time for Threading (in minutes)	1	3	8	2	12	10	3	5	9	4	2	6	5	9	3	6	11	1	7	L2	CO3				
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	c.	<p>Find the transportation cost given problem IBFS by VAM and test for the optimality:</p> <table border="1" data-bbox="378 994 1291 1261"> <thead> <tr> <th></th> <th>D1</th> <th>D2</th> <th>D3</th> <th>Supply</th> </tr> </thead> <tbody> <tr><td>F1</td><td>8</td><td>5</td><td>6</td><td>120</td></tr> <tr><td>F2</td><td>15</td><td>10</td><td>12</td><td>80</td></tr> <tr><td>F3</td><td>3</td><td>9</td><td>10</td><td>80</td></tr> <tr><td>Demand</td><td>150</td><td>80</td><td>50</td><td>280</td></tr> </tbody> </table>		D1	D2	D3	Supply	F1	8	5	6	120	F2	15	10	12	80	F3	3	9	10	80	Demand	150	80	50	280	10	L3	CO2
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Q.5	a.	What is pure strategy and mixed strategy?	3	L1	CO1																									
	b.	<p>A company manufactures two types of leather belts; A and B. Profits on two types of belts are 40 and 30 paise per belt respectively. Each belt of type A requires twice as much time as required by belt B, the company could make 1000 belts per day. The supply of leather is sufficient for only 800 belts per day. Belt A requires a fancy buckle, and only 400 fancy buckles are available for this per day. For belt B are only 700 buckles available per day. How should the company manufacture 2 types of belts in order to have maximum overall profit.</p>	7	L2	CO3																									
	c.	<p>Tasks A, B, C, D, E, F, G, H, I constitute a project. The precedence relationships are $A < D$; $A < E$; $B < F$; $D < F$; $C < G$; $C < H$; $F < I$; $G < I$. Draw a network to represent the project and find the minimum time of completion of the project when time in days, of each tasks is as follows:</p> <table border="1" data-bbox="336 1944 1291 2122"> <thead> <tr> <th>Tasks:</th> <th>A</th> <th>B</th> <th>C</th> <th>D</th> <th>E</th> <th>F</th> <th>G</th> <th>H</th> <th>I</th> </tr> </thead> <tbody> <tr> <th>Time:</th> <td>8</td> <td>10</td> <td>8</td> <td>10</td> <td>16</td> <td>17</td> <td>18</td> <td>14</td> <td>9</td> </tr> </tbody> </table>	Tasks:	A	B	C	D	E	F	G	H	I	Time:	8	10	8	10	16	17	18	14	9	10	L4	CO4					
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Q.6	a.	Write assumptions under sequencing models.	3	L1	CO1																									
	b.	<p>A small machine shop has 4 jobs to be assigned to 4 machines. The following matrix indicates the cost of assigning each of the 4 jobs to each of the 4 machines. Obtain the optimum assignment of the jobs to machines, in order to minimise the total assignment cost.</p> <table border="1" data-bbox="336 2404 892 2656"> <thead> <tr> <th></th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr><td>A</td><td>10</td><td>12</td><td>19</td><td>11</td></tr> <tr><td>B</td><td>5</td><td>10</td><td>7</td><td>8</td></tr> <tr><td>C</td><td>12</td><td>14</td><td>13</td><td>11</td></tr> <tr><td>D</td><td>8</td><td>15</td><td>11</td><td>9</td></tr> </tbody> </table>		1	2	3	4	A	10	12	19	11	B	5	10	7	8	C	12	14	13	11	D	8	15	11	9	7	L3	CO3
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	<p>c. The products are to be transported from Factory A, B, C to destination D1, D2, D3 and D4. The factory capacities are 1000, 700, and 900. The destination requirements are 900, 800, 500 and 400. The unit transportation cost from various factories to destinations are given in the table. The unit returns from the factories are Rs. 8, 7, 9 Solve the transportation problem for maximisation by NWCM & VAM.</p> <table border="1" data-bbox="415 819 1213 1056"> <thead> <tr> <th></th> <th>D1</th> <th>D2</th> <th>D3</th> <th>D4</th> </tr> </thead> <tbody> <tr> <th>A</th> <td>2</td> <td>2</td> <td>2</td> <td>4</td> </tr> <tr> <th>B</th> <td>3</td> <td>5</td> <td>3</td> <td>2</td> </tr> <tr> <th>C</th> <td>4</td> <td>3</td> <td>2</td> <td>1</td> </tr> </tbody> </table>		D1	D2	D3	D4	A	2	2	2	4	B	3	5	3	2	C	4	3	2	1	10	L3	CO2			
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Q.7	a. Write the difference between PERT and CPM.	3	L2	CO4																							
	<p>b. In a toy manufacturing company, suppose the product acceptance probabilities are not known but the following data is known:</p> <table border="1" data-bbox="327 1299 1360 1697"> <thead> <tr> <th rowspan="2">Product Acceptance (Nature)</th> <th colspan="3">Anticipated First Year Profit ('000 Rs)</th> </tr> <tr> <th colspan="3">Product Line (course of action)</th> </tr> <tr> <th></th> <th>Full</th> <th>Partial</th> <th>Minimal</th> </tr> </thead> <tbody> <tr> <th>Good</th> <td>8</td> <td>70</td> <td>50</td> </tr> <tr> <th>Fair</th> <td>50</td> <td>45</td> <td>40</td> </tr> <tr> <th>Poor</th> <td>-25</td> <td>-10</td> <td>0</td> </tr> </tbody> </table> <p>Determine the optimal decision under each of the following decision criteria and show how to arrive at it: (a) Maximax, (b) Maximin, (c) Equal likelihood</p>	Product Acceptance (Nature)	Anticipated First Year Profit ('000 Rs)			Product Line (course of action)				Full	Partial	Minimal	Good	8	70	50	Fair	50	45	40	Poor	-25	-10	0	7	L3	CO3
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	<p>c. Solve the following game using graphical method:</p> <table border="1" data-bbox="327 1964 726 2332"> <thead> <tr> <th></th> <th>B1</th> <th>B2</th> </tr> </thead> <tbody> <tr> <th>A1</th> <td>-6</td> <td>7</td> </tr> <tr> <th>A2</th> <td>4</td> <td>-5</td> </tr> <tr> <th>A3</th> <td>-1</td> <td>-2</td> </tr> <tr> <th>A4</th> <td>-2</td> <td>5</td> </tr> <tr> <th>A5</th> <td>7</td> <td>-6</td> </tr> </tbody> </table>		B1	B2	A1	-6	7	A2	4	-5	A3	-1	-2	A4	-2	5	A5	7	-6	10	L3	CO3					
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Compulsory Questions

Q.8

A small project involves 7 activities, and their time estimates are listed in the following table. Activities are identified by their beginning (i) and ending (j) node numbers.

Activities:	Optimistic time, t_0 :	Most likely time, t_m :	Pessimistic time, t_p :
1 – 2	1	1	7
1 – 3	1	4	7
1 – 4	2	2	8
2 – 5	1	1	1
3 – 5	2	5	14
4 – 6	2	5	8
5 – 6	3	6	15

- Draw the network diagram of the activities in the project.
- Find the expected duration and variance for each activity. What is the expected project length?
- Calculate the variance and standard deviation of the project length. What is probability that the project will be completed
- at least 4 weeks earlier than expected time.

Given:

Z :	0.50	0.67	1.00	1.33	2.00
Prob. :	0.3085	0.2514	0.1587	0.0918	0.0228
