

15UME 504 – OPERATION RESEARCH – QUESTION BANK

UNIT 1 – LINEAR MODEL		
PART A		
1.	Which one of the following can be made an optimal solution? a) Feasible solution b) Degenerate solution c) Unbounded solution d) None of the above	(Remember)
2.	If a constraint with = type, then _____ variable should be added a) Slack b) Surplus c) Artificial d) Decision	(Remember)
3.	The intersection of key row and key column element is called _____ a) Pivot element b) Key element c) Both A & B d) None of the above	(Remember)
4.	To apply the simplex method to solve an LP problem, all the R.H.S values should be _____ a) Positive b) Negative c) Either A or B d) Equal to zero	(Remember)
5.	Big M method also known as _____ method a) Simplex b) Graphical c) Penalty d) Dual simplex	(Remember)
6.	LP model is based on the assumptions of ----- a) Proportionality b) Additivity c) Certainty d) All of the above	(Remember)
7.	Any solution to a LPP which satisfies the non- negativity restrictions of the LPP is called its ----- a) Unbounded solution b) Optimal solution c) Feasible solution d) Both A & B	(Remember)
8.	Graphical method can be applied to solve a LPP when there are only ----- variable a) One b) More than One c) Two d) Three	(Remember)
PART B		
1.	Explain the term feasible solution.	(Understand)
2.	Show the applications of OR.	(Understand)
3.	Explain the term surplus variable.	(Understand)
4.	Explain dual problem of LP.	(Understand)
5.	Explain the term optimal solution.	(Understand)
6.	Illustrate the limitations of graphical method of solving LPP.	(Understand)
7.	Explain the term feasible region.	(Understand)
8.	Explain the term optimal solution.	(Understand)

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PART C																									
1.	<p>A paper mill produces 2 grades of paper namely X and Y. Because of raw material restrictions, it cannot produce more than 400 tonnes of grade X and 300 tonnes of grade Y in a week. There are 160 production hours in a week. It requires 0.2 and 0.4 hours to produce a ton of products X and Y respectively with corresponding profits of Rs.200 and Rs. 500 per ton. Formulate the above as a LPP to maximize profit.</p>	(8 Marks) (Apply)																							
2.	<p>A firm manufactures two types of products A & B, and sells them at a unit profit of Rs.2 on A and Rs. 3 on B. Each product is processed on two machines G & H. One unit of the type A requires 1 min. of processing time on G and 2 min on H. One unit of type B requires 1 min of processing time on each of G & H. The machine G is available for not more than 6 h and 40 mins, while H is available for not more than 10 hours during any day. Formulate the LPP o maximize profit.</p>	(8 Marks) (Apply)																							
3.	<p>Use Graphical method to solve the following LP problem to</p> <p align="center">Maximize $Z = 6X_1 + 5X_2$</p> <p align="center">Subject to $X_1 + 5X_2 \leq 5$</p> <p align="center">$3X_1 + 2X_2 \leq 12$</p> <p align="center">$X_1, X_2 \geq 0$</p>	(8 Marks) (Apply)																							
4.	<p>Use Simplex method to formulate the following LP problem and find out initial basic feasible solution.</p> <p align="center">Maximize $Z = 3X_1 + 2X_2 + 5X_3$</p> <p align="center">Subject to $X_1 + 4X_2 \leq 420$</p> <p align="center">$3X_1 + 2X_3 \leq 460$</p> <p align="center">$X_1 + 2X_2 + X_3 \leq 430$</p> <p align="center">$X_1, X_2 \geq 0$</p>	(8 Marks) (Apply)																							
5.	<p>A firm produces three products. These products are processed on three different machines. The time required to manufacture one unit of each of the three products and daily capacity of the three machines are given in the table below:</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th rowspan="2">Machine</th> <th colspan="3">Time per unit (minutes)</th> <th rowspan="2">Machine capacity (min/day)</th> </tr> <tr> <th>Product 1</th> <th>Product 2</th> <th>Product 3</th> </tr> </thead> <tbody> <tr> <td>M1</td> <td align="center">2</td> <td align="center">3</td> <td align="center">2</td> <td align="center">440</td> </tr> <tr> <td>M2</td> <td align="center">4</td> <td align="center">--</td> <td align="center">3</td> <td align="center">470</td> </tr> <tr> <td>M3</td> <td align="center">2</td> <td align="center">5</td> <td align="center">--</td> <td align="center">430</td> </tr> </tbody> </table> <p>It is required to determine the number of units to be manufactured for each product daily. The profit per unit for product 1, 2 and 3 is Rs.4, Rs.3 and Rs.6 respectively. It is assumed that all the amounts produced are consumed in the market. Formulate the mathematical for the problem.</p>	Machine	Time per unit (minutes)			Machine capacity (min/day)	Product 1	Product 2	Product 3	M1	2	3	2	440	M2	4	--	3	470	M3	2	5	--	430	(8 Marks) (Apply)
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M1	2	3	2	440																					
M2	4	--	3	470																					
M3	2	5	--	430																					

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UNIT 2 – TRANSPORTATION AND ASSIGNMENT MODEL

PART A

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1.	VAM stands for _____ a) Vogel's Approximation Method b) Voges Approximation Method c) Vowel's Approximation Method d) Volt's Approximation Method	(Remember)
2.	How do you convert unbalanced TP into balanced TP by adding _____ a) Dummy activity b) Dummy row c) Dummy column d) Neither Dummy row / Dummy column	(Remember)
3.	MODI stands for _____ a) Modified Distribution b) Maximum distribution c) Minimum distribution d) Medium distribution	(Remember)
4.	MODI method is used to obtain _____ a) Optimal solution b) Optimality test c) Both A & B d) None of the above	(Remember)
5.	TSP stands for _____ a) Transportation Problem b) Travelling Salesman Problem c) Travelling Schedule Problem d) Task Scheduling Problem	(Remember)
6.	Degeneracy in an $m \times n$ transportation problem occurs when the number of occupied cells is less than _____ a) $m-n-1$ b) $m+n+1$ c) $m+n-1$ d) $2m+3n-1$	(Remember)
7.	In a travelling salesman problem, the optimal solution is determined by using ____ a) Johnson's algorithm b) Simplex algorithm c) Transportation algorithm d) Assignment algorithm	(Remember)
8.	8 In an assignment problem, if the number of jobs are not equal to the number of resources, it means that the problem is _____ a) Not optimal b) Not balanced c) Not feasible d) Not ideal	(Remember)

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PART B																																										
1.	Explain transportation model	(Understand)																																								
2.	Explain balanced assignment problem.	(Understand)																																								
3.	Explain unbalanced transportation problem. How do you balance it?	(Understand)																																								
4.	Explain travelling salesman problem	(Understand)																																								
5.	Explain the methods to find basic feasible solution of a transportation problem	(Understand)																																								
6.	Compare transportation model and assignment model.	(Understand)																																								
7.	If each entry of the cell is increased by 3 in a 4*4 assignment problem, what is the effect in optimal value?	(Understand)																																								
8.	Explain the conditions for optimal solution reached in a travelling salesman problem.	(Understand)																																								
PART C																																										
1.	<p>Find the basic feasible solution for the following transportation problem using i) North-West Corner Rule</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="2"></th> <th colspan="4" style="text-align: center;">To</th> <th style="text-align: center;">Supply</th> </tr> <tr> <th colspan="2"></th> <th style="text-align: center;">4</th> <th style="text-align: center;">6</th> <th style="text-align: center;">8</th> <th style="text-align: center;">8</th> <th></th> </tr> </thead> <tbody> <tr> <th rowspan="3" style="text-align: right;">From</th> <th style="text-align: right;">O₁</th> <td style="text-align: center;">4</td> <td style="text-align: center;">6</td> <td style="text-align: center;">8</td> <td style="text-align: center;">8</td> <td style="text-align: center;">40</td> </tr> <tr> <th style="text-align: right;">O₂</th> <td style="text-align: center;">6</td> <td style="text-align: center;">8</td> <td style="text-align: center;">6</td> <td style="text-align: center;">7</td> <td style="text-align: center;">60</td> </tr> <tr> <th style="text-align: right;">O₃</th> <td style="text-align: center;">5</td> <td style="text-align: center;">7</td> <td style="text-align: center;">6</td> <td style="text-align: center;">8</td> <td style="text-align: center;">50</td> </tr> <tr> <th colspan="2" style="text-align: right;">Demand</th> <td style="text-align: center;">20</td> <td style="text-align: center;">30</td> <td style="text-align: center;">50</td> <td style="text-align: center;">50</td> <td></td> </tr> </tbody> </table>			To				Supply			4	6	8	8		From	O ₁	4	6	8	8	40	O ₂	6	8	6	7	60	O ₃	5	7	6	8	50	Demand		20	30	50	50		(8 Marks) (Apply)
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PART B																																												
1.	Explain the three main phases of project.	(Understand)																																										
2.	List some network scheduling techniques.	(Understand)																																										
3.	Explain optimistic time and pessimistic time.	(Understand)																																										
4.	Explain critical path and shortest path.	(Understand)																																										
5.	Explain critical path.	(Understand)																																										
6.	Explain maximal flow model.	(Understand)																																										
7.	Write and explain the formula for computing expected duration and expected variation in PERT.	(Understand)																																										
8.	Compare CPM and PERT.	(Understand)																																										
PART C																																												
1.	<p>Consider the details of a distance network as shown below.</p> <p>(i) Construct a project network</p> <p>(ii) Determine the minimal spanning tree from node 1 to 5</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Activity</th> <th>1-2</th> <th>1-3</th> <th>1-4</th> <th>2-3</th> <th>2-5</th> <th>3-4</th> <th>3-5</th> <th>4-5</th> </tr> </thead> <tbody> <tr> <td>Distance (meters)</td> <td>10</td> <td>12</td> <td>25</td> <td>13</td> <td>22</td> <td>18</td> <td>20</td> <td>24</td> </tr> </tbody> </table>	Activity	1-2	1-3	1-4	2-3	2-5	3-4	3-5	4-5	Distance (meters)	10	12	25	13	22	18	20	24	(8 Marks) (Apply)																								
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3.	Consider the details of a distance network as shown below. (i) Construct a project network (ii) Determine the shortest path from node 0 to 5	(8 Marks) (Apply)																																								
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1-4	6	30	12																																							
2-5	2	8	5																																							
2-6	5	17	11																																							
3-6	3	15	6																																							
4-7	3	27	9																																							
5-7	1	7	4																																							
6-7	2	8	5																																							
5.	Consider the details of a distance network (months) as shown below. (i) Construct a project network (ii) Determine the critical path with its duration	(8 Marks) (Apply)																																								
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 5px;">Activity</td> <td style="padding: 5px;">1-2</td> <td style="padding: 5px;">1-3</td> <td style="padding: 5px;">1-4</td> <td style="padding: 5px;">2-3</td> <td style="padding: 5px;">2-6</td> <td style="padding: 5px;">3-5</td> <td style="padding: 5px;">3-6</td> <td style="padding: 5px;">4-5</td> <td style="padding: 5px;">5-6</td> </tr> <tr> <td style="padding: 5px;">Time duration</td> <td style="padding: 5px;">23</td> <td style="padding: 5px;">8</td> <td style="padding: 5px;">20</td> <td style="padding: 5px;">16</td> <td style="padding: 5px;">24</td> <td style="padding: 5px;">18</td> <td style="padding: 5px;">4</td> <td style="padding: 5px;">19</td> <td style="padding: 5px;">10</td> </tr> </table>			Activity	1-2	1-3	1-4	2-3	2-6	3-5	3-6	4-5	5-6	Time duration	23	8	20	16	24	18	4	19	10																				
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15UME 504 – OPERATION RESEARCH – QUESTION BANK

UNIT 4 – INVENTORY AND REPLACEMENT MODEL

PART A

1.	The inventory may be categorized as a) Raw materials inventory b) In-process inventory c) Finished goods inventory d) All the above	(Remember)
2.	The inventory needs to be maintained to decrease the _____ a) Shortage costs b) Setup costs c) Loss of goodwill d) All the above	(Remember)
3.	When the demand in practical situation and is not known accurately then the model is called as _____ a) Probabilistic model b) Deterministic model c) Uniform model d) Variable model	(Remember)
4.	Which of the following cost always increases? a) Capital cost b) Maintenance cost c) Resale value d) None of the above	(Remember)
5.	In which replacement, the item is replaced at a particular interval of time expecting its failure? a) Individual replacement b) Group replacement c) Individual / Group replacement d) None of the above	(Remember)
6.	Which of the following is an inventory management technique? a) HML analysis b) VED analysis c) ABC analysis d) All the above	(Remember)
7.	The capital cost items are replaced at the end of 'n' years when the _____ cost at the end of 'n' years is minimum. a) Running cost b) Average cost c) Maintenance cost d) Capital cost	(Remember)
8.	Average cost of replacement is _____ a) $P(n) / n$ b) $P(n) / R_n$ c) $P(n) / \sum R_n$ d) $P(n) / C$	(Remember)

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PART B																													
1.	Explain inventory.	(Understand)																											
2.	Explain buffer stock or safety stock.	(Understand)																											
3.	Classify the types of replacement methods.	(Understand)																											
4.	Explain individual replacement with an example	(Understand)																											
5.	Show the different inventory management techniques.	(Understand)																											
6.	Explain economic order quantity.	(Understand)																											
7.	Show the different inventory management techniques.	(Understand)																											
8.	Outline any two reasons for the replacement of an item.	(Understand)																											
PART C																													
1.	Describe the various selective inventory control techniques in detail.	(8 Marks) (Understand)																											
2.	List out the step by step procedure for ABC analysis in inventory control.	(8 Marks) (Understand)																											
3.	<p>The cost of a machine is Rs. 6100 and its scrap value is only Rs. 100. The maintenance cost are found to be</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">Year</th> <th style="text-align: center;">1</th> <th style="text-align: center;">2</th> <th style="text-align: center;">3</th> <th style="text-align: center;">4</th> <th style="text-align: center;">5</th> <th style="text-align: center;">6</th> <th style="text-align: center;">7</th> <th style="text-align: center;">8</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Maintenance Cost (in Rs)</td> <td style="text-align: center;">100</td> <td style="text-align: center;">250</td> <td style="text-align: center;">400</td> <td style="text-align: center;">600</td> <td style="text-align: center;">900</td> <td style="text-align: center;">1250</td> <td style="text-align: center;">1600</td> <td style="text-align: center;">2000</td> </tr> </tbody> </table> <p>When the machine should be replaced?</p>	Year	1	2	3	4	5	6	7	8	Maintenance Cost (in Rs)	100	250	400	600	900	1250	1600	2000	(8 Marks) (Apply)									
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Maintenance Cost (in Rs)	100	250	400	600	900	1250	1600	2000																					
4.	<p>A machine owner finds from his past records that the costs per year of maintaining a machine whose purchase price is Rs. 6000 are given below. Determine at what age the machine should be replaced.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">Year</th> <th style="text-align: center;">1</th> <th style="text-align: center;">2</th> <th style="text-align: center;">3</th> <th style="text-align: center;">4</th> <th style="text-align: center;">5</th> <th style="text-align: center;">6</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Maintenance Cost (in Rs)</td> <td style="text-align: center;">1000</td> <td style="text-align: center;">1200</td> <td style="text-align: center;">1400</td> <td style="text-align: center;">1800</td> <td style="text-align: center;">2300</td> <td style="text-align: center;">2800</td> </tr> <tr> <td style="text-align: center;">Resale Value (in Rs)</td> <td style="text-align: center;">3000</td> <td style="text-align: center;">1500</td> <td style="text-align: center;">750</td> <td style="text-align: center;">375</td> <td style="text-align: center;">200</td> <td style="text-align: center;">200</td> </tr> </tbody> </table>	Year	1	2	3	4	5	6	Maintenance Cost (in Rs)	1000	1200	1400	1800	2300	2800	Resale Value (in Rs)	3000	1500	750	375	200	200	(8 Marks) (Apply)						
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5.	<p>An Electromechanical equipment has a purchase price of Rs. 7000 its resale value and running cost are given below. When to replace the machine?</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">Year</th> <th style="text-align: center;">1</th> <th style="text-align: center;">2</th> <th style="text-align: center;">3</th> <th style="text-align: center;">4</th> <th style="text-align: center;">5</th> <th style="text-align: center;">6</th> <th style="text-align: center;">7</th> <th style="text-align: center;">8</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Running Cost (in Rs)</td> <td style="text-align: center;">2000</td> <td style="text-align: center;">2100</td> <td style="text-align: center;">2300</td> <td style="text-align: center;">2600</td> <td style="text-align: center;">3000</td> <td style="text-align: center;">3500</td> <td style="text-align: center;">4100</td> <td style="text-align: center;">4600</td> </tr> <tr> <td style="text-align: center;">Resale Value</td> <td style="text-align: center;">4000</td> <td style="text-align: center;">3000</td> <td style="text-align: center;">2200</td> <td style="text-align: center;">1600</td> <td style="text-align: center;">1400</td> <td style="text-align: center;">700</td> <td style="text-align: center;">700</td> <td style="text-align: center;">700</td> </tr> </tbody> </table>	Year	1	2	3	4	5	6	7	8	Running Cost (in Rs)	2000	2100	2300	2600	3000	3500	4100	4600	Resale Value	4000	3000	2200	1600	1400	700	700	700	(8 Marks) (Apply)
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15UME 504 – OPERATION RESEARCH – QUESTION BANK

PART C																									
6.	<p>Solve the following game.</p> <table style="margin-left: auto; margin-right: auto;"> <tr> <td colspan="2"></td> <td colspan="3" style="text-align: center;">Player B</td> </tr> <tr> <td colspan="2"></td> <td style="text-align: center;">I</td> <td style="text-align: center;">II</td> <td style="text-align: center;">III</td> </tr> <tr> <td rowspan="3" style="vertical-align: middle;">Player A</td> <td style="text-align: center;">I</td> <td style="border: 1px solid black; padding: 5px;">1</td> <td style="border: 1px solid black; padding: 5px;">7</td> <td style="border: 1px solid black; padding: 5px;">2</td> </tr> <tr> <td style="text-align: center;">II</td> <td style="border: 1px solid black; padding: 5px;">6</td> <td style="border: 1px solid black; padding: 5px;">2</td> <td style="border: 1px solid black; padding: 5px;">7</td> </tr> <tr> <td style="text-align: center;">III</td> <td style="border: 1px solid black; padding: 5px;">6</td> <td style="border: 1px solid black; padding: 5px;">1</td> <td style="border: 1px solid black; padding: 5px;">6</td> </tr> </table>			Player B					I	II	III	Player A	I	1	7	2	II	6	2	7	III	6	1	6	(8 Marks) (Apply)
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Company A	I	20	15	22																					
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10.	<p>Explain the queuing system.</p>	(8 Marks) (Understand)																							