Enrolment No:	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Term Examination, May 2019

Programme: MBA (GM) **Semester: II**
Course: Operation Research **Time: 03 hrs**
Course Code: DSQT 7002 **Max. Marks: 100**

Instructions: Simple Calculator is allowed not the scientific (991-function) one. Statistical Tables and graph sheets will be provided by SRE. Try to maintain the sequence while answering.

SECTION A

S. No.		Marks	COs
Q 1	Note: Answer the following MCQs with relevant explanation: I. A type of decision making environment could be a) Certain b) Uncertain c) Risky d) All the above II. The transportation model relies on certain assumptions. They include all of the following except a) the items must be homogeneous b) the items must be large scale c) there is only one route being used between each origin and destination d) the shipping cost per unit is the same **III.** Which of the following are supply points that a transportation model can analyze? a) Factories b) warehouses c) departments d) all of the above IV. The graphical method of LP problem uses a) Objective function equation b) constraint equation c) Linear equation d) 'b' and 'c' both V. A constrain in an LP model restricts a) A constrain in an LP value of objective function	(10*3=30)	**CO1** **CO1** **CO2** **CO1** **CO2**

	b) value of a decision variable c) value of decision variables is non -negative d) all of them		
	VI. Except to be used to minimized the costs associated with distributing good, transportation model can also be used in a) production planning b) capacity planning c) transshipment problem d) comparison of location alternative		**CO2**
	VII. If two constrains do not intersect in the positive quadrant of the graph, then a) the problem is infeasible b) the solution is inbounded c) one of the constraints is redundant d) None of the above		**CO2**
	VIII. Before the analysis of the transportation model, what data would they need to collect? a) A list of destinations b) Unit cost to ship c) A list of origins d) All of the above		**CO1**
	VIII. For maximization LP model, the simplex method is terminated when all values a) cj-zj ≤ 0 b) cj-zj>0 c) cj-zj$=0$ d) zj<0		**CO2**
	IX. The transportation model is used to determine a) what type of transportation to use (boat, truck, train or plane) to transport goods, while minimizing costs b) what day of the week goods should be transportation on to minimize costs c) how to distribute goods from multiple origins to multiple destinations to minimize total shipping costs d) how to best package goods so that they wouldn't break while transporting them		**CO2**
	X. Which of the following criteria is not used for decision making under uncertainty a) Maximin Criterion b) Maximax Criterion c) Minimax Criterion d) Minimize expected loss		**CO2**
	SECTION B		
	Attempt all 4 questions in this section:	(4*5=20)	

<table>
<tr>
<td>Q2</td>
<td>A company that operates 10hours a day manufactures two products on three sequential process. And these process parallelally operated. The following table summarizes the data of the problem:
<table>
<tr><th rowspan="2">Product</th><th colspan="3">Minutes per units</th><th rowspan="2">Unit Profit</th></tr>
<tr><th>Process 1</th><th>Process 2</th><th>Process 3</th></tr>
<tr><td>1</td><td>10</td><td>6</td><td>8</td><td>Rs. 20</td></tr>
<tr><td>2</td><td>5</td><td>20</td><td>10</td><td>Rs. 30</td></tr>
</table>
Formulate this as LPP for mix of the two products.</td>
<td>5</td>
<td>CO1
CO3</td>
</tr>
<tr>
<td>Q3.</td>
<td>Find an initial basic feasible solution for given transportation problem by using
(a) North-West corner method
(b) Least cost method
<table>
<tr><th></th><th>D_1</th><th>D_2</th><th>D_3</th><th>D_4</th><th>Supply</th></tr>
<tr><td>S_1</td><td>11</td><td>13</td><td>17</td><td>14</td><td>250</td></tr>
<tr><td>S_2</td><td>16</td><td>18</td><td>14</td><td>10</td><td>300</td></tr>
<tr><td>S_3</td><td>21</td><td>24</td><td>13</td><td>10</td><td>400</td></tr>
<tr><td>Demand</td><td>200</td><td>225</td><td>275</td><td>250</td><td></td></tr>
</table></td>
<td>5</td>
<td>CO3
&
CO4</td>
</tr>
<tr>
<td>Q4.</td>
<td>The estimated sales of proposed types of perfume are as under:
<table>
<tr><th rowspan="2">Types of perfume</th><th colspan="3">Estimated levels of sales(units)</th></tr>
<tr><th>Rs. 20,000</th><th>Rs. 10,000</th><th>Rs. 25,000</th></tr>
<tr><td>A</td><td>25</td><td>15</td><td>10</td></tr>
<tr><td>B</td><td>40</td><td>20</td><td>5</td></tr>
<tr><td>C</td><td>60</td><td>25</td><td>3</td></tr>
</table>
What will be the best alternative if a person adopts the Laplace criterion?</td>
<td>5</td>
<td>CO2</td>
</tr>
<tr>
<td>Q5</td>
<td>Solve the following LPP by graphical method
Maximize Z = 5X1 + 3X2
Subject to constraints 2X1 + X2 ≤ 1000</td>
<td>5</td>
<td>CO3
&</td>
</tr>
</table>

	$X1 \leq 400$ $X2 \leq 700$ $X1, X2 \geq 0$		**CO4**
	SECTION-C		
	Attempt any two questions in this section:	(2*15=30)	
Q6.	The initial cost of a machine is Rs. 6100 and resale value drops as the time passes. Cost data are given in the following table: **Year** 1 2 3 4 5 6 7 8 **Maintenance** 100 250 400 600 900 1200 1600 2000 **Resale Value** 800 700 600 500 400 300 200 100 When should the machine be replaced?	15	**CO2 CO3 & CO4**
Q7.	There are four expert in computer Programming. The center wishes to develop with four different App. The head of the computer center, estimates the time (in minutes) required by the different computer programmer for app designing are as follows: App / Experts: A B C D 1: 15 13 14 17 2: 11 12 15 13 3: 13 12 10 11 4: 15 17 14 16 Using Hungarian method assign the app designing suitably and calculate the minimum time required.	**15**	**CO2 & CO4 & CO5**
Q8.	A company has factories at F1, F2 and F3, which supply to warehouses at W1, W2 and W3. Weekly factory capacities are 200, 160 and 90 units, respectively. Weekly warehouse requirement are 180, 120 and 150 units, respectively. Unit shipping costs (in rupees) are as follows: W_1 W_2 W_3 Supply		

	F_1 16 20 12 200 F_2 14 8 18 160 F_3 26 24 16 90 Demand 180 120 150 450 Find the allocation from terminals to plants using Vogel's Approximation method in order to minimize total transportation cost. Also, find the optimum cost using Modified Distribution method.		
	SECTION-D **Attempt one case in this section**		
Q9.	**CASE : Tata Motors production Line**	**20**	
	The Big bazaar in Dehradun city has daily needs between 28 and 36 workers depending on the time of the day. The rush hours are between noon and 4 pm. The table below exhibits the number of workers needed at various hours when the bazaar is open. Time period — No. of workers needed 10am – 12 am — 22 12am – 2 pm — 34 2pm – 4pm — 32 4 pm – 6 pm — 26 The Big bazaar now employs 26 full time workers, but needs a few part time workers also to manage rush time. A part time worker must put in exactly 4 hours per day, but can start any time between 10 am and 2 pm. Full time workers work from 10am to 6 pm but are allowed an hour for lunch at 1 pm. Full timers thus provide 35 hours per week of productive labour time. The management of Big bazaar, limits part time hours to a maximum of 50 percent of the day's total requirement. Part timer earns Rs. 100 per day on the average, while full timers earn Rs. 225 per day in salary and benefits on the average. The management wants to set a schedule that would minimize total worker costs. Formulate this problem as an LP model to minimize total daily work force cost.		**CO2 & CO4 & CO5**
	CASE STUDY : Investment Decision During Recession		
Q10.	Mr. Sethi has Rs. 10,000 to invest in 1 of 3 options, A, B or C. The return on his investment depends on whether the economy experiences inflation, recession or no change at all. His possible returns under each economic condition are: State of nature	**20**	**CO4 & CO5**

Strategy	Inflation	Recession	No Change
A	2000	1200	1500
B	3000	800	1000
C	2500	1000	1800

What should he decide using the following criterion:

a) Pessimistic (Maximin) criterion
b) Optimistic (Minimax) criterion,
c) Equally likely criterion,
d) Hurwitz criterion,

Given: The degree of optimism (α) being 0.7

Set -2

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SECTION A

S. No.		**Marks** (10*3=30)	**COs**
Q 1	**I.** Except to be used to minimized the costs associated with distributing good, transportation model can also be used in a) production planning b) capacity planning c) transshipment problem d) comparison of location alternative		**CO1**
	II. If two constrains do not intersect in the positive quadrant of the graph, then e) the problem is infeasible f) the solution is inbounded g) one of the constraints is redundant h) None of the above		**CO1**
	III. Before the analysis of the transportation model, what data would they need ? e) A list of destinations f) Unit cost to ship g) A list of origins h) All of the above		**CO1**
	IV. For maximization LP model, the simplex method is terminated when all values e) cj-zj ≤ 0 f) cj-zj>0 g) cj-zj$=0$ h) zj<0		**CO2**

	V. The transportation model is used to determine e) what type of transportation to use (boat, truck, train or plane) to transport goods, while minimizing costs f) what day of the week goods should be transportation on to minimize costs g) how to distribute goods from multiple origins to multiple destinations to minimize total shipping costs h) how to best package goods so that they wouldn't break while transporting them		**CO2**
	VI. Which of the following criteria is not used for decision making under uncertainty e) Maximin Criterion f) Maximax Criterion g) Minimax Criterion h) Minimize expected loss		**CO2**
	VII. A type of decision making environment could be e) Certain f) Uncertain g) Risky h) All the above		**CO2**
	VIII. The transportation model relies on certain assumptions. They include all of the following except a) the items must be homogeneous e) the items must be large scale f) there is only one route being used between each origin and destination g) the shipping cost per unit is the same		**CO1**
	IX. The graphical method of LP problem uses e) Objective function equation f) constraint equation g) Linear equation h) 'b' and 'c' both		**CO1**
	X. A constrain in an LP model restricts e) A constrain in an LP value of objective function f) value of a decision variable g) value of decision variables is non -negative h) all of them		
	SECTION B		
	Attempt all 4 questions in this section:	(4*5=20)	
Q2		**5**	**CO2**

	Solve the following LPP by graphical method Minimize Z = 20X1 + 40X2 Subject to constraints 36X1 + 6X2 ≥ 108 3X1 + 12X2 ≥ 36 20X1 + 10X2 ≥ 100 X1 X2 ≥ 0		**& CO3**
Q3.	In Suvidha grocery Store, shelf space is limited and must be used effectively to increase profit. Two cereal items, a packet of Ashirbad and Pills Berry, complete for a total self-space of 60 square ft. A bucket of Asirbad occupies 2 square ft. and a packet of pills berry occupies 4 square ft. The maximum daily demand of Ashirbad and Pills Berry are 200 and 120 packets. A packet of Ashirbad net Rs. 70 profit and a packet of Pills Berry Rs. 74. Owner of Suvidha thinks that because unit profit of Pills Berry is 35% higher than Ashirbad, which amounts to allocate about to Pills Berry? Using Graphical /Simplex Method, find the optimum required unit space for both the products.		
Q4.	You work as an executive sales manager for a manufacturing company, and you currently have three salespeople on the road meeting buyers. Your salespeople are in Mumbai, Bengaluru, and Odisha; you want them to fly to three other cities: Delhi, Chennai, and Kolkata. The table below shows the cost of airplane tickets in INR between these cities. From/To | Delhi | Chennai | Kolkata Mumbai | 2500 | 4000 | 3500 Bengaluru | 4000 | 6000 | 3500 Odisha | 2000 | 4000 | 2500 Where should you send each of your salespeople in order to minimize airfare?	**5**	**CO3**
Q5	There are four expert in computer Programming. The center wishes to develop with four different App. The head of the computer center, estimates the time (in minutes) required by the different computer programmer for app designing are as follows: App | Experts: A | B | C | D 1 | 15 | 13 | 14 | 17 2 | 11 | 12 | 15 | 13 3 | 13 | 12 | 10 | 11 4 | 15 | 17 | 14 | 16 Using Hungarian method assign the app designing suitably and calculate the minimum time required.	**5**	**CO3 & CO4**

Q6.	Find an initial basic feasible solution for given transportation problem by using (a) North-West corner method (b) Least cost method D_1 D_2 D_3 D_4 Supply S_1 11 13 17 14 250 S_2 16 18 14 10 300 S_3 21 24 13 10 400 Demand 200 225 275 250	**5**	**CO3 & CO4**
	SECTION-C		
	Attempt two questions in this section:	(2*15=30)	
Q7.	The initial cost of a machine is Rs. 6100 and resale value drops as the time passes. Cost data are given in the following table: **Year** 1 2 3 4 5 6 7 8 **Maintenance** 100 250 400 600 900 1200 1600 2000 **Resale Value** 800 700 600 500 400 300 200 100 When should the machine be replaced?	15	**CO2 & CO4**
Q8.	A Company has 3 production facilities S1, S2 and S3 with production capacity of 7, 9 and 18 units (in 100's) per week of a product, respectively. These units are to be shipped to 4 warehouses D1, D2, D3 and D4 with requirement of 5, 6, 7 and 14 units (in 100's) per week, respectively. The transportation costs (in rupees) per unit between factories to warehouses are given in the table below. D_1 D_2 D_3 D_4 Capacity S_1 19 30 50 10 7 S_2 70 30 40 60 9 S_3 40 8 70 20 18 Demand 5 8 7 14 34 Find the allocation from terminals to plants using Vogel's Approximation method in order to minimize total transportation cost. Also, find the optimum cost using Modified Distribution method.	15	**CO3 & CO4**

Q9.	Mr. Sharma has Rs. 10,000 to invest in 3 different options, A, B or C. The return on his investment depends on whether the economy experiences inflation, recession or no change at all. His possible returns under each economic condition are as follows: What should he decide using the following criterion: a) Pessimistic (Maximin) criterion b) Optimistic (Minimax) criterion, c) Equally likely criterion, d) Hurwitz criterion, Given: The degree of optimism (α) being 0.8	**15**	**CO2 & CO4**

Strategy	State of nature		
	Inflation	Recession	No Change
A	5000	3200	2500
B	4000	800	1000
C	3500	1000	1800

SECTION-D
CASE STUDY

Q9.	**CASE : Investment in Agro-Business is always Profitable**	**20**	

The director of finance, for a firm cooperative is concerned about the yield per acre she can expect from this year's corn crop. The probability distribution of the yields for the current weather conditions is given below:

Yield in Kg per acre	Probability
120	0.18
140	0.26
160	0.44
180	0.12

She would like to see a simulation of the yields she might expect over the next 10 years for weather conditions similar to those she is now experiencing.

(i) Simulate the average yield she might expect per acre using the following random numbers : 20, 72, 34, 54, 30, 22, 48, 74, 76, 02

She is also interested in the effect of market-price fluctuations on the cooperative's farm revenue. She makes the estimates of per Kg prices for corn.

Price per Kg (Rs.)	Probability
2.00	0.05
2.10	0.15
2.20	0.30
2.30	0.25
2.40	0.15
2.50	0.10

(ii) Simulate the price she might expect to observe over the next 10 years using the following random number:

82, 95, 18, 96, 20, 84, 56, 11, 52, 03

CO3 & CO4 & CO5