

May - June 2023 / KT

(B.Tech) Program: Electronics and Telecommunication, Information Technology and Computer Engineering
Examination: LY Semester: VII
Course Code: ILC7055 and Course Name: Operation Research
Duration: 2.5 Hours Max. Marks: 60

Instructions:
(1) All questions are compulsory.
(2) Draw neat diagrams wherever applicable.
(3) Assume suitable data, if necessary.

		Max. Marks	CO	BT level
Q 1	Solve any six questions out of eight:	12		
i)	What is operation research? And write in brief its importance.	2	-	U
ii)	A manufacturer produces two types of models M1 & M2. Each model of type M1 requires 4 hr of grinding and 2 hr of polishing. Whereas model M2 requires 2 hr of grinding and 5 hr of polishing. The manufacturer has 2 grinders and 3 polishers. Each grinder works 60 hr a week and each polisher works 50 hr a week. Profit on model M1 is Rs 4.00 and on model M2 is Rs 5.00. How should the manufacturer allocate his production capacity to the two types of models, so that he may make the maximum profit in a week? Formulate it as linear programming problem.	2	CO1	C
iii)	Write dual of following LPP Maximize $Z = 40x_1 + 120x_2$ subject to $x_1 - 2x_2 \leq 8$ $3x_1 + 5x_2 = 90$ $15x_1 + 44x_2 \leq 660$ $x_1, x_2 \geq 0$	2	CO1	U
iv)	The arrival of a customer at a public telephone booth follows a poisson distribution with mean arrival rate of 5 customers/hour. If service time distribution is exponential with mean service rate of 8 customers/hour. Find	2	CO3	U

	out the average waiting time for customer in minutes.																						
v)	<p>A computer centre has got three expert programmers. The centre needs three application programmes to be developed. The head of the computer centre after studying carefully the programmes to be developed estimates the computer time in minutes required by the expert for the application programmes as follows.</p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">Programmer</th> <th colspan="3">Programmes</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">120</td> <td style="text-align: center;">100</td> <td style="text-align: center;">80</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">80</td> <td style="text-align: center;">90</td> <td style="text-align: center;">110</td> </tr> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">110</td> <td style="text-align: center;">140</td> <td style="text-align: center;">120</td> </tr> </tbody> </table> <p>Assign the programmers to the programmes to have the least total computer time.</p>	Programmer	Programmes			A	B	C	1	120	100	80	2	80	90	110	3	110	140	120	2	CO2	A
Programmer	Programmes																						
	A	B	C																				
1	120	100	80																				
2	80	90	110																				
3	110	140	120																				
vi)	Write short note on sequencing with proper example.	2	CO4	U																			
vii)	What is simulation? Explain with example.	2	CO5	U																			
viii)	Explain the concept of decision tree and give its advantages.	2	CO6	R																			
Q2	Solve any four questions out of six.	16																					
i)	<p>Use simplex method to</p> <p>Minimize $Z = x_1 - 3x_2 + 2x_3$</p> <p>subject to $3x_1 - x_2 + 2x_3 \leq 7$</p> <p style="padding-left: 40px;">$- 2x_1 + 4x_2 \leq 12$</p> <p style="padding-left: 40px;">$- 4x_1 + 3x_2 + 8x_3 \leq 10$</p> <p style="padding-left: 40px;">$x_1, x_2, x_3 \geq 0$</p>	4	CO1	A																			

ii)	<p>A company has factories at Nashik, Wardha and Jalgaon which supply units to warehouses at Nagpur, Pune and Mumbai. The weekly factory capacities are 200, 160 and 90 units respectively while the weekly warehouses requirements are 180, 120 and 150 units respectively. The unit shipping costs (in Rupees) are as follows. Find the minimum transportation cost using Vogel's Approximation Method.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="2"></th> <th colspan="3">Warehouses</th> </tr> <tr> <th colspan="2"></th> <th>Nagpur</th> <th>Pune</th> <th>Mumbai</th> </tr> </thead> <tbody> <tr> <th rowspan="3">Factories</th> <th>Nashik</th> <td>16</td> <td>20</td> <td>12</td> </tr> <tr> <th>Wardha</th> <td>14</td> <td>8</td> <td>18</td> </tr> <tr> <th>Jalgaon</th> <td>26</td> <td>24</td> <td>16</td> </tr> </tbody> </table>			Warehouses					Nagpur	Pune	Mumbai	Factories	Nashik	16	20	12	Wardha	14	8	18	Jalgaon	26	24	16	4	CO2	A
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iii)	<p>The production department of a company requires 3600 kg of raw material for manufacturing a particular item per year. It has been estimated that the cost of placing an order is Rs.36 and the cost of carrying inventory is 25% per year of the cost of material. The material cost is Rs. 10 per kg. Find the economic order quantity, time between successive order, variable inventory cost and yearly total cost.</p>	4	CO5	U																							
iv)	<p>Explain the differences between PERT and CPM</p>	4	CO4	U																							
v)	<p>What is game theory? Explain the terms: pure strategy, mixed strategy and saddle point.</p>	4	CO3	R																							
vi)	<p>What is decision making? Explain and differentiate decision making under the conditions of certainty and uncertainty.</p>	4	CO6	U																							
Q.3	<p>Solve any two questions out of three.</p>	16																									
i)	<p>Solve the following LPP by graphical method Maximize $Z = 20x_1 + 30x_2$ subject to $3x_1 + 3x_2 \leq 36$ $5x_1 + 2x_2 \leq 50$ $2x_1 + 6x_2 \leq 60$ $x_1, x_2 \geq 0$</p>	8	CO1	A																							
ii)	<p>There are seven jobs each of which has to go through the machines A and B</p>	8	CO4	U																							

in the order AB. Processing times in hours are given below.

Job	Machine A	Machine B
1	3	8
2	12	10
3	15	10
4	6	6
5	10	12
6	11	1
7	9	3

Determine a sequence of these jobs that will minimize the total elapsed time. Also find total elapsed time and idle time for machine B.

iii) A project schedule has the following characteristics.

Activity	Preceding Activity	Time in weeks		
		t_0	t_m	t_p
A	-	4	7	16
B	-	1	5	15
C	A	6	12	30
D	A	2	5	8
E	C	5	11	17
F	D	3	6	15
G	B	3	9	27
H	E,F	1	4	7
I	G	4	19	28

1. Construct the project network
2. Find the critical path
3. Find project completion time
4. Find variance for critical path

Q.4 Solve any two questions out of three.

8

CO4

E

16

i)	<p>Consider the following payoff matrix for two players A and B and find the best strategies for both the firms and value of 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;">B₁</td> <td style="text-align: center;">B₂</td> <td style="text-align: center;">B₃</td> </tr> <tr> <td rowspan="3" style="vertical-align: middle;">Player A</td> <td style="text-align: center;">A₁</td> <td style="text-align: center;">1</td> <td style="text-align: center;">7</td> <td style="text-align: center;">2</td> </tr> <tr> <td style="text-align: center;">A₂</td> <td style="text-align: center;">6</td> <td style="text-align: center;">2</td> <td style="text-align: center;">7</td> </tr> <tr> <td style="text-align: center;">A₃</td> <td style="text-align: center;">5</td> <td style="text-align: center;">2</td> <td style="text-align: center;">6</td> </tr> </table>			Player B					B ₁	B ₂	B ₃	Player A	A ₁	1	7	2	A ₂	6	2	7	A ₃	5	2	6	8	CO3	A
		Player B																									
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Player A	A ₁	1	7	2																							
	A ₂	6	2	7																							
	A ₃	5	2	6																							
ii)	<p>Auto vehicles arrive at a petrol pump having one petrol unit in a poisson fashion with an average of 10 units per hour. The service time is distributed exponentially with a mean of 3 minutes. Find - 1) average number of units in the system 2) average waiting time for customer 3) average length of the queue 4) the probability that a customer arriving at the pump will have to wait. 5) probability that number of units in the system is 2.</p>	8	CO3	U																							
iii)	<p>A company manufactures around 200 vehicles. Depending upon the availability of raw materials and other conditions the daily production has been varying from 196 to 204 vehicles whose probability distribution is as given below.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: left;">Production per day</td> <td>196</td> <td>197</td> <td>198</td> <td>199</td> <td>200</td> <td>201</td> <td>202</td> <td>203</td> <td>204</td> </tr> <tr> <td style="text-align: left;">Probability</td> <td>0.05</td> <td>0.09</td> <td>0.12</td> <td>0.14</td> <td>0.20</td> <td>0.15</td> <td>0.11</td> <td>0.08</td> <td>0.06</td> </tr> </table> <p>The finished vehicles are transported in a specially designed three storey lorry that can accommodate only 200 vehicles. Using the given 15 random numbers 82, 89, 78, 24, 53, 61, 18, 45, 04, 23, 50, 77, 27, 54, 10.</p> <p>Simulate the process to find out –</p> <ol style="list-style-type: none"> 1) What will be the average number of vehicles waiting in the factory? 2) What will be the average number of empty space on the lorry? 	Production per day	196	197	198	199	200	201	202	203	204	Probability	0.05	0.09	0.12	0.14	0.20	0.15	0.11	0.08	0.06	8	CO5	A			
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