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Odd Semester Examination-2022

Paper Name: Operation Research **Paper Code: BTCSE OE-23**
Time: 3 Hours **Maximum Marks: 75**
Note: Programmable calculator is not allowed.

PART –A

(All questions are compulsory) **(7 X 5 = 35)**

S. No.	Questions	Marks	Course Outcome	Blooms Level
Q.1	Find the initial basic feasible solution of the following transportation problem (Vogel`s Approximation Method).	5	CO2	L3
Q.2	Write down the dual of the following LP problem: Max $Z = 4x_1 + 2x_2$, Subject to: $-x_1 - x_2 \leq -3$, $-x_1 + x_2 \leq -2$, and $x_1 \geq 0$, $x_2 \geq 0$.	5	CO4	L3
Q.3	Construct graphical representation of the LPP Max $Z = x_1 + 2x_2$, Subject to: $x_1 + 2x_2 \leq 200$, $x_1 + x_2 \leq 150$, $x_1 \leq 60$ and $x_1 \geq 0$, $x_2 \geq 0$. Hence, find its solution.	5	CO2	L5
Q.4	A company produces two types of Hats. Each hat of the first type requires twice as much labour time as the second type. If all hats are of the second type only, the company can produce a total of 500 hats of day. The market limits daily sales of the first and second type to 150 and 250 hats. Assuming that the profits per that are Rs. 8 for type A and Rs. 5 for type B, formulate the problem as a linear programming model in order to determine the number of hats to be produced of each type so as to maximize the profit.	5	CO1	L5
Q.5	In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day. Assuming that the inter-arrival time follows an exponential distribution and the service time (the time taken to hump a train) distribution with an average 36 minutes. Calculate the following: (i) the average number of trains in the queue. (ii) the probability that the queue size exceeds 10.	5	CO3	L3
Q.6	Consider the following payoff (profit) matrix: Solve this using Hurwics criterion with $\alpha = 0.75$.	5	CO5	L3
Q.7	The occurrence of rain in a city on a day is dependent upon whether or not it rained on the previous day. If it rained on the previous day, the rain distribution is: If it did not rain on the previous day, the rain distribution is: Simulate the city`s whether for 10 days and determine by simulation the total days without rain as well as the total rainfall during the period. Use the following random numbers: 67 63 39 55 29 78 70 06 78 76 for simulation. Assume that for the first day of the simulation it had not rained the day before.	5	CO3	L5

Warehouse→ Factory↓	W_1	W_2	W_3	W_4	Factory Capacity
F_1	19	30	50	10	7
F_2	70	30	40	60	9
F_3	40	8	70	20	18
Warehouse Requirement	5	8	7	14	34

	A	B	C	D
P	5	10	18	25
Q	8	7	8	23
R	21	18	12	21
S	30	22	19	15

Event	No rain	1cm rain	2cm rain	3cm rain	4cm rain	5cm rain
Probability	0.5	0.25	0.15	0.05	0.03	0.02

Event	No rain	1cm rain	2cm rain	3cm rain
Probability	0.75	0.15	0.06	0.04

PART – B

(Attempt any Four Questions out of Six) (4 X 10 = 40)

<table>
<tr><th>S. No</th><th>Questions</th><th>Marks</th><th>Course Outcome</th><th>Blooms Level</th></tr>
<tr><td>Q.1</td><td>Solve the following transportation problem in which cell entries represents unit costs.
<table>
<tr><td>Warehouse→ Factory↓</td><td>W_1</td><td>W_2</td><td>W_3</td><td>Factory Capacity</td></tr>
<tr><td>F_1</td><td>2</td><td>7</td><td>4</td><td>5</td></tr>
<tr><td>F_2</td><td>3</td><td>3</td><td>1</td><td>8</td></tr>
<tr><td>F_3</td><td>5</td><td>4</td><td>7</td><td>7</td></tr>
<tr><td>F_4</td><td>1</td><td>6</td><td>2</td><td>14</td></tr>
<tr><td>Warehouse Requirement</td><td>7</td><td>9</td><td>18</td><td>34</td></tr>
</table></td><td>10</td><td>CO3</td><td>L3</td></tr>
<tr><td>Q.2</td><td>Solve by using Big-M Method to the following LP problem: Max $Z = -2x_1 - x_2$, Subject to: $3x_1 + x_2 = 3$, $4x_1 + 3x_2 \geq 6$, $x_1 + 2x_2 \leq 4$, and $x_1 \geq 0$, $x_2 \geq 0$.</td><td>10</td><td>CO2</td><td>L3</td></tr>
<tr><td>Q.3</td><td>Five men are available to do five different jobs. Form past records, the time (in hours) that each man takes to do each job is known and given in the following table:
<table>
<tr><td></td><td>I</td><td>II</td><td>III</td><td>IV</td><td>V</td></tr>
<tr><td>A</td><td>2</td><td>9</td><td>2</td><td>7</td><td>1</td></tr>
<tr><td>B</td><td>6</td><td>8</td><td>7</td><td>6</td><td>1</td></tr>
<tr><td>C</td><td>4</td><td>6</td><td>5</td><td>3</td><td>1</td></tr>
<tr><td>D</td><td>4</td><td>2</td><td>7</td><td>3</td><td>1</td></tr>
<tr><td>E</td><td>5</td><td>3</td><td>9</td><td>5</td><td>1</td></tr>
</table>
Find the assignment of the men to jobs that will minimize the total time taken.</td><td>10</td><td>CO3</td><td>L3</td></tr>
<tr><td>Q.4</td><td>A project consists of a series of tasks labelled A, B, …….H, I with the following relationships (W<X, Y means X and Y cannot start until W is completed; X, Y<W means X and Y cannot start until both X and Y are completed). With this notation construct the network diagram having the following constraints: A<D, E; B, D<F; C<G; B, G< H; F, G<I.
Find also the minimum time of completion of the project, when the time (in days) of completion of each task is as follows:
<table>
<tr><td>Task</td><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>F</td><td>G</td><td>H</td><td>I</td></tr>
<tr><td>Time</td><td>23</td><td>8</td><td>20</td><td>16</td><td>24</td><td>18</td><td>19</td><td>4</td><td>10</td></tr>
</table></td><td>10</td><td>CO3</td><td>L5</td></tr>
<tr><td>Q.5</td><td>Solve the LP problem (Using simplex method): Min $Z = x_1 - 3x_2 + 2x_3$, Subject to: $3x_1 - x_2 + 3x_3 \leq 7$, $-2x_1 + 4x_2 \leq 12$, $-4x_1 + 3x_2 + 8x_3 \leq 10$, and $x_1 \geq 0$, $x_2 \geq 0$, $x_3 \geq 0$</td><td>10</td><td>CO2</td><td>L3</td></tr>
<tr><td>Q.6</td><td>What is Operation Research? Account for the growing importance of O. R. in business decisions. Discuss the significance and scope of Operation Research in decision-making with special reference to Health Care Administration.</td><td>10</td><td>CO1</td><td>L2</td></tr>
</table>

BL – Bloom's Taxonomy Levels (1- Remembering, 2- Understanding, 3- Applying,
4- Analyzing, 5- Evaluating, 6- Creating)

***************End of Paper***************