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Odd Semester Examination-2024

Paper Name: Operation Research **Time: 3 Hours**

Paper Code: BTCSE OE23/BTCSEAI OE3 **MM: 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	A firm manufactures two type of products A and B, and sells them at a profit of Rs. 2 on type A and Rs. 3 on type B. Each product is processed on two machines G and H. Type A requires one minute of processing time on G and two minutes on H; type B requires one minute on G and one minute on H. The machine G is available for not more than 6 hour 40 minutes while machine H is available for 10 hours during any working day. Formulate the problem as a linear programming problem.	5	CO1	L5
Q.2	Write the dual of the primal problem: Max $Z = 5x_1 + 12x_2 + 4x_3$, Subject to the constraints: $x_1 + 2x_2 + x_3 \leq 5$, $2x_1 - x_2 + 3x_3 = 2$, and $x_1 \geq 0, x_2 \geq 0, x_3 \geq 0$.	5	CO2	L3
Q.3	Find the initial basic feasible solution of the following transportation problem (Vogel's Approximation Method).	5	CO3	L4
Q.4	Construct graphical representation of the LPP Max $Z = x_1 + x_2$, Subject to the constraints: $2x_1 + x_2 \leq 10, x_1 + 2x_2 \leq 8$, $x_1 \leq 12$ and $x_1 \geq 0$, $x_2 \geq 0$. Hence, find its solution.	5	CO2	L5

Warehouse→ Factory↓	A	B	C	D	Availability
E	7	3	5	5	34
F	5	5	7	6	15
G	8	6	6	5	12
I	6	1	6	4	19
Demand	21	25	17	17	80

Q.5	An investor is given the following investment alternatives and percentage rates of return. State of nature (Market conditions)	5	CO5	L4
Q.6	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:	5	CO5	L5
Q.7	Rewrite in standard form the following LPP: Minimize $Z = 2x_1 + x_2 + 4x_3$, Subject to the constraints: $-2x_1 + 4x_2 \leq 4$, $x_1 + 2x_2 + x_3 \geq 8$, $2x_1 + 3x_3 \leq 2$, $x_1 \geq 0$, $x_2 \geq 0$, and x_3 unrestricted in sign.	5	CO1	L2

	Low	Medium	High
Regular Shares	7%	10%	15%
Risky Shares	-10%	12%	25%
Property	-12%	18%	30%

Over the past 300 days, 150 days have been medium market conditions and 60 days have had high market conditions. On the basis of these data, state the optimum investment strategy for the investment.

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

If it did not rain on the previous day, the rain distribution is:

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

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.

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>What is Operation Research? Account for the growing importance of O. R. in business decisions. Describe in detail the four areas for applications of O. R. Techniques in Financial Management.</td><td>10</td><td>CO1</td><td>L2</td></tr>
<tr><td>Q.2</td><td>Solve the following transportation problem.
<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>16</td><td>20</td><td>12</td><td>200</td></tr>
<tr><td>F_2</td><td>14</td><td>18</td><td>160</td><td>160</td></tr>
<tr><td>F_3</td><td>26</td><td>24</td><td>16</td><td>90</td></tr>
<tr><td>Warehouse Requirement</td><td>180</td><td>120</td><td>150</td><td>350</td></tr>
</table></td><td>10</td><td>CO3</td><td>L4</td></tr>
<tr><td>Q.3</td><td>A departmental head had four subordinates, and four tasks to be performed. The subordinates differ in efficiency, and the tasks differ in their intrinsic difficulty. His estimate, of the time each man would take to perform each task, is given in the matrix below:
<table>
<tr><td>Men → Tasks ↓</td><td>I</td><td>II</td><td>III</td><td>IV</td></tr>
<tr><td>A</td><td>18</td><td>26</td><td>17</td><td>11</td></tr>
<tr><td>B</td><td>13</td><td>28</td><td>14</td><td>26</td></tr>
<tr><td>C</td><td>38</td><td>19</td><td>18</td><td>15</td></tr>
<tr><td>D</td><td>19</td><td>26</td><td>24</td><td>10</td></tr>
</table>
How should the tasks be allocated, one to one man, so as to minimize the total man-hours?</td><td>10</td><td>CO3</td><td>L4</td></tr>
<tr><td>Q.4</td><td>Solve by using Big-M Method to the following LP problem:
Max $Z = 6x_1 + 4x_2$,
Subject to the constraints:
$2x_1 + 3x_2 \leq 30$, $3x_1 + 2x_2 \leq 24$,
$x_1 + x_2 \geq 4$,
and $x_1 \geq 0$, $x_2 \geq 0$.</td><td>10</td><td>CO2</td><td>L3</td></tr>
<tr><td>Q.5</td><td>Solve the LP problem (Using simplex method): Min $Z = x_1 + 2x_2 + 3x_3$,
Subject to the constraints:
$x_1 + 2x_2 + 3x_3 \leq 10$, $x_1 + x_2 \leq 5$,
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>Consider a box office ticket window managed by a single server Customer arrives to purchase ticket according to Poisson input process with a mean rate of 30/hr. the time required to serve a customer has an ED with a mean of 90 seconds determine: (i) Mean queue length. (ii) Mean waiting time in the system. (iii) The probability of the customer waiting in the queue for more than 10min. (iv) The fraction of the time for which the server is busy.</td><td>10</td><td>CO4</td><td>L4</td></tr>
</table>

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

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