B. Tech.

(SEM. VIII) EXAMINATION, 2006-07

OPERATIONS RESEARCH

Time : 3 Hours] [Total Marks : 100

Note : Attempt all 5 questions as instructed. Choices are within the questions

1 Attempt any four parts of the following : \(5 \times 4 = 20\)

(a) Discuss the scope of Operations Research (OR) as Modern Management Tool.

(b) What are simplification assumptions/approximations needed in constructing an Operational Research Model.

(c) A firm manufactures headache pills in two sizes A and B. Size A contains 2 grains of aspirin, 5 grains of bicarbonate and 1 grain of codeine. Size B contains 1 grain of aspirin, 8 grains of bicarbonate and 6 grains of codeine. It is found by users that it requires atleast 12 grains of codeine. 

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[Contd...
aspirin, 74 grains of bicarbonate and 24 grains of codeine for providing immediate relief. Formulate the problem as a standard LPP.

(d) Using graphical method, solve the LPP.

Maximize $Z = 3x + 2y$

subject to $-2x + 3y \leq 9,$

$x - 5y \geq -20 ; x, y \geq 0$

(e) Write a general linear programming problem.

(f) Convert the following LPP to standard form:

Maximize $Z = 3x, -2x_2 + 4x_3$

subject to $x_1 + 2x_2 + x_3 \leq 8,$

$2x_1 - x_2 + x_3 \geq 2,$

$4x_1 - 2x_2 - 3x_3 = -6; x_1, x_2, x_3 \geq 0.$

2 Attempt any two parts of the following:

(a) Explain Simplex Method in detail.

(b) Solve the following LPP by Simplex method:

Minimize $Z = x_1 - 3x_2 + 3x_3$

subject to $3x_1 - x_2 + 2x_3 \leq 7,$

$2x_1 + 4x_2 \geq -12,$

$-4x_1 + 3x_2 + 8x_3 \leq 10; x_1, x_2, x_3 \geq 0$

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(c) Construct the dual of the following and solve both the primal and the dual:

Maximize \( Z = 2x_1 + x_2 \)

subject to \(-x_1 + 2x_2 \leq 2,\)
\(x_1 + x_2 \leq 4; x_1 \leq 3; x_1, x_2 \geq 0.\)

3 Attempt any two parts of the following: 10×2=20

(a) Write a general formulation of dual problem when primal is in standard form and hence construct the dual of the problem.

Maximize \( Z = 3x_1 + 17x_2 + 9x_3 \)

subject to \(x_1 - x_2 + x_3 \geq 3,\)
\(-3x_1 + 2x_3 \leq 1, x_1, x_2, x_3, \text{ all } \geq 0\)

(b) Using Dual Simplex Method, solve the following problem:

Minimize \( Z = 2x_1 + 2x_2 + 4x_3 \)

subject to \(2x_1 + 3x_2 + 5x_3 \geq 2\)
\(3x_1 + x_2 + 7x_3 \leq 3\)
\(x_1 + 4x_2 + 6x_3 \leq 5; x_1, x_2, x_3 \geq 0\)

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(c) Explain in detail, degeneracy in Simplex Method.

4 Attempt any two parts of the following: 10×2=20

(a) Explain the Column Minima Method for finding a basic feasible solution of a transport problem.

(b) The company has three cement factories located in cities 1,2,3 which supply cement to four projects located in towns 1,2,3,4. Each plant can supply 6,1,10 truck loads of cement daily respectively and the daily cement requirements of the projects are respectively 7,5,3,2 truck loads. The transportation cost per truck load of cement (in hundreds of rupees) from each plant to each project cite is as follows:

<table>
<thead>
<tr>
<th>Project Cities</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Factories</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>5</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>5</td>
<td>8</td>
<td>15</td>
</tr>
</tbody>
</table>

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Determine the optimal distribution for the company so as to minimise the total transportation cost.

(c) Solve the assignment problem:

A machine tool company decides to make four sub assemblies through four contractors. Each contractor is to receive only one sub assembly. The cost of each subassembly is determined by the bids submitted by each contractor and is shown in table below (in hundreds of rupees).

Assign different assemblies to contractors so as to minimize the cost.

<table>
<thead>
<tr>
<th>Contractors</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Supply ai</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>15</td>
<td>13</td>
<td>14</td>
<td>17</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sub-assemblies</th>
<th>2</th>
<th>11</th>
<th>12</th>
<th>15</th>
<th>13</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3</td>
<td>18</td>
<td>12</td>
<td>10</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>15</td>
<td>17</td>
<td>14</td>
<td>16</td>
<td>1</td>
</tr>
</tbody>
</table>

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5 Attempt any **two** parts of the following: 10\(\times\)2=20

(a) Define an integer LPP. Name any two of them. Discuss one of them.

(b) Use branch and bound technique to solve the following integer programme problem.

Maximize \( Z = 7x_1 + 9x_2 \)

subject to \(-x_1 + 3x_2 \leq 6,\)

\[ 7x_1 + x_2 \leq 35, \]

\[ 0 \leq x_1, x_2 \leq 7; \text{ and } x_1, x_2 \]

are integers.

(c) Solve the following game by the principle of dominance:

\begin{tabular}{c|cccccc}
Player A & 1 & 2 & 3 & 4 & 5 & 6 \\
\hline
I & 4 & 2 & 0 & 2 & 1 & 1 \\
II & 4 & 3 & 1 & 3 & 2 & 2 \\
III & 4 & 3 & 7 & -5 & 1 & 2 \\
IV & 4 & 3 & 4 & -1 & 2 & 2 \\
V & 4 & 3 & 3 & -2 & 2 & 2 \\
\end{tabular}

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