1. [10 pt] A friend of mine suggested to me that the number for solutions for any \( n \)-queen problem \( (n \geq 4) \) is always even. He said that for 4-queen problem, there are two solutions, for 5-queen problem, there are ten solutions, and so on. Do you think he is right? Explain your answer.

2. [10 pt] Given a sequence of \( n \) numbers, the distinct elements problem is to check if there are equal numbers. Give an \( O(1) \) time nondeterministic algorithm for this problem.
3. [10 pt] Give an algorithm to count the number of leaf nodes in a binary tree. What is its computational complexity?
4. [15 pt] Draw the branch and bound tree to solve the traveling salesperson problem for the following data set of five cities:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>-</td>
<td>22</td>
<td>9</td>
<td>15</td>
<td>27</td>
</tr>
<tr>
<td>B</td>
<td>9</td>
<td>-</td>
<td>30</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>C</td>
<td>24</td>
<td>14</td>
<td>-</td>
<td>21</td>
<td>16</td>
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<tr>
<td>D</td>
<td>16</td>
<td>5</td>
<td>7</td>
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<td>20</td>
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<td>E</td>
<td>8</td>
<td>9</td>
<td>5</td>
<td>21</td>
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</tr>
</tbody>
</table>

Use greedy algorithm to get the first bound.
5. [10 pt] Consider the following instance of knapsack problem: \( n = 4, m = 119, P = \{95, 25, 41, 21\}, \ W = \{63, 29, 9, 26\} \). What is the value of \( \rho(n) \) for the greedy algorithm for this instance?

6. [10 pt] Draw the following undirected graph and find its vertex cover:

\[
\begin{array}{cccccc}
\text{A} & \text{B} & \text{C} & \text{D} & \text{E} & \text{F} \\
\hline
\text{A} & - & 0 & 1 & 0 & 1 & 1 \\
\text{B} & - & 1 & 1 & 0 & 0 & \\
\text{C} & - & 1 & 1 & 0 & \\
\text{D} & - & 0 & 0 & \\
\text{E} & - & 1 & \\
\text{F} & - &
\end{array}
\]