CSE101 (WI99) - Midterm

Name: .......................... ..........................
      (first)               (last)

ID: ..............................

Pseudo-name: ........................

1

2

3

4

5

Total:
Problem 1 (60 points)

Are the following statements and expressions true or false? Write “True” or “False” and give a counter-example, or a short justification.

a. Let $x$ and $y$ be two arbitrary real numbers, then $\lceil x + y \rceil \leq \lceil x \rceil + \lceil y \rceil$

b. Let $n$ be a positive integer. A sufficient condition for $n \pmod{2} \neq 0$ is that $n \pmod{6} \neq 0$.

c. Heapsort is a in-place sorting algorithm.

d. If $f(n) = O(h(n))$ and $g(n) = O(h(n))$ then $f(n) = \Theta(g(n))$
Problem 2 (30 points)

Write the “Postorder” traversal of the following binary tree as a sequence of letters.

```
  C
 /   \
A     B
|     |
G     D  E
|   |   |   |
H   J   E   F
```
Problem 3 (40 points)

Find Max \[ 10x_1 + 7x_2 + x_3 \]
subject to \[ 7x_1 + 5x_2 + x_3 \leq 10, \ x_j \geq 0, \text{ integers, } (j = 1, 2, 3) \]

Define \( F_k(y) \) as the MAX value when there are \( k \) kinds of items to choose from and the weight limitation is \( y \). Fill the values in the following table:

<table>
<thead>
<tr>
<th>( k )</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td></td>
</tr>
</tbody>
</table>
Problem 4 (40 points)

Start with the node A and traverse the graph in the DFS order. Darken the edges and write the number 1, 2, ..., 9, 10 in the order that the node are discovered. In the case of tie, break the tie alphabetically, i.e. x before y.
Problem 5 (40 points)

If you use Prim's algorithm to find the Min spanning tree starting from \( v_a \) and have connected four other nodes to \( v_a \). What would be the temp labels on all other nodes?

Darken the edges used in the min spanning tree and write the values of the temporary labels on the nodes. In the case of tie, break the tie alphabetically.