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**Course: CS590-A Algorithms**

**Instructor: Dr. William Hendrix**

**Due Date: February 27, 2025**

**Description: Homework 3 Algorithms**

# Problem 1

What new field(s) does the data structure need?

The new solution requires that the root node is augmented to store the minimum value, such as in node.minval.

# Problem 2

Give pseudocode for the min operation for the BST.

**Algorithm 1** BST.min()

**Output**: The minimum value in the tree

```
1: node = root
2: if node ≠ NIL then
3:     return node.minval
4: end if
```

# Problem 3

Give pseudocode for the insert operation. Reference pseudocode for the insert method appears below.

**Algorithm 2** BST.insert()

```
1:  node = root
2:  while node ≠ NIL do
3:    if node.value ≤ new then
4:      if node.left = NIL then
5:        Add new as left child of node
6:        node = node.left
7:      else
8:        node = node.left
9:      end if
10:     if root.minval > node.value then
11:       root.minval = node.value
12:     end if
13:   else
14:     if node.right = NIL then
15:       Add new as right child of node
          node = node.right
16:     else
17:       node = node.right
18:     end if
19:   end if
20: end while
```

# Problem 4

**Algorithm 3** BST.delete(node)

```
1: if node has two children then
2:    swapnode = right
3:    while swapnode has a left child do
4:       swapnode = swapnode.left
5:    end while
6:    Swap node's parent and children links with swapnode
7:    if node is the BST root then
8:       Set root to be swapnode
9:    end if
10: end if
11: if node has no children then
12:    if node is the root then
13:       Set root to be NIL
14:    else
15:       Set node.parent's child to be NIL
16:    end if
17: else
18:    // node must have one child
19:    if node is the root then
20:       Set root to be node's child
21:    else
22:       Set node.parent's child to be node's child
23:    end if
24:    Set node's child's parent to be node.parent
25: end if
```

# Problem 5

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