This quiz has 3 questions, for a total of 10 points.

1. **3 points** Given the following AVL tree, insert a node with key 9 and re-balance the tree if necessary using one or more left or right tree rotations. State which rotations you applied to which nodes.

   ![AVL Tree Diagram]

   **Solution:**
   - Insert 9. (1 point)
   - Rotate 8 left. (1 point)
   - Rotate 10 right. (1 point)

2. **3 points** You visit an alien planet with a strange currency. The smallest denomination is called a “jot” and they have 1-jot, 4-jot, and 9-jot coins. Write an exponential-time recursive function in Python named `min_jots` that computes the minimum number of coins needed to make \( n \) jots.

   **Solution:**
   ```python
def min_jots(n):
    if n == 0:
        return 0  # 1/2 point
    else:
        alternatives = [1 + min_jots(n - 1)]  # 1/2 point
        if n >= 4:
            alternatives.append(1 + min_jots(n - 4))  # 1/2 point
        if n >= 9:
            alternatives.append(1 + min_jots(n - 9))  # 1/2 point
        return min(alternatives)  # 1 point for min
```

3. **4 points** Fill in the blanks in the below function that performs a left rotate on node \( x \).

   ```python
def left_rotate(T, x):
    y = x.right
    b = y.left
```
x.right = b
if b != None:
    b.parent = ___(a)___
___(b)___ = x.parent
if x.parent == None:
    T.root = y
elif x == x.parent.left:
    x.parent.left = y
else:
    x.parent.right = y
y.left = ___(c)___
x.parent = ___(d)___

Solution:
(a) x
(b) y.parent
(c) x
(d) y