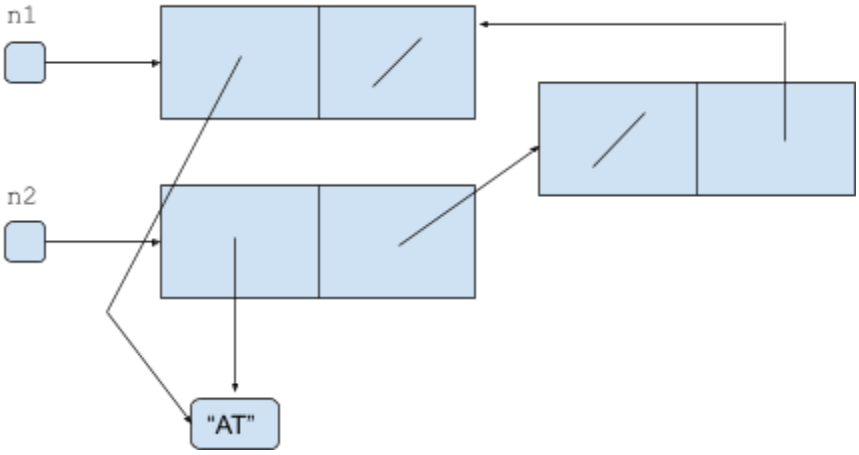
Skyler's Mega Awesome (and ugly … and probably incorrect) Psuedo-Key. Email me at skylervestal@utexas.edu if anything is incorrect.

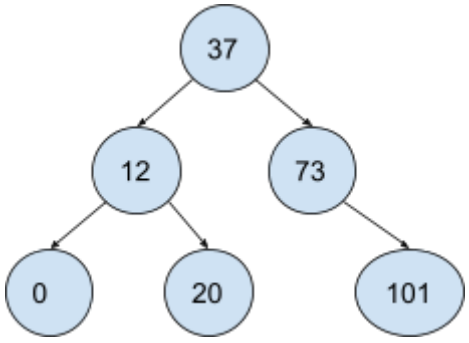
A. 13
B. -5
C. L2O*3G1
D. 58
E. Either is fine. O(1) regardless.
F. 9 seconds
G. Selection, insertion, and quick sort.
H. .20 seconds

I.



J. 80 seconds
K. Move t1.get(i) above the for loop with j (t1 is a LinkedList)

L.



M. 0 20 12 101 73 37
N. 9 (Only the left node has 2 children -- repeat to height 4)
O. 20 seconds (N log(N))

2.

```java
public boolean rangeEqualsTarget(int tgt, int start, int stop) {
        int sum = 0;
        int index = 0;
        IntNode temp = first;
        while (temp != null && index < start) {
            temp = temp.next;
            index += 1;
        }
        while (temp != null && index < stop) {
            sum += temp.data;
            temp = temp.next;
            index += 1;
        }
        return sum == tgt;
}
```

Thought Process:

- The conditions Mike gives (if stop is out of bounds go until the end of the list and consider that sum) makes the iteration clear -- get to the first node at index start, and then sum each node's data until you either hit the node at index stop or the end
- Only thing to consider is if we're off by one getting to the start node (maybe it should be index <= start?). Let's try it out:
  - If start == 0, then the first while loop will never iterate. We'll start adding at 0
  - If start == 1, then the first while loop will iterate a single time (0 < 1) and then stop. We'll start adding at 1
  - This is CS 314 and not CS 331. Good enough for me!

Remarks:

- If you get to index start you could just iterate while temp != null and stop - start times. Around the same amount of code and the one I wrote above

3.

```
public LinkedIntList combineIgnoreValue(LinkedIntList other, int tgt) {
    LinkedIntList res = new LinkedIntList();
    // res.first right now is null (ugh) -- important to work around this
    IntNode tempR = null;

    IntNode tempT = first;
    IntNode tempO = other.first;
    // Hit the end of the shorter
    while (tempT != null && tempO != null) {
        // Pretty straight forward, hard part is the helper method
        // tempR = ... is kinda weird -- look at the comments below
        if (tempT.val != tgt && tempO.val != tgt) {
            tempR = addNode(res, tempR, tempT.val + tempO.val);
        }
        tempT = tempT.next;
        tempO = tempO.next;
    }
    // One list may be longer -- add the data in from the longer
    tempT = tempT != null ? tempT : tempO;
    while (tempT != null) {
        if (tempT.val != tgt) {
            tempR = addNode(res, tempR, tempT.val);
        }
    }
    return res;
}
```

```java
// The idea is to add in the first node if needed, and otherwise add a new node to the end
// In both cases we return the last node in the list so we can add to this node in the future
private IntNode addNode(LinkedIntList list, IntNode curr, int val) {
    IntNode next;
    if (list.first == null) {
        list.first = new IntNode();
        next = list.first;
    } else {
        curr.next = new IntNode();
        next = curr.next;
    }
    next.val = val;
    return next;
}
```

Thought Process:

- This one is very tedious. Note if I was a student on the exam I wouldn't make the helper method. I'd just repeat the same code twice and let my TA be sad about my choices
- The idea of the question is pretty simple, but dealing with if first is null or not is very tedious to work around. As a result, I think it's easiest to make a helper method that will take care of the complicated logic for me, and it'll return the last node in the list to make adding to the end easy in the future.
- I would not be ashamed if I lost a few points on this question for the sake of covering the rest of the exam with enough time (5 coding questions?!?). Lots of details that are diminishing gains vs making sure the rest of your exam is strong. If you have the time though a solution like this is very satisfying. Really good question for distinguishing efficiency and details.

4.

```java
public static<E> boolean sameBottomN(Stack<E> s1, Stack<E> s2, int n) {
    Stack<E> t1 = new Stack<>();
    Stack<E> t2 = new Stack<>();
    if (move(s1, t1) < n || move(s2, t2) < n) {
        move(t1, s1); move(t2, s2);
        return false;
    }
    // We'll have to remove all the elements to get to the bottom anyway, so
    // let's make it easier on ourselves and start from the bottom element
    // Compare the first n -- stop if there's a different
    boolean same = true;
    int count = 0;
    while (count < n && same) {
        E e1 = t1.pop();
        E e2 = t2.pop();
        same = e1.equals(e2);
        s1.push(e1);
        s2.push(e2);
        count++;
    }
    // Add everything back
    move(t1, s1);
    move(t2, s2);
    return same;
}

private static<E> int move(Stack<E> oldStack, Stack<E> newStack) {
    int count = 0;
    while (!oldStack.isEmpty()) {
        newStack.push(oldStack.pop());
        count += 1;
    }
    return count;
}
```

Thought Process:

- First handle any weird cases with out of bounds w/ n. A helper method makes this easy
- Next we need to get to the bottom of the stack. Pop everything off, compare the first n (stop at the first mismatch), then add everything back

5.

```
public int makeFull() {
   return helper(root);
}

private int helper(BNode curr) {
   if (curr == null) {
       return 0;
   }
   boolean leftEmpty = curr.left == null;
   boolean rightEmpty = curr.right == null;
   boolean needsFix = (leftEmpty && !rightEmpty) || (!leftEmpty &&
rightEmpty);
   if (needsFix) {
       if (leftEmpty) {
           curr.left = new BNode(curr.data);
       } else {
           curr.right = new BNode(curr.data);
       }
   }
   // Run recursion to fix any subtrees -- base case handles newly created
fixes easily
   return helper(curr.left) + helper(curr.right) + needsFix ? 1 : 0;
}
```

Thought Process:

- Not much to say here. Classic recursion.

6.

```
private int help(int start, int dest, TNode n, int distanceFromStart) {
    // REMEMBER -- NO DUPLICATES! Make this much easier for the base cases:
    // If the tree is empty OR if we reach the end (if we find end before start
it works out!)
    if (n == null || n.data == dest) {
        return distanceFromStart;
    }
    // We can finally start counting
    if (n.data == start) {
        distanceFromStart = 0;
    }
    // Only add an edge if we've reached start to count
    int addEdge = distanceFromStart >= 0 ? 1 : 0;
    for (TNode c : children) {
        int res = help(start, dest, c, distanceFromStart + addEdge);
        if (res > 0) {
            return res;
        }
    }
    return -1;
}
```

Thought Process:

- Last question and is not easy to handle. I'd be running out of time at this point so I'd write the first thing that seems right and only check if I have time to.
- Base case:
  - If our tree is empty no point to going on. Otherwise since each node's data is unique if we find dest then we know we're done!
    - Does this work if we found end before start? Well if we do then distanceFromStart is -1 (case below). Yup!
- Lastly -- How do we handle recursion?
  - Mark distanceFromStart to be 0 if we actually find start -- we only want to add to our current distance if we've already found start (which we can know by checking if distanceFromStart is positive)
  - Tricky part: There is only one path, so if we never find it we should return -1. This means if we ever get a non-negative value we found the path. Return it!
  - Sanity Check:
    - Can we ever return a positive value without finding the path? We only return not -1 if we find the end after the start. (Base case second condition). Works for me!