CS 61B Small Group Tutoring Section
Spring 2023 February 27, 2023

1 Asymptotics

(a) Consider the following method:

```java
public int beta(int N) {
    if (N <= 0) {
        return 0;
    }
    Random rand = new Random();
    int r = rand.nextInt();
    if (r % 3 == 0) {
        for (int i = 0; i < N; i += 1) {
            constant(); // runs in constant time
        }
    }
    return beta(N/2);
}
```

(i) What is the best case runtime?

(ii) What is the worst case runtime?

(iii) Why can't we say that the best case is when $N = 0$?

(b) Consider the following method:

```java
public void delta(int N, boolean bool) {
    if (N == 0) {
        System.out.println("hello");
    }
    expo(N); // runs in 2^N time
    if (bool == true) {
        delta(N-1, bool);
        delta(N-1, bool);
    } else {
        delta(N-1, bool);
    }
}
```

(i) What is the best case runtime?

(ii) What is the worst case runtime?

2 Binary Search Trees

(a) We implement a binary search tree with the following methods:

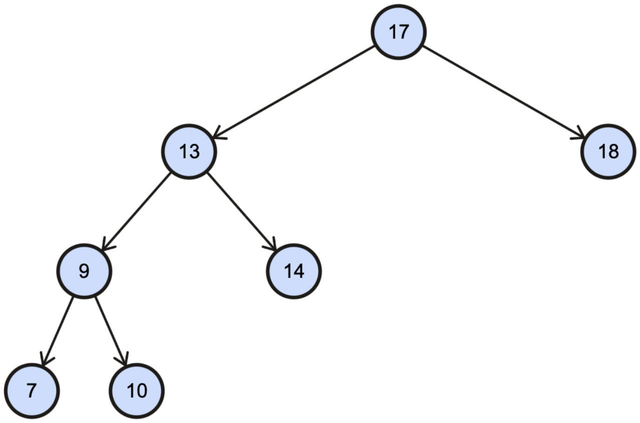
```
// Inserts an item into the binary search tree.
public void insert(T item) {
    // Implementation has been omitted
}

// Deletes an item from the binary search tree.
public void delete(T item) {
    // Implementation has been omitted
}
```

Draw the binary search tree that results from the following operations. Assume we start from an empty tree.

```
insert(5)
insert(7)
insert(10)
insert(6)
insert(3)
insert(1)
insert(4)
delete(10)
delete(7)
```

(b) Given the following binary search tree:



Suppose we delete the root node. Which node(s) can we replace 17 with as the new root node?

(c) Suppose we create a BST by inserting the nodes $V_0, V_1, ..., V_n$, where V_i is strictly smaller than V_{i+1}, in order. That is, we first insert V_0, then V_1, and so on. What is the runtime to find an element in this BST in the worst case, where N is the number of nodes?