CSE 332: Data Abstractions

Section 3: BSTs, Recurrences, and Amortized Analysis

0. Interview Question: Binary Search Trees

Write pseudo-code to perform an in-order traversal in a binary search tree without using recursion.

1. Big-Oh Bounds for Recurrences

For each of the following, find a Big-Oh bound for the provided recurrence.

(a) $T(n) = \begin{cases} 1 & \texttt{if } n = 1 \\ 8T(n/2) + 4n^2 & \texttt{otherwise} \end{cases}$

(b) $T(n) = \begin{cases} 1 & \texttt{if } n = 1 \\ 7T(n/2) + 18n^2 & \texttt{otherwise} \end{cases}$

(c) $T(n) = \begin{cases} 1 & \texttt{if } n = 1 \\ T(n/2) + 3 & \texttt{otherwise} \end{cases}$

2. Recurrences and Closed Forms

For the following code snippet, find a recurrence for the worst case runtime of the function, and then find a closed form for the recurrence.

Consider the function g:

```
1  g(n) {
2     if (n == 1) {
3        return 1000;
4     }
5     if (g(n/3) > 5) {
6        for (int i = 0; i < n; i++) {
7           System.out.println("Yay!");
8        }
9        return 5 * g(n/3);
10    }
11    else {
12       for (int i = 0; i < n * n; i++) {
13          System.out.println("Yay!");
14       }
15       return 4 * g(n/3);
16    }
17 }
```

- Find a recurrence for $g(n)$.

- Find a closed form for $g(n)$.

3. MULTI-pop

Consider augmenting the `Stack` ADT with an extra operation:

`multipop(k)`: Pops up to k elements from the `Stack` and returns the number of elements it popped

What is the amortized cost of a series of `multipop`'s on a `Stack` assuming `push` and `pop` are both $\mathcal{O}(1)$?