CSE 214 FALL 2022 (Student Version)

Recitation 1 – Order of Complexity

1. [5 minutes] Order the following from most to least efficient:

   $\{O(10^n), O(10n), O(n!), O(10), O(n^{10}), O(\log n), O(n^3), O(10^n)\}$

2. [10 minutes] What is the time complexity of the following algorithms:
   a. An algorithm that first fills an array of size n with random integers, sorts them using an O(n^2) algorithm.

   b. An O(nlogn) algorithm that sorts an array of *n* integers from smallest to largest and then returns the smallest integer.

   c. Reversing a String of length n (ex: “hello” -> “olleh”)

   d. Finding the mean, median, and mode of a set of numbers (unsorted)

3. [5 Minutes] What is the order of complexity for the following code:

```
int i, j , k = 0;
for (i = 0; i <= n; i += 2) {     //n/2
      for (j = 2; j <= n; j = j * 2) { //log n
             k = k + n / 2;
      }
}
```

4. [5 minutes] Why is it that we use O(log n) without specifying the base of the log? (Ex: $O(\log_2 n)$)

5. [5 minutes] Write the order of complexity for the following programs using Big O notation if the programs execute the following number of operations for n inputs:
   a. 50
   b. $n - n^3 + 7n^5$
   c. $n^2 + logn$
   d. $5^n + n! + 2n^{64n}$
   e. $n^{\frac{1}{3}} + logn$
   f. $O(100^n) + O(23^n) + O(560^n)$

6. [10 min] Suppose we have a list of $1{,}024$ elements. Searching for a value in a list:

   a)Assume the list is not sorted. To perform binary search, we must first sort the list. We can use a sorting algorithm that has a complexity of $\mathrm{n}\log\mathrm{n}$. If it takes 200 ms to complete the sorting process, how long will it take to sort a list of $262{,}144$ elements using the same algorithm?

   b) Assume now the list is currently sorted. Using binary search, we can find our target value using a $\log\mathrm{n}$ algorithm. If using this algorithm takes 50 ms to complete, how long will it take if we increased the list size to $1{,}048{,}576$?

7. [10 minutes] Code Analysis: What is the order of complexity of the following blocks of code?

```
int i, j, k = 0;
for (i = 0; i <= n; i+=2) {
    for (j = 2; j <= n; j = j * 2) {
        k = k + n/2;
        break;
    }
}
```

```
int count = 0;
for (int i = n; i > 0; i /= 4) {
    for (int j = 0; j < i; j++) {
        count += 1;
    }
}
```