

CS 3343 (Spring 2008) Assignment 3

Due: Feb 6 before class starts

1. (15 points) Compute the following sums. If the computation involves multiple steps, write down each intermediate step.

a. $\sum_{i=1}^{100} (10 + i).$

b. $\sum_{i=1}^{15} (i + 1)2^i.$

c. $\sum_{i=-\infty}^{10} 2^i.$

2. (15 points) Find the order of growth of the following sums (i.e., is it in $\Theta(n^2)$, $\Theta(n \lg n)$, or ...?) Similar to above, write down your analysis (be succinct, however).

a. $\sum_{i=1}^n i(i + i).$

b. $\sum_{i=1}^n (\lg(n) + i).$

c. $\sum_{i=0}^{\lfloor \lg(n) \rfloor} 2^i.$

3. (30 points) Selection sort is another popular sorting algorithm. The algorithm works as follows: 1). Find the minimum value in the list. 2). Swap it with the value in the first position. 3). Repeat the steps above for remainder of the list. Below is a Java implementation of the algorithm.

```
1  int[] selectionSort(int[] A) {
2      for (int i = 0; i < A.length - 1; i++) {
3          int indexOfMin = i;
4          int min = A[i];
5          for (int j = i + 1; j < A.length; j++) { // find the min value in A[i..n]
6              if (A[j] < min) {
7                  indexOfMin = j;
8                  min = A[j];
9              }
10         }
11         // swap A[indexOfMin] and A[i]
12         A[indexOfMin] = A[i];
13         A[i] = min;
14     }
15     return A;
16 }
```

- a. (5 points) Use a small example, (e.g., “5 2 8 4 3”) to show how the algorithm works. Specifically, write down the contents of array A at line 13 after each iteration.
- b. (5 points) Which line of the program will be executed the most number of times?
- c. (15 points) For an input array of size n , how many times the line you choose in (b) will be executed in the best case? How about in the worst-case? First express your result as a sum of a series, $T(n) = \sum_{i=\dots}^{\dots} \dots$, and then derive a closed form.
- d. (5 points) How does this algorithm compare with insertion sort? To answer this question, you can google or find answers from other resources, but don't copy your friend's answer, of course. I am expecting at least two advantages or disadvantages when these two sorting algorithms are compared.

4. **Bonus** (4 points) How much time did you spend on this homework? Who did you discuss with and what was the discussion about? What do you think about the difficulty level of the homework (harder than expected? just all right? easy?) What is the most difficult part? Do you have any comments/suggestions about the lecture, recitation, and homework?

Note: Nobody will not get more than 60 points for this homework, which means if you have answered all the other questions correctly, answering these bonus questions will NOT help you earn an extra score.