CS 372/469, Fall 2018
Assignment 3, due 10/16, before class
Total points: 100

1. (20 points) Use the master theorem to give bounds on the following recurrences:
   (a) $T(n) = 2T(n/4) + 1$
   (b) $T(n) = 2T(n/4) + \sqrt{n}$
   (c) $T(n) = 2T(n/4) + n$
   (d) $T(n) = 2T(n/4) + n^2$
   (e) $T(n) = 2T(n/3) + 1$
   (f) $T(n) = 5T(n/4) + n$
   (g) $T(n) = 7T(n/7) + n$
   (h) $T(n) = 9T(n/3) + n^2$
   (i) $T(n) = 8T(n/2) + n^3$
   (j) $T(n) = 49T(n/25) + n^{3/2} \log n$
2. (15 points) Textbook problem 2.14.
3. (15 points) Textbook problem 2.16.
4. (15 points) Textbook problem 2.17.
5. (15 points) Quicksort: In class, we had completed the first partitioning step for array $A = \langle 13, 19, 9, 5, 12, 8, 7, 4, 21, 2, 6, 11 \rangle$. 11 was the pivot, and the array after first partition looked like this: $\langle 9, 5, 8, 7, 4, 2, 6, \mathbf{11}, 21, 13, 12, 19 \rangle$. Complete the rest of the partitions, until you get a fully sorted array.
6. (20 points) Counting sort-based problems:
   (a) Show the operation of counting sort on $A = \langle 6, 0, 2, 0, 1, 3, 4, 6, 1, 3, 2 \rangle$. Maintain flags on repeated elements to show that counting sort is stable.
   (b) Describe an algorithm that, given n integers in the range $[0..k]$, pre-processes its input and answers any query about how many of the n integers fall in a range $[a..b]$ in $O(1)$ time. Your algorithm can use up to $O(n + k)$ pre-processing time.

How to submit: Upload your **pdf** file on Canvas.