Homework assignment 5:
Due date: Sunday, October 18 2020 at 11:59pm

1- Sort the below numbers using: (Show the work)
   a. Counting Sort
   b. Radix Sort
   c. Insertion Sort
   d. Bubble Sort
   e. Selection Sort

   - 1, 2, 0, -3, 5, -7, 10
   - 0, 2, 3, 8, 9, 16

2- What is the running time of Insertion Sort if all elements are equal? Explain.

3- Sort the below numbers using: (Show the work)
   a. Merge Sort
   b. Quicksort

   - 8, 0, 2, -1, -2, 2, 3, 7, -6, -9
   - 19, 7, 6, 3, 2, -1, -7, -18

4- Perform the partitioning algorithm on the below array using the median-of-three heuristic.

   - 1, 2, 6, -3, 20, -61, 7, 8, 19, 100
   - 0, 7, -6, 23, 12, 30, -71, 19

5- What is the worst-case running time of Quicksort if the pivot is randomly chosen as the first element in the array in each recursive call? Explain.
6- Show that the average size of a_{left} is *(n-1)/2* when the input to Quicksort is *n* distinct elements and the median M is randomly chosen from one of the elements.
7- Calculate the running time of a divide-and-conquer algorithm that requires three recursive calls (each with input-size *n/2*) and $5n^2$ steps that include dividing the input, and using the three solutions to obtain the final solution.
8- Use a recursion tree for the following algorithms to find the running time.

   a. T(n) = $T(n/2)+1$
   b. T(n) = $T(n-1)+1$
   c. T(n) = $2T(n-1)+1$
   d. T(n) = $3T(n/4)+n$
   e. T(n) = $3T(n/3)+\sqrt{n}$
   f. T(n) = $T(n/2)+n^2$

g. T(n) = $T\left(\frac{3n}{4}\right) + T\left(\frac{n}{4}\right) + n$

h. T(n) = $4T(\lfloor n/2 \rfloor + 2) + n^2$

9- Use the formula you learned in class to determine the asymptotic growth of T(n).

a. T(n) = $T(n/2) + 1$

b. T(n) = $3T(n/3) + n$

c. T(n) = $4T(n/3) + n$

d. T(n) = $3T(n/4) + \sqrt{n}$

e. T(n) = $5T(n/7) + n^2$

f. T(n) = $6T(n/5) + n^3$