Home Work #1
DUE: 1pm Saturday September 5 (portrait-mode PDF)

☞ Handwritten assignments will not be accepted.

- Write your name at the top of the page.
- Start your assignment with the following text if you can honestly agree with it.
  - I certify that every answer in this assignment is the result of my own work; that I have neither copied off the Internet nor from any one else's work; and I have not shared my answers or attempts at answers with anyone else.

1. Compute the worst-case time requirement of the following algorithm as a function of n, the length of the input array A. Assume a constant cost of 2 for the loop control statements and 1 for every other executable statement (and, of course, zero for comments).

   Insert entries in a table with 3 columns: *Line#*, *Cost*, and *#Times*.

   Next, use those entries to obtain a closed-form expression (a polynomial in n) for $T(n)$. *Hint*: see the slides for INSERTIONSORT.

   Repeat the above for best-case.

```
BUBBLESORT(A)
1   n ← A.length   ▷ A[1..n] comprises the input array
2   for pass ← 1 to (n − 1) do
3       flag ← FALSE
4       for j ← 1 to (n − pass) do
5           ▷ each pass puts one element in proper place:
6           ▷ so there is one less element to consider per pass
7           if A[j] > A[j + 1] then
8               tmp ← A[j]
9               A[j] ← A[j + 1]
10              A[j + 1] ← tmp
11              flag ← TRUE
12      if not flag then
13          return ()
```

2. For each of the following statements, answer if it is true or false as per the definition of the three asymptotic notations $O()$ / $\Omega()$ / $\Theta()$. If true, then provide appropriate corresponding constant(s) c / c_1, c_2 when n_0 is chosen as 2. If false, then correct the RHS (righthand side) by replacing the function family but retaining the asymptotic notation (i.e., do not change $O()$ to something else like $\Theta()$). Provide as tight a

bound as possible and provide appropriate constant(s) c / c_1, c_2 when n_0 is chosen as 2.

TRUE /FALSE $2n \lg n + 100n + 10 = O(n^2)$

TRUE /FALSE $2n \lg n + n + 10 = \Omega(n^2)$

TRUE /FALSE $10n \lg n + n^2 + n + 10 = \Theta(n^2)$

Notation: $\lg n$ is logarithm to the base 2.