

Home Work #1
DUE: 1pm Sunday September 13 (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. For each of the following, indicate whether the statement is TRUE or FALSE. You must also explain the reason for your answer.

Do not write pseudo-code. Provide answers that are brief but rich in content.

T / F INSERTIONSORT is a *stable* sorting algorithm.

2. Assume that the HEAPIFY algorithm we have seen in class is coded as procedures and executed on a normal computer where parameters are pushed on a stack on a recursive call and popped upon return.

Suppose each such recursive call requires $\Theta(1)$ stack space.

The maximum amount of such stack space used at any time during a computation is defined to be the *stack depth*.

Write recurrence relations for $C(n)$, where the input to HEAPIFY is an array of size n .

3. The operation $\text{HEAPINCREASEKEY}(A, i, \Delta)$ increases the value of node number i of (max) heap A by amount Δ , which could be either positive or negative. Of course, the heap property is re-established efficiently. Write an algorithm for HEAPINCREASEKEY (using the notation and model we have used in class) that runs in $O(\lg n)$ time for an n -element heap.

It is *crucial* that you explain your algorithm clearly using comments.

If the grader cannot understand your algorithm, he may presume that it is wrong.

Explain (no need to prove) why your algorithm attains the $O()$ bound.