

CS 200 Algorithms and Data Structures

Written Assignment #2

Due on Feb, 15 at the beginning of the class

[Problem 1] 5 pts

Give as good big O estimations for:

- a) $f(x) = 8n^3 - 9n^2$
- b) $f(x) = \log_2 n + 20$
- c) $f(x) = x^4 / 2$
- d) $f(x) = 2^x$
- e) $f(x) = (x^2 + 1) / (x + 1)$

[Problem 2] 5 pts

Show that $(x^2 + 4x + 17)$ is $O(x^3)$.

[Problem 3] 8 pts (2+3+3)

Consider the following segment of the algorithm.

```
1: int t = 0;
2: for (int i = 0; i < n; i++){
3:     for( int j = 0; j < n; j++){
4:         if (i < j){
5:             t = t+i+j;
6:         }
7:     }
8: }
```

- a) How many times does this algorithm perform comparisons (in line 4) with input n (positive integer)?
- b) How many times does this algorithm perform additions (in line 5) for the input n (positive integer)?
- c) Give a big- O estimate for the number of additions used in this segment of the algorithm

[Problem 4] 12 pts (3+3+3+3)

- a) Trace the quicksort as it sorts the following array into **ascending** order (Assume that this algorithm chooses *the first element* as pivot.)
80, 40, 25, 20, 30, 60, 15
- b) Trace the mergesort as it sorts the following array into **ascending** order
80, 40, 25, 20, 30, 60
- c) Trace the bubble sort as it sorts the following array into **descending** order
10, 12, 23, 34, 5
- d) Trace the insertion sort as it sorts the following array into **ascending** order
8, 11, 23, 1, 20, 33