

**CSE 250 Spring 2011**  
**Homework 3**  
**Due Date: March 21, Monday, by 2:05pm**  
**Total Points: 30**

**Due Time: 2:05'00" pm.**

**Print your Name, UB #, and Recitation section on the first page.**

**If these guidelines are not followed, TA may deduct 10% of points.**

1. (10 pts) Order the following functions by growth rate. Indicate which functions grow at the same rate. Use limit test to justify your answer.

$$N, \sqrt{N}, N \log N, N^2/\log N, N \log(N^3), 2^N, 2^{N/3}$$

Note: The easiest way to solve this problem is: First, arrange the functions in the order of increasing growth rate. Then, compare each pair of consecutive functions in the list.

2. (3 pts.) An algorithm takes 2 ms (1 ms =  $10^{-3}$  seconds) for input size  $n = 100$ . How long will it take for the input size  $n = 5000$  if the running time is the following (assume low-order terms are negligible)?

- (a)  $\Theta(N)$ ,
- (b)  $\Theta(N \log_2 N)$ ,
- (c)  $\Theta(N^3)$

3. (3 pts.) An algorithm takes 2 ms for input size  $n = 100$ . How large a problem can be solved in 10 min if the running time is the following (assume low-order terms are negligible)?

- (a)  $\Theta(N)$ ,
- (b)  $\Theta(N \log_2 N)$ ,
- (c)  $\Theta(N^3)$

4. (1+1=2 pts) Consider the following program segments:

(a)

```
int s = 0;
for (int i = 0; i < n ; i++)
    for (int j = 0; j < n ; j++)
        for (int k = 0; k < n ; k++)
            if ((i+j) == k)
                s = s+i;
```

How many times the inner loop body iterates? What's the growth rate of the run time function of this segment.

(b)

```
int t = 0;
for (int i = 0; i < n ; i++)
    for (int j = n-1; j >= i; j--)
        s = s+i+j;
```

How many times the inner loop body iterates? What's the growth rate of the run time function of this segment.

5. (3+3+3+3= 12 pts) Consider the array:

1, -9, 89, 25, 0, 5, 99, -4

Show the progress and the array after each pass, when the following sorting algorithms are performed on this array.

- (a) Selection Sort
- (b) Bubble Sort
- (c) Insertion Sort
- (d) Merge Sort