CS302 Data Structures

Spring 2010 – Dr. George Bebis

Homework 2 - Due Date: 2/16/2010

1. Rank the following **functions** by order of growth from the slowest to the fastest (<u>notation:</u> lgn=$\log_2 n$)

   $$1000,\ 10\lg n,\ 4n^2,\ \ n^2,\ \ 2^n,\ \ 100n,\ \ 2^{\lg n}$$

2. Compare the two functions n^2 and $2^n/4$ for various values of n. Determine when the second becomes larger than the first.
3. Determine the time complexity of the following code segments. In each case, justify your answer.

```
(a) sum = 0;
    for(i=1; i<=2*n; i++)
        sum = sum + 1;
```

```
(b) sum = 0;
    for(i=1; i<=n*n; i++)
        sum = sum + 1;
```

```
(c) sum=0;
    for(i=1; i<=n; i++)
        sum = sum + n;
```

```
(d) sum = 0;
    for(i=1; i<=n i++)
        for(j=1; j<=i; j++)
            sum = sum + i;
```

```
(e) sum = 0;
    for(i=1; i<=100; i++)
        for(j=1; j<=n; j++)
            sum = sum + i;
```

```
(f) sum = 0;
    for(i=1; i<=n; i++)
        for(j=1; j<=n; j*=2)
            sum = sum + 1;
```

4. Give the complexity of the functions below using big-O notation
   a. $5n + n^2 - 2$
   b. 7
   c. 4n + 10 lgn + 25
   d. 3 + 4 lgn
   e. $n^2 + n^3 + 10$

5. (a) Explain how to analyze the running time requirements of (i) a for-loop, (b) a while-loop, and (c) an if-then-else statement. (b) A program's main function consists of two function calls in sequence. The first function that is called has a time complexity of O(100lgn), and the second function has a time complexity of O(n), What is the overall time complexity of the program? Justify your answer.