

**Computer Science I – Summer 2011**  
**Recitation #4: Algorithm Analysis**

**Spend no more than THREE minutes each on the next four questions (12 min total).**

*Directions: For questions 1 – 4, utilize the technique shown in class of setting up an equation with a constant, solve for that constant, and then answer the given question.*

- 1) For an  $O(n^3)$  algorithm, one data set with  $n = 3$  takes 54 seconds. How long will it take for a data set with  $n = 5$ ?
- 2) For an  $O(2^n)$  algorithm, a friend tells you that it took 17 seconds to run on her data set on a  $O(2^n)$  algorithm. You run the same program, on the same machine, and your data set with  $n = 7$  takes 68 seconds. What size was her data set?
- 3) For an  $O(N^k)$  algorithm, where  $k$  is a positive integer, an instance of size  $M$  takes 32 seconds to run. Suppose you run an instance of size  $2M$  and find that it takes 512 seconds to run. What is the value of  $k$ ?
- 4) Assume that an  $O(\log_2 N)$  algorithm runs for 10 milliseconds when the input size ( $N$ ) is 32. What input size makes the algorithm run for 14 milliseconds?

**Spend no more than FOUR minutes each on the next five questions (20 min total).**

*Directions: For questions 5 – 9, represented as functions with appropriate names, determine the run-time for the function in terms of the variable  $n$ . The answers should simply be Big-Oh answers, but you need to provide ample justification for your answers. You may assume that  $n$  is a positive integer.*

**Question 5**

```
int function5(int A[], int B[], int n) {  
  
    int i, j, sum = 0;  
    for (i=0; i<n; i++)  
        for (j=0; j<n; j++)  
            if (A[i] == B[j])  
                sum++;  
    return sum;  
}
```

### Question 6

```
int function6(int A[], int B[], int n) {
    int i=0,j=0;

    while (i < n) {
        while (j < n && A[i] > B[j]) j++;
        i++;
    }
    return j;
}
```

### Question 7

```
int function7(int A[], int B[], int n) {
    int i=0,j;

    while (i < n) {
        j=0;
        while (j < n && A[i] > B[j]) j++;
        i++;
    }
    return j;
}
```

### Question 8

```
void function8(int n) {

    while (n > 0) {
        printf("%d\n", n);
        n = n/2;
    }
}
```

### Question 9

```
int function9(int n) {
    int i,j;
    for (i=0; i<n; i++)
        for (j=0; j<n; j++)
            if (j == 1)
                break;
    return j;
}
```