

Computer Science I – Spring 2012
Lab: 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;
}
```