

# CSE 312 Midterm 1

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## I. QUESTION (ALGORITHM ANALYSIS) (15 POINTS)

Given the following function

```
int algorithm1(int N){
    int i, j, k, sum = 0;
    for (i = 1; i <= N; i++)
        for (j = i; j <= N; j++)
            for (k = 1; k <= j - i; k++)
                sum++;
    return sum;
}
```

What does the function algorithm1 return in terms of N?

## II. QUESTION (ALGORITHM ANALYSIS) (15 POINTS)

Given the following function

```
int algorithm2(int N){
    if (N == 0)
        return 0;
    sum = 0;
    for (i = 0; i < N; i++)
        sum++;
    return algorithm2(N - 1) + sum;
}
```

What does the function algorithm2 return in terms of N?

## III. QUESTION (ALGORITHM ANALYSIS) (15 POINTS)

Given the following function

```
int algorithm3(int N){
    if (N == 1)
        return 0;
    sum = 0;
    for (i = 0; i < N; i++)
        sum++;
    return algorithm3(N / 2) + sum;
}
```

What is the time complexity of algorithm3?

## IV. QUESTION (ALGORITHM ANALYSIS) (15 POINTS)

Given the following function

```
int algorithm4(int N){
    sum = 0;
    for (i = 0; i < N; i++)
        sum++;
    for (i = 1; i < N; i++)
        for (j = 1; j < N; j++)
            if (i % j == 0)
                sum++;
    for (i = 0; i < N; i++)
        for (j = 1; j < N; j *= 2)
            sum++;
    return sum;
}
```

What is the time complexity of algorithm4?

## V. QUESTION (BRUTE FORCE) (20 POINTS)

A sequence of  $n > 0$  integers is called a jolly jumper if the absolute values of the differences between successive elements take on **all** possible values 1 through  $n - 1$ . For instance, 1 4 2 3 is a jolly jumper, because the absolute differences are 3, 2, and 1, respectively. The definition implies that any sequence of a single integer is a jolly jumper. Write the function

```
boolean jollyJumper(int[] A)
```

which returns true if A is jolly, false otherwise.

## VI. QUESTION (BRUTE FORCE) (20 POINTS)

You are given a **sorted** array of  $n$  elements, and you notice that some of the elements are duplicates; that is, they appear more than once in the array. Write a function that returns another array which contains the same elements of the first array without duplicates.

```
int[] withoutDuplicates(int[] A)
```