

# BRAC University (Department of Computer Science and Engineering)

CSE 221 (Algorithms) for Spring 2025 Semester

## Quiz 1

Student ID:

Section:

Full Marks: 20

Name:

Duration: 20 minutes

1. Write the time complexity of the following code snippet. Show your works/reasoning. (5 marks)

Code:

```

sum1 = 0;
for (k=1; k<=n; k++)
    for (j=1; j<=k; j++)
        sum1++;
for (i=1; i<=n; i++)
    a[i] = i;
    
```

Handwritten analysis: The first loop is a nested loop where the inner loop runs  $k$  times for each  $k$  from 1 to  $n$ . This results in a total of  $1 + 2 + 3 + \dots + n = \frac{n(n+1)}{2}$  iterations, which is  $O(n^2)$ . The second loop is a simple linear loop that runs  $n$  times, which is  $O(n)$ . Since  $O(n^2)$  dominates  $O(n)$ , the overall time complexity is  $O(n^2)$ .

2. Write the time complexity of the following code snippet. Show your works/reasoning.

(5 marks)

```

for i in range (1,n)
    j= 1
    while j < i*i
        j=j+1
    
```

Handwritten analysis: The inner loop  $j=j+1$  executes  $i^2 - 1$  times for each  $i$ . The total number of iterations is the sum of  $i^2 - 1$  for  $i$  from 1 to  $n-1$ .

$$\sum_{i=1}^{n-1} (i^2 - 1) = \sum_{i=1}^{n-1} i^2 - \sum_{i=1}^{n-1} 1$$

$$= \frac{(n-1)n(2n-1)}{6} - (n-1)$$

The final result is  $O(n^3)$ .

$$O(n^3) \leftarrow = \frac{n^3}{3} - \frac{n^2}{2} - \frac{5n}{6} + 1$$

3. Consider an 2D sorted array with m rows and n columns. Your task is to check if an item is in the 2D array or not. Now, write an efficient pseudocode or program with time complexity  $O(\log m + \log n)$  to find the row and column of an item in this 2D array. If the item is not in the 2D array the program should print -1. **10 marks**

similar to:

<https://www.geeksforgeeks.org/search-element-sorted-matrix/>