

Data Structures and Algorithms – CS2402

Quiz 2

10 points - 10 minutes

Make sure that you justify all your answers.

For all the following exercises, find the running time function. Detail the steps that lead you to the result.

Exercise 1 (5 points)

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

Solution:

Let us first rewrite the fragment of code as follows:

```
// Part 1:
for (int i = 0; i < n; i = ++ )
    my_procedure;
```

where `my_procedure` is defined as follows:

```
// Part 2:
for (int j = 0, j < i, j = ++ )
    sum++;
```

The time complexity of `my_procedure` / Part 2 is $2 + 3i$. Therefore, p , the time complexity of `my_procedure`, depends on i , not on n : $p(i) = 2 + 3i$.

Let's now consider Part 1.

`int i=0;`

1 step

per valid loop:

`i < n` 1 step

`i ++` 1 step

`my_procedure;` $p(i)$ step

$= 2 + p(i)$ steps per valid loop

n valid values for i

we consider all values of i

$= (2 + p(0)) + (2 + p(1)) + (2 + p(2)) + \dots + (2 + p(n - 1))$

$= \sum_{i=0}^{n-1} (2 + p(i))$

exit condition, when $i \not< n$

1 step

TOTAL:

$2 + \sum_{i=0}^{n-1} (2 + p(i))$ steps

