

## SOLUTION

ICS-202 Data Structures and Algorithms, Quiz 01, Section \_\_\_\_\_, (V314), First Semester 2021-22

Name: \_\_\_\_\_, ID: \_\_\_\_\_

Q. 1 [4 marks] Consider the following functions  $f(n)$  stated as follows ( $n$  is a positive integer):

$$2^n, 2^{n/2}, 2^{\log_2(n)}, n!$$

Write them in the table below from the most efficient to the least efficient in terms of big- $O$  complexity of  $f(n)$ :

Most Efficient			Least Efficient
$2^{\log_2 n}$	$2^{n/2}$	$2^n$	$n!$

Q. 2 [6 marks] Consider the following code fragment (assume  $n$  is a power of 3, i.e.,  $n = 3^k$ )

```
for(int i = 1; i <= n; i = i*3)
    for(int j = 1; j <= n; j++)
        //S1
```

(a) State the number of times the statement S1 is executed as a function of  $n$ .(b) Express this in terms of the big- $O$  complexity of the code fragment.

(a) For the outer loop, since $i = 3^0, 3^1, 3^2, \dots, 3^k$
Let $i = 3^r$ . $\therefore r = 0, 1, 2, \dots, k$ as $i = 1, 3, 3^2, \dots, 3^k$
$\therefore \sum_{r=0}^k \sum_{j=1}^n (1) = \sum_{r=0}^k (n - 1 + 1) = n \sum_{r=0}^k (1)$
$= n(k - 0 + 1) = nk + n$
$= n \log_3 n + n$
(b) Big O. complexity = $O(n \log n)$