King Fahd University of Petroleum & Minerals, Information & Computer Science Department

SOLUTION

ICS-202 Data Structures and Algorithms, Quiz 01, Section _____, (V270), First Semester 2021-22

Name: _____, ID: _____

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

$$n \log(n), \ n^2, \ n\sqrt{n}, \ 1/n$$

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
$\dfrac{1}{n}$	$n \cdot \log(n)$	$n\sqrt{n}$	n^2

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

```
for(int i = 1; i <= n; i = i*2)
    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.

For the outer loop, since $i = 2^0, 2^1, 2^2, \ldots, 2^r, \ldots, 2^k$

Let $i = 2^r$ $\therefore$ $r = 0, 1, 2, \ldots, k$ as $i = 1, 2, 2^2, \ldots, 2^k$.

$$\therefore \sum_{r=0}^{K} \sum_{j=1}^{n} (1) = \sum_{r=0}^{k} (n - 1 + 1) = \sum_{r=0}^{k} (n)$$

$$= n(k - 0 + 1) = n(k+1)$$

$$= n(\log_2 n + 1)$$

$$= n \log_2 n + n$$

(b) Big-O complexity $= O(n \log n)$