

Assignment 1

Due Date: 19-Feb-2020 (11:59 pm) (Wednesday)

Assignment Submission

All sections will submit the assignment on Google classroom if your section has otherwise submit this document on the slate before the deadline

Anyone submit plagiarized document will get -5 abs

Update this document with your answers and submit it as required.
There are total five (5) questions.

Submit DOC file+ Excel sheet including data and graphs+ CPP

Roll No: _____

Section: _____

Name: _____

Question 1. Write Order the following functions by growth rate, also Indicate which functions grow at the same rate.

$n, \sqrt{n}, n^{3/2}, n^2, n \log n, n \log(\log n), n \log^2 n, n \log(n^2), n \log^2(n^2), 2/n, 2^n, 2^{n/2}, 100, n^2 \log n, n^3, n/e^n$

Solution Q1: Write your solution here.

Question 2. Solve the following recurrence either exactly or asymptotically

$$T(n) = \begin{cases} 1 & \text{for } n = 1 \\ \sum_{i=1}^{n-1} T(i) + n & \text{for } \forall n \geq 2 \end{cases}$$

Solution Q2: Write your solution [you have to write it on paper and add pic].

Question 3. Which function grows faster (High Complexity)? (the two functions may have similar growth rate as well)

- (a) $n \log n$, or, $n^{[1 + 1/\log n]}$
- (b) n^k or c^n , where $k \geq 1$ and $c \geq 1$, are constants
- (c) $\text{Log}_2 n$ or $\log_{10} n$,
- (d) $n^2 \log n$ or $n \log^2 n$,
- (e) 8^n or 4^n
- (f) $\text{Log } n^{\log 17}$ or $\text{Log } 17^{\log n}$

Solution Q3: Write your solution here.

Q4a. Fine the time complexity of the following code

```
1  Sum()
2  {
3    for i=1 to n do
4      i=i+1
5    for j = 1 to n do
6      for k = n down to 1 do
7        sum=sum+1
8    }
```

Q4a. Solve the following problems.

- a) Suppose we have an unsorted array of size 'n' and we want to find a middle element of the array. Describe an algorithm which will take $O(n \log n)$ time. (just a paragraph of maximum three lines).
- b) What will be the upper bound to choose middle element, if array (in part 'a') is already sorted.

Solution Q4a: Write your solution here.

Solution Q4b

Q5. For each of the following six program fragments:

- a) Give an analysis of the running time (**Big-Oh** will do).
- b) Implement the code in the language of your choice, and give the **running time** for 10 values of n (e.g., $n = 100, 200, 300, \dots, 1000$) in table form. If the difference in the results are not prominent you can use larger values than the given.
- c) Plot the running time with respect to input size them in a graphical format in excel put plots with each part in this Doc.
- d) Submit this document on slate/Google classroom as suggested with **C++ code/this document and also the excel sheet**

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

```
(2)    sum = 0;
        for( i=1; i<n; i=i*2 )
            for( j=0; j<n; j++ )
                sum++;
```

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

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

```
(5)    sum = 0;
        for( i=1; i<n; i++ )
            for( j=0; j<i*n; j++ )
                ( k=0; k<j; k++)
                    sum++;
```

```
(6)    sum = 0;
        for( i=1; i<n; i++ )
            ( j=1; j<i*n; j++ )
                if( j%1 == 0 )
                    ( k=0; k<j; k++ )

sum++;
```

Solution Q5: Write your solution here.

<Good Luck>