

## CSE 321-Introduction to Algorithms-Fall 2020

### Homework 1

Deadline: November 6<sup>th</sup>, 23:59 pm

1)

For each of the following statements, specify whether it is true or not. Explain your reasoning for each of them.

a)  $\log_2 n^2 + 1 \in O(n)$

b)  $\sqrt{n(n+1)} \in \Omega(n)$

c)  $n^{n-1} \in \theta(n^n)$

d)  $O(2^n + n^3) \subset O(4^n)$

e)  $O(2 \log_3 \sqrt[3]{n}) \subset O(3 \log_2 n^2)$

f)  $\log_2 \sqrt{n}$  and  $(\log_2 n)^2$  are of the same asymptotical order.

2) Order the following functions by growth rate and explain your reasoning for each of them.

$$n^2, n^3, n^2 \log n, \sqrt{n}, \log n, 10^n, 2^n, 8^{\log n}$$

3) What is the time complexity of the following programs? Explain by giving details.

a)

```
void f( int my_array[]){
    for(int i=0;i<sizeofArray;i++){
        if(my_array[i]<first_element){
            second_element=first_element;
            first_element=my_array[i];
        }
        else if(my_array[i]<second_element){
            if(my_array[i]!= first_element){
                second_element= my_array[i];
            }
        }
    }
}
```

```

    }
}

```

**b)**

```

void f(int n){
    int count=0;
    for(int i=2;i<=n;i++){
        if(i%2==0){
            count++;
        }
        else{
            i=(i-1)i;
        }
    }
}

```

**4 )** Find the complexity classes of the following functions using the integration method.

a)  $\sum_{i=1}^n i^2 \log i$

b)  $\sum_{i=1}^n i^3$

c)  $\sum_{i=1}^n 1/(2\sqrt{i})$

d)  $\sum_{i=1}^n 1/i$

**5)** Find the best case and worst case complexities of linear search with repeated elements, that is, the elements in the list need not be distinct. Show your analysis.