

Assignment 2

1. Order the following functions by growth rate (5 points)

N

\sqrt{N}

$N^{1.5}$

N^2

$N \log N$

$N \log \log N$

$N \log^2 N$

$N \log(N^2)$

$2/N$

2^N

37

$N^2 \log N$

N^3

Indicate which of the functions grow at the same rate.

2. For each of the following code fragments give running time analysis (Big Oh) (12 points)

a. `sum = 0;`
 `for (i=0; i < n ; i++)`
 `sum++;`

b. `sum = 0;`
 `for(i = 0; i < n; i++)`
 `for(j = 0; j < i ; j++)`
 `sum++;`

c. `sum = 0;`
 `for(i = 0; i < n; i++)`
 `for(j = 0; j < i * i ; j++)`
 `for(k = 0; k < j; k++)`
 `sum++;`

3. What is the time complexity of the below function?

(5 points)

```
void fun(int n, int arr[])
{
    int i = 0, j = 0;
    for(; i < n; ++i)
        while(j < n && arr[i] < arr[j])
            j++;
}
```

4. An algorithm takes 0.5 ms for input size 100. How long will it take for input size 500 if the running time is the following (assume lower order terms are negligible) **(8 Points)**
- linear
 - $O(N \log N)$
 - quadratic
 - cubic
5. Show that X^{62} can be computed with only eight multiplications **(4 Points)**
6. Give an efficient algorithm to determine if there exists an integer i such that $A_i = i$ in an array of N distinct integers, sorted in ascending order. What is the running time of given algorithm? **(8 Points)**
7. Give an efficient algorithm along with running time analysis to find the minimum subsequence sum (Assume the minimum sum is either 0 or a negative value) **(8 points)**