

Course/ Batch: BTech/ SCSET
Course Code: CSET244
Semester: Even
Session: 2024-2025

Course Type: Core
Course Name: Design and Analysis of Algorithms

Tutorial Assignment: Week 1

Tutorial title: Running time of the loop execution of functions, Growth of functions

CO Mapping

Question no	CO1	CO2	CO3
Q1	✓		
Q2	✓		
Q3	✓		

Q1. Arrange the following list of functions in ascending order of growth.

(a) $2^{\sqrt{\log n}}$, 2^n , $n^{4/3}$, $\log n$, $n^{\log n}$, 2^{2^n} , 2^{n^2}

$$2^{\sqrt{\log n}} < \log n < n^{4/3} < n^{\log n} < 2^n < 2^{n^2} < 2^{2^n}$$

(b) $\log(\log_2 n)$, $1/n$, $\sqrt{\log n}$, 100, 2^n , $\sqrt{n}$, $n^{1/3}$

$$1/n < 100 < \log(\log_2 n) < \sqrt{\log n} < n^{1/3} < \sqrt{n} < 2^n$$

Q2. For the following functions, determine how many times will the print() statement be executed? Give your answer in terms of n.

(a)

```

fun(n)
{
    for (i=n/2; i>=1; i--)
        for (j=2; j<=n; j=j*2)
            print("Nested loop execution");
}

```

nlogn

(b)
fun(n)
{
 for(i =1; i<=n²; i++)
 for (j=n; j>=1; j=j/2)
 print(“Nested loop execution”);
}
n²logn

Q3. Suppose that for inputs of size n on a particular computer, insertion sort runs in $8n^2$ steps and merge sort runs in $64n\log n$ steps. For which values of n does insertion sort beat merge sort?

$$8n^2 < 64n\log n$$

$$n < 8\log n$$

$$n/8 < \log n$$

$$2^{n/8} < n$$

$$n \leq 43$$

Insertion sort runs faster when we are sorting at most 43 items. Otherwise merge sort is faster.