$$f(n) = 100n + 5 \neq \Omega(n^2) \checkmark$$

$$n^2 \leq 100n + 5 \quad \forall \quad \boxed{n \geq n_0} \checkmark$$

$$100n + 5 \leq 100n + 5n \checkmark$$

$$\leq 105n \quad \forall \quad n \geq n_0$$

$$cn^2 \leq 105n \quad \forall \quad n \geq n_0 \quad [c, n_0]$$

$$cn^2 - 105n \leq 0$$

$$n(cn - 105) \leq 0$$

$$cn - 105 \leq 0$$

$$cn \leq 105$$

$$\checkmark \boxed{n} \leq (105/4) \checkmark$$

$$f(n) = n + \frac{n}{2} + \frac{n}{4} + \frac{n}{8} + \cdots + \quad \approx 2$$
$$= n\left(\frac{1}{2} + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \cdots\right)$$

$$f(n) = 2n$$
$$= O(n)$$

i	j
n	n
$n/2$	$n/2$
$n/4$	$n/4$
$\vdots$	
1	1

Jaypee University of Engineering and Technology

18B11CI311 – Data Structures
B.Tech -3rd Semester
Tutorial – 2 (Time Complexity)

Q1. Analyze the time complexity for following code segments/ functions.

i.	ii.

1. int count = 0;
2. for (int i = n; i > 0; i /= 2)
3.   for (int j = 0; j < i; j++)
4.   count += 1;
	for (i=1; i<=n; i++)
	    for (j=1; j<=log(i); j++)
	        PRINT "HELLO JUET !" ;

(handwritten i:) O(n)

(handwritten ii:) ✓ O(log n!) ≈ O(n log n)

iii.	iv.

if (n==1)
    return;
for (int i=1; i<=n; i++)
{
    for (int j=1; j<=n; j++)
    {
	void fun(int n, int arr[])
	1. {
	2. int i = 0
	3. for(; i < n; i++)
	4. for(j=0;j < n && arr[i] < arr[j];j++)

```
void function(int n)
{
    int count = 0;
    for (int i=n/2; i<=n; i++)
        for (int j=1; j<=n; j = 2 * j)
            for (int k=1; k<=n; k = k * 2)
                count++;
}
```

100

1. For I = 1 to n-1
2.   For J = 0 to (n-I-1)
3.   If a[J] > a[J+1] then,
4.   Set temp = a[J]
5.   Set a[J] = a[J+1]
6.   Set a[J+1] = temp

vii.

```
void function(int n)
{
    int count = 0;
    for (int i=n/2; i<=n; i++)
        for (int j=1; j+n/2<=n; j = j+1)
            for (int k=1; k<=n; k = k * 2)
                count++;
}
```

$O(n)$
$O(n)$
$O(\log n)$

$O\left(n^2 \log_2 n\right)$

viii.

1. For I = 0 to n-2
2.   min=I
3.   For J = I+1 to (n-1)
4.   If a[min] > a[J]
5.   min=J
6.   Set temp = a[min]
7.   Set a[min] = a[I]
8.   Set a[I] = temp

Q2. Rank the following function by their order of growth (increasing order).

$(n+1)!$, 1 , $n^{1/\log n}$, $(3/2)^n$, $\log(\log n)$, $\text{sqrt}(2)^{\log n}$, $(\log n)^{\log n}$, $\text{sqrt}(\log n)$