ASSIGNMENT - 53

1. What is the time complexity of the following Code:

```
int a=0, b=0;

for (i=0; i<N; i++)
{
    a = a + rand();
}
for (j=0; j<M; j++)
{
    b = b+rand();
}
```

The first loop $\simeq N$, the second loop $\simeq M$.

=> Time complexity :- $O(N)$

2. What is the time complexity of th code:-

```
int i,j, k=0;

for (i=n/2; i<=n; i++)
{
 for (j=2; j<=n; j=j*2)
{
    k = k+n/2;
 }
}
```

$\simeq n \cdot \log n$

=> Time complexity - $O(n \log n)$

3. What is the time complexity of the code:

```
int a = 0;

for (i=0 ; i<N ; i++)        ≈ N
{
  for (j=N ; j>i ; j--)      ≈ N^2
  {
     a= a+i+j;
  }
}
```

=> Time complexity = $O(N^2)$

4. What is the time complexity of the code:-

```
Void fun(int n)
{
  for (int i=0 ; i<n/2 ; i++)
  for (int j=1 ; j+n/2 <=n ; j++)
  for (int k=1 ; k<=n ; k= k*2)
       Cout << "Prateek Jain";
}
```

=> Time complexity = $O(n^2 \log n)$

5. $T(n) = 3T(n/3) + \frac{n}{2}$

$\Rightarrow a = 3, b = 3, k = 1, P = 0$

$a \quad b^k$

$3 = 3^1$

$a = b^k$

$P > -1$

$T(n) = \Theta(n^{\log_b a} \cdot \log^{P+1} n)$

$T(n) = \Theta(n^{\log_3 3} \cdot \log n)$

$T(n) = \Theta(n \log n)$ Ans

6. $T(n) = 6T(n/3) + n^2 \log n$

$\Rightarrow a = 6, b = 3, k = 2, P = 1$

$a < b^k$

$P \geq 0$

$T(n) = \Theta(n^k \log^P n)$

$T(n) = \Theta(n^2 \log n)$

Ans

7. $T(n) = 4T(n/2) + n/\log n$

$\Rightarrow T(n) = 4T(\frac{n}{2}) = n(\log n)^{-1}$

$a = 4, \quad b = 2, \quad k = 1, \quad p = -1$

$\boxed{a > b^k}$

$T(n) = \theta(n^{\log_b a})$

$T(n) = \theta(n^{\log_2 4})$

$\boxed{T(n) = \theta(n^2)}$

8. $T(n) = 64T(n/8) - n^2 \log n$

$\Rightarrow a = 64, \quad b = 8, \quad k = 2, \quad p = 1$

$\boxed{a = b^k}$

$p \geq -1$

$T(n) = \theta(n^{\log_b a} \cdot \log^{p+1} n)$

$T(n) = \theta(n^{\log_8 64} \cdot \log^2 n)$

$\boxed{T(n) = \theta(n^2 \cdot \log^2 n)}$

9. $T(n) = 7T(n/3) + n^2$

$\Rightarrow a = 7, b = 3, k = 2, p = 0$

$a < b^k$

$p \geq 0$

$T(n) = \theta(n^k \cdot \log^p n)$

$\boxed{T(n) = \theta(n^2)}$

10. $T(n) = 4T(n/2) + \log n$

$\Rightarrow a = 4, b = 2, k = 0, p = 1$

$a > b^k$

$T(n) = \theta(n^{\log_b a})$

$T(n) = \theta(n^{\log_2 4})$

$T(n) = \theta(n^{\log_2 2^2})$

$\boxed{T(n) = \theta(n^2)}$