Tutorial - II

Ques^n 1~~st~~st :-

```
void fun (int n)
{
  int j = 1;
   i = 0;
  while ( i < n) √2n  +1 +1
  {
     i = i + j ; √2n
     j++ ; √2n
  }
}
```

$i = \left(1 + 2 + \cdots + \frac{k(k+1)}{2}\right)$

$\frac{K^2}{2} = n$

$K^2 = 2n$

$K = \sqrt{2n}$

$O(\sqrt{2n})$

Ques^n 2nd :-

febonacci's series :-

0 1 1 2 3 5 8

$T(n) = T(n-2) + T(n-1)$.

Q3 :- $n(\log(n))$, n^3, $\log(\log(n))$

~~void main()~~

~~while (~~

(a:) $n\log(n)$

```
# include <iostream>
using namespace std;
void main()
 { int i = 1, j = 1;
     cin>>n;
   while ( i <= n)
     {
       for (j = 1; j < n; j = j * 2)
       {
           cout << "#";
       }
       i = i + 1;
     }
 }
```

- {
  + Cout << "#";
  }
 }
 }
 } }

(C:) :-

Q4 :- (b.) n^3

```
#include < iostream >
using namespace std;
void main()
{
    int n;
    cin>>n;
    for( int i = 1; i <= n; i++)
      {  for ( int j = 1 ; j <= n ; j ++)
           {  for( int k = 1; k <= n ; k ++)
```

~~Ques~~ 4th - $T(n) = T(n/4) + T(n/2) + cn^2$.

Q4 :-

$T(n) = T(n/4) + T(n/2) + cn^2$.

$= T(n/16) + T(n/8) + cn^2 + T(n/48) + T(n/4) + cn^2$

$T(n/2) >= T(n/4)$

$T(n) <= 2T(n/2) + cn^2$.

using Master's Theorem,

$T(n) <= \Theta(n^2) \Rightarrow T(n) = O(n^2)$

$T(n) >= c(n^2) \Rightarrow T(n) >= \Theta(n^2) \Rightarrow T(n) = \Omega(n^2)$.

Since, $T(n) = O(n^2)$ and $T(n) = \Omega(n^2)$.

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

Q5- ~~Solution~~ int fun(int n)

```
{
    for (int i = 1; i <= n; i++)          n+1
    {   for (int j = 1; j < n; j++ → j = j + i)   n(n+1)
        {
            // Some O(1) task;
                                 n(n)
        }
    }
}
```

$\frac{n + i - j + 1}{i}$

$n = j + (k-1) i$

$n = j + ki - i$

$\frac{n+i-j}{ki} = k$

~~n^2~~ $O(n^2)$.

$\cancel{i^k = n}$

```
for(int i=2; i<=n; i=pow(i,k))
{
    // some O(1) expression or statement
}
```

$\cancel{2^k = n}$

$\cancel{2^k = n}$

$\cancel{k = \log_i n}$

$i = i^k$

$i = (i^k)^k$

$n = i^{k^t}$

$\log_i n = k^t$

$\log_k \log_i n = t$

$$\boxed{\log_k \log_i n = t}$$

$O(\log_k \log_i n)$.

Ans 8 :- ~~At~~ ↑

a) $100 < \log(\log(n)) < \log n < \log^2 n < \sqrt{n} < n < n\log n < n^2 < 2^n < 4^n < 2^{2n} < \log(n^2) < \angle\angle n$.

(b.) $1 < \log(\log(n)) < \sqrt{\log n} < \log n < \log 2n < 2\log n \leq n < 2n < 4n < n\log n < n^2 < \log(\angle n) < \angle n < 2(2^n)$.

(c.) $96 < \log 8(n) < \log_2(n) < 8n. < n\log_8 n < n\log_2 n < \angle\angle n < \log n! < 8^{2n}$.