~~module (1)~~ ⇒ 2Q

Ques. find the recurrect rel^n of the following funtion. For the obtained recurrent ~~recursive~~ ~~for~~ rel^n use subsitution method to find its time complexity. & and also verify the obtained time complexity using tree method.

Recurssive relation:

```
void test (int n)
{ if (n>0)
   { printf("%d", n);
     test (n-1);
   }
}
```

1

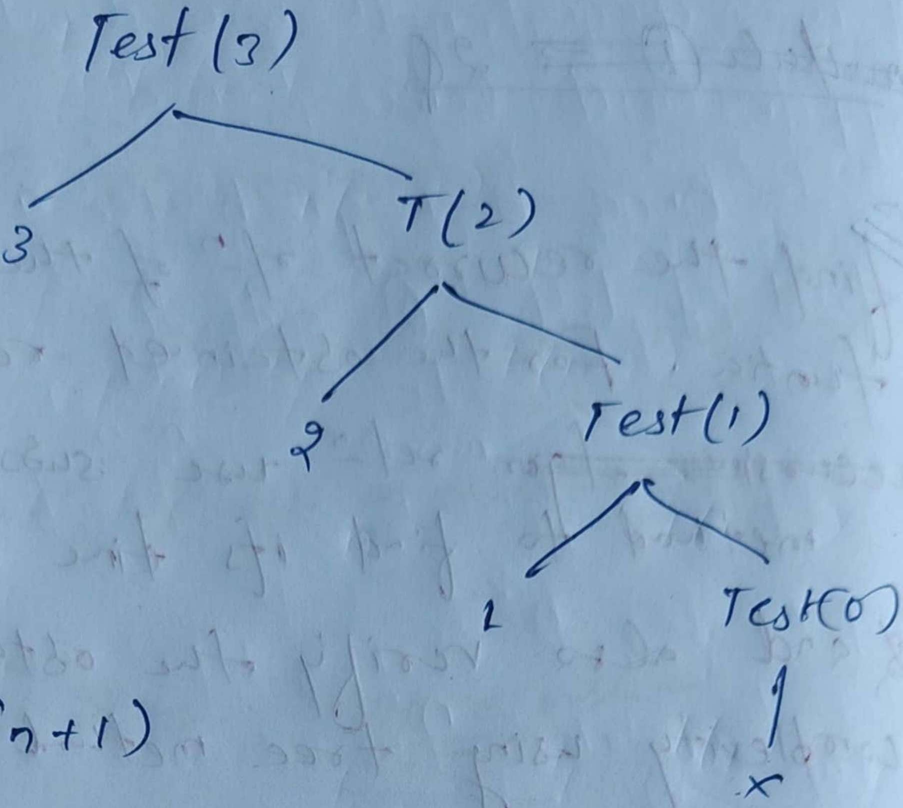
1

T(n-1)

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

~~2023~~

$n=3$



$T_n = (n+1)$

$$T(n) = \begin{cases} 1 & n=0 \\ T(n-1)+1 & n>0 \end{cases}$$

$$\therefore T(n) = T(n-1)+1$$

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

by subsitution

$$T(n) = [T(n-2)+1]+1$$

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

$$T(n) = [T(n-3)+1]+2$$

$T(n) = (n-k) + k$

Assume $(n-k) = 0 \quad \therefore n = k$

$T(n) = T(n-n) + n$

$T(n) = T(0) + 1$

$T(n) = 1 + n$

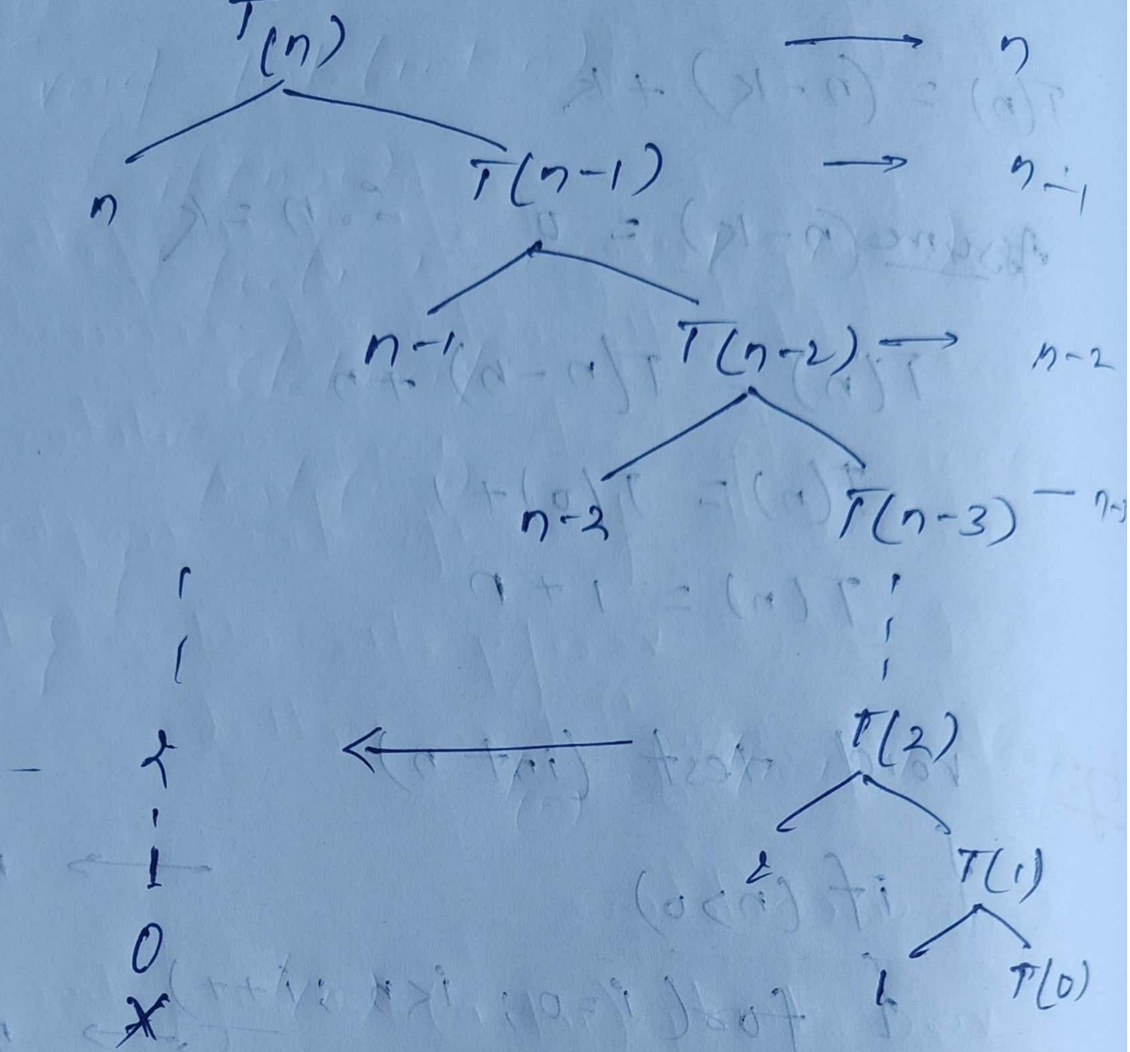
Eg: void test (int n)

```
{ if (n>0)                        --> 1
  { for( i=0 ; i<n ; i++)         --> n+1
        statement                 --> n
     test (n-1)                   --> T(n-1)
  }
}
```

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

n class algorithm

80,



$$0+1+2+(n-1)+(n-2)+\cancel{n+1}+n$$

$$= \frac{n(n+1)}{2} \Rightarrow \quad T(n) = \frac{n(n+1)}{2}$$

$$T(n) = n^2$$

Prof → verification

$$T(n) \begin{cases} 1 & n=0 \\ T(n-1)+n & n>0 \end{cases}$$

$T_{(n)} = T(n-1) + n$

$T(n-1) = T(n-2) + n-1$. ——(1)

$T_{(n)} = [T(n-2) + n-1] + n$

$T(n) = T(n-2) + (n-1) + n$ ——(11)

$= [T(n-3) + n-2] + (n+1) + n$

$T(n) = T_{(n-k)} + (n-(k+1)) + n-(k-2) + \cdots + (n-1) + n$

$$\boxed{\begin{matrix} \because n-k=0 \\ n=k \end{matrix}}$$

putting

$T_{(n)} = T\,0 + 1 + 2 + 3 + \cdots (n-1) + n$

$T_{(n)} = 1 + \frac{n(n+1)}{2}$

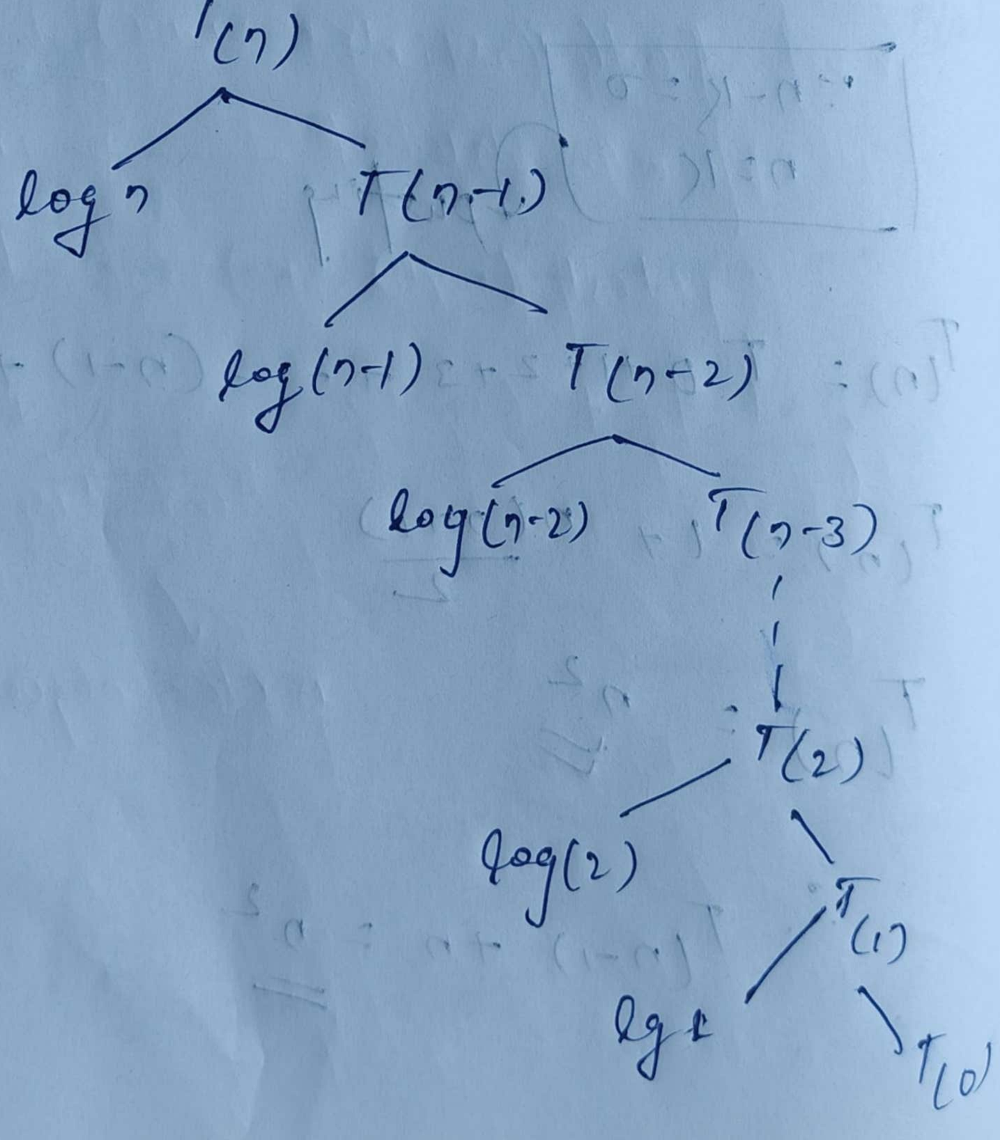
$T_{(n)} = n^2$

$\therefore T_{(n-1)} + n = n^2$

Eg ③

```
void test(int n)
{ if(n>0)                          ---- ①
  { for(i=1; i<n; i=i*2)          log(n)
      Statement
    test(n-1)                      ---- T(n-1)
  }
}
```

$$T(n) = T(n-1) + \log n$$



$\log n + \log(n-1) + \cdots + \log_2 + \log^1$

$\log[n \times (n-1) \times \cdots \times 2 \times 1]$

$\rightarrow \log n!$

$T_{(n)} = T(n-1) + \log n$

$T(n) = [T(n-2) + \log(n-1)] + \log n$

$= [T(n-3) + \log(n-2) + \log(n-1) + \log n$

$T(n) = T(n-k) + \log 1 + \log n + \cdots +$
$\log(n-1) + \log(n)$

$$\boxed{\begin{matrix} n-k=0 \\ n=k \end{matrix}}$$

$T_{(n)} = T_{(0)} + \log n!$

$T_{(n)} = 1 + \log n!$

$T_{(n)} = n \log n$

$T_{(n)} = T(n-1) + \log n$

$O(n \log n)$