$510 \times \frac{n}{2}$ 1+2+3+

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1) Time Complexity : $O(n^2)$
Better approach

```
int sum = 0
int n = 4
~~for( int i=1; i<=n; i++){~~
~~sum+=i~~
}
sum = n* (n+1) /2;
```

T.C = $O(1)$
S.C = $O(1)$

2) $T(n) = 3T(n-1) + 12n$

$T(0) = 5$, given

$T(2) = ?$

$T(1) = 3T(0) + 12n$

$\boxed{T(1) = 15 + 12n}$

$T(2) = 3T(1) + 12n$

$= 3[15 + 12n] + 12n$

$= 45 + 36n + 12n$

$\boxed{T(2) = 45 + 48n}$

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Q4 $T(n) = 16T\left(\frac{n}{4}\right) + n^2 \log n$

$T(n) = aT\left(\frac{n}{b}\right) + \theta(n^k \log^p n)$

$a = 16$, $k = 1$
$b = 4$, $P = 1$

Compare a & b^k
$16 > 4^1$

$a > b^k$

$T(n) = \theta(n^{\log_b a})$
$= \theta(n^{\log_4 16})$
$= \theta(n^{\log_4 4^2})$

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

$$T(n) = T(n-1) + c \quad — (1)$$

$n \to n-1$

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

$$T(n) = T(n-2) + c + c \quad — (2)$$

$n \to n-2$

$$T(n-2) = T(n-3) + c$$

$$T(n) = T(n-3) + c + c + c \quad — (3)$$

⋮ kth time

$$T(n) = T(n-k) + c + c + c + \cdots k \text{ times}$$

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

$T(1) = 1$ Base case

$$T(n-k) = 1$$

$$n-k = 1$$

$$n = k+1$$

$$\boxed{k = n-1}$$

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

$$T(n) = 1 + nc - c$$

$$\boxed{T(n) = O(n)} \text{ ans}$$

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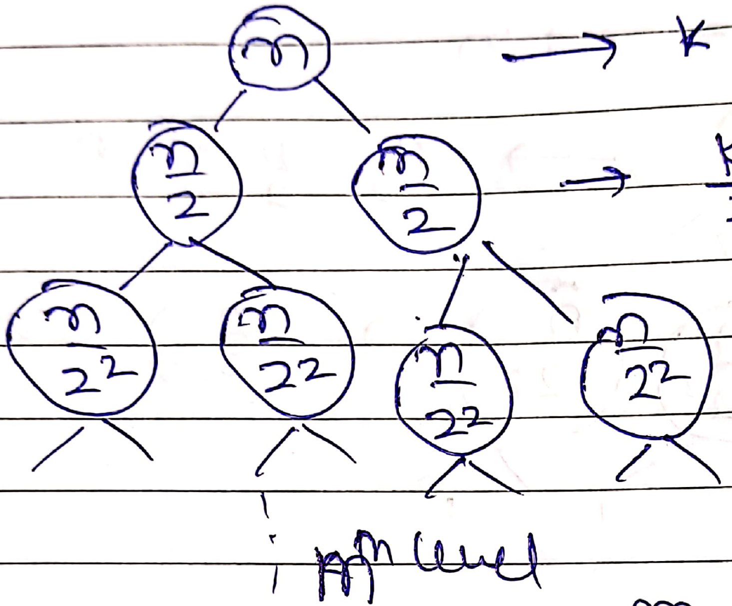
Q6 $T(n) = 2T\left(\frac{n}{2}\right) + K$

$T(n) = T\left(\frac{n}{2}\right) + T\left(\frac{n}{2}\right) + K$



$\rightarrow K$

$\rightarrow \frac{K}{2} + \frac{K}{2} \Rightarrow K$

$\rightarrow \frac{4K}{2^2} \Rightarrow K$

$\frac{n}{2^m} = 1 \qquad n = 2^m$

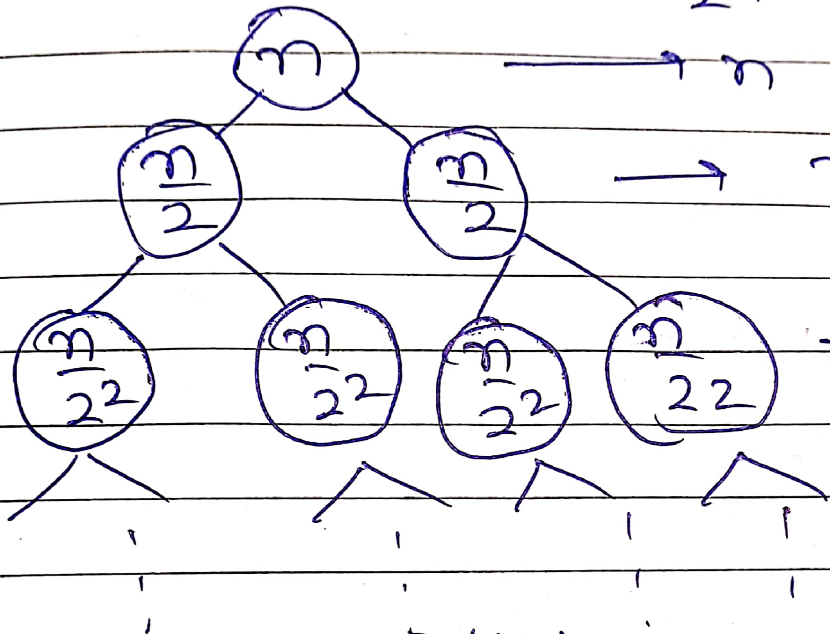
$\boxed{m = \log_2 n}$ level separation

$K + K + K - - - m^{th}$ level
$= \log_2 n$

$\Rightarrow \theta(K \log_2 n)$ ans

Q5 $T(n) = 2T\left(\frac{n}{2}\right) + n$

$T(n) = T\left(\frac{n}{2}\right) + T\left(\frac{n}{2}\right) + n$



$\longrightarrow n$

$\longrightarrow \frac{n}{2} + \frac{n}{2} \Rightarrow n$

$\rightarrow 4\left(\frac{n}{2^2}\right) \Rightarrow n$

kth level

$\frac{n}{2^k} = 1$ (Base case condition)

$n = 2^k$

$\boxed{k = \log_2 n}$ level repeatation

$n + n + n + \cdots$ $\log_2 n$ times

$\Theta(n(\log_2 n))$ ans