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Q.2:-

$n = 45 \times 2 + 771$

$= 861$

We know if $n = 2^m + 2^{m-1} + l$, the serial of second last man is $2l+1$; where $l \geq 0$ and m is maximized.

$n = 861 = \cancel{3 \times 2^8 + 93}$ $2^9 + 2^8 + 93$

So, serial of second last man is $(2 \times 93 + 1) = 187$

Now, we know if $n = 2^m + l$, serial of ~~second~~ last man is $2l+1$; where $l \geq 0$ and m is maximized,

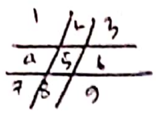
$n = 861 = 2^9 + 349$

So, serial of last man is $= 349 \times 2 + 1$

$= 699$

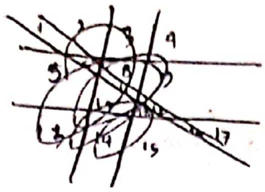
So, 699 and 187 are last twos.

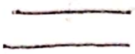
(Q7)



$n=2$

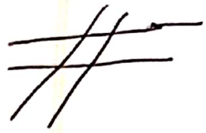
answer = 9

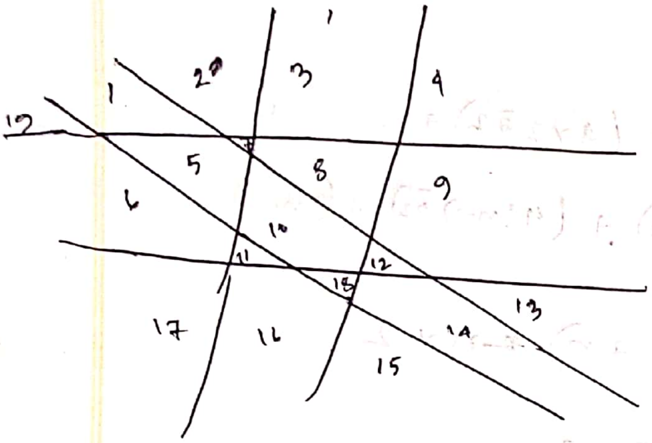




$n=1$

answer = 3



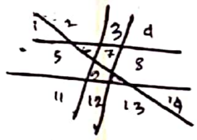


$n=3$

answer = 19

$L_n = L_{n-1} + n$

$9+5+\cdot$



I claim, $P(n) = P(n-1) + 2(n-1)+1+2(n-1)+1$ ~~$2(n-1)+1$~~

$= P(n-1) + 4(n-1) + 2$

$= P(n-1) + 4n - 2$

And $P(0)=1$

$2(n-1)+2$

$2(n-1)+1$

$2(n-1)+1$

$= 4(n-1)+2$

Here, to calculate $P(n)$ from $P(n-1)$, the first line ~~wi~~ of n-th pair will ~~touch~~ intersect $2(n-1)$ lines. It will add $2(n-1)+1$ regions. The case of second ~~pair~~ line of n-th ~~line~~ pair is similar. It will intersect $2(n-1)$ lines.

So, $P(n) = P(n-1) + 4n - 2$, as show above.

And $P(0)=1$; this is recurrence relation

Now,

$$P(n) = P(n-1) + 4n - 2$$

$$= P(n-2) + (4(n-1) - 2) + (4n - 2)$$

$$= P(n-3) + (4(n-2) - 2) + (4(n-1) - 2) + (4n - 2)$$

$$= \ldots\ldots$$

$$= P(n-n) + (4\times1 - 2) + (4\times2 - 2) + \ldots\ldots +$$
$$(4(n-2) - 2) + (4(n-1) - 2) + (4n - 2)$$

$$= 1 + 4(1+2+3+\ldots+n) - n\times 2$$

$$= 1 + \frac{4n(n+1)}{2} \cancel{+2n} - 2n$$

$$= \frac{2 + 4n^2 + 4n - 4n}{2}$$

$$= 2n^2 + 1 \quad \text{(Closed form)}$$

(Ans)