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Tuesday, April 9, 2019 8:36 AM

$$T(0) = 1$$

$$T(N) = T(N-1) + N$$

$$T(N) - T(N-1) = N$$

$$T(N-1) - T(N-2) = N-1$$

$$T(N-2) - T(N-3) = N-2$$

plugging in values for N:

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

$$T(1) - T(0) = 1$$

=> add the equations up

$$\begin{aligned} & [T(N) - \cancel{T(N-1)}] + [\cancel{T(N-1)} - \cancel{T(N-2)}] + [\cancel{T(N-2)} - \cancel{T(N-3)}] \\ & + [\cancel{T(2)} - \cancel{T(1)}] + [\cancel{T(1)} - T(0)] = \underbrace{N + (N-1) + (N-2) + \dots + 2 + 1} \end{aligned}$$

$$\Rightarrow T(N) - T(0) = \sum_{i=1}^N i = \frac{n \times (n+1)}{2} \quad \text{summation}$$

$$\Rightarrow T(N) - T(0) = \frac{n \times (n+1)}{2} \Rightarrow \boxed{O(N^2)}$$