5/5

$A2_Q1$

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$$a_n = \frac{N}{N+1}a_{n-1} + 1$$

$$(n+1)a_n = a_{n-1} + (n+1)$$ (small typo, dropped the n)

(telescoping, note $a_0 = 1$, gives)

$$(n+1)a_n = (n-1)a_{n-2} + (n) + (n+1) = ... = (n-(n-1))a_0 + \sum_{k=2}^{n+1} k$$

$$\implies a_n = \frac{1}{n+1}\sum_{k=1}^{n+1} k = \frac{(n+1)(n+2)}{2(n+1)} = \frac{n+2}{2}.$$