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COS 488
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Feb 16, 2017

PS2 - Q1

First, we multiply the equation by $n+1$:

$$(n+1)a_n = na_{n-1} + n + 1 \qquad \text{for } n > 0$$

Then, we can immediately telescope and iterate the na_{n-1} term to get:

$$(n+1)a_n = 1 * a_0 + \sum_{2 \le j \le n+1} j \qquad \text{for } n > 0$$

Plugging in $a_0 = 1$ gives:

$$(n+1)a_n = \sum_{1 \le j \le n+1} j = \frac{(n+1)(n+2)}{2} \qquad \text{for } n > 0$$

Divide by $n+1$:

$$a_n = \frac{n+2}{2} \qquad \text{for } n > 0$$

Since for $n = 0$, we also have

$$\frac{0+2}{2} = 1 = a_0$$

We can write:

$$a_n = \frac{n+2}{2} \qquad \text{for } n \ge 0$$