1 | Motivation: Fibonacci series

Each number is the sum of two previous numbers, we all know it:

$$1, 1, 2, 3, 5, 8, 13, 21, \ldots \tag{1}$$

How many digits does the *billionth* number have? We obviously can't just compute it.

2 | Motivation: Bernie Sanders Memes???

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

That, the first $T(n-1)$ are the meme makers of the day, $2T(n-1)$ are the newly anointed meme makers, and $2T(n-2)$ are the tired meme-makers.

Let's, instead, guess that there is some kind of exponential relationship, in perspective to a variable r with a few degrees of freedom:

$$T(n) = T(n-1) + 2T(n-1) - 2T(n-2) \tag{2}$$
$$T(n) - T(n-1) - 2T(n-1) + 2T(n-2) = 0 \tag{3}$$
$$r^n - r^{n-1} - 2r^{n-1} + 2^{n-2} = 0 \tag{4}$$
$$r^n - 3r^{n-1} + 2^{n-2} = 0 \tag{5}$$
$$r^{n-2}(r-2)(r-1) = 0 \tag{6}$$
$$r = \{0, 1, 2\} \tag{7}$$

So there must be some kind of exponential relationship:

$$T(n) = a(1^n) + b(2^n) + c(0^n) \tag{8}$$

We can finally solve for a and b given the base cases: then we know that $b = 3$, $a = -3$.