

# CsecIITB CTF 2020

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Category: Misc

Challenge: Fibonacci

Points: 500

Description:

I hope you can really calculate the last 9 digits of fibonacci of  $10^{420} + 69$

Idea:

What we need to do is to find  $\text{fib}(10^{420} + 69) \bmod (10^9)$ , for that we use the fact that for  $k \geq 3$  last  $k$  digits of fibonacci sequence repeat after ever  $15 \cdot 10^{(k-1)}$  terms (Fact 1). So we need to find  $\text{fib}(10^{420} + 69)$ . Lets call  $\text{toFind} = (10^{420} + 69) \% (15 \cdot 10^8)$ . This can be found easily using modular exponentiation.  $\text{toFind}$  comes out to be equal to 1000000069. To find fibonacci of this order we cannot use the linear iterations, so we use the matrix exponentiation method, which takes  $O(\log n)$  time.

For Fact 1 click [here](#), For modular exponentiation method click [here](#)

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