

61A Extra Lecture 2

Thursday, February 5

Announcements

- If you want 1 unit (pass/no pass) of credit for this CS 98, you need to:
 - Enroll in "Additional Topics on the Structure and Interpretation of Computer Programs"
 - Course control number: 25709
- Extra Homework 1 due Thursday 2/12 @ 11:59pm

Dice

Hog: The End Game

You: 98
Them: 99

You: 92
Them: 99

You: 88
Them: 99

You: 80
Them: 99

What is the chance that I'll score at least k points rolling n six-sided dice?

S_n : Score from rolling n dice

t : A single outcome of rolling once

$$P(S_n > k) = \sum_{t=2}^6 P(t) \cdot P(S_{n-1} > k - t)$$

(assuming $k > 1$)

The chance to score at least k in n rolls can be computed using tree recursion!

Sum over each possible dice outcome t that does not *pig out*:

The chance to roll t times the chance to score at least $k - t$ points using $n - 1$ rolls.

Base case: The chance to score at least 0 in 0 rolls is 1 (guaranteed)

Base case: The chance to score more than 0 in 0 rolls is 0 (impossible)

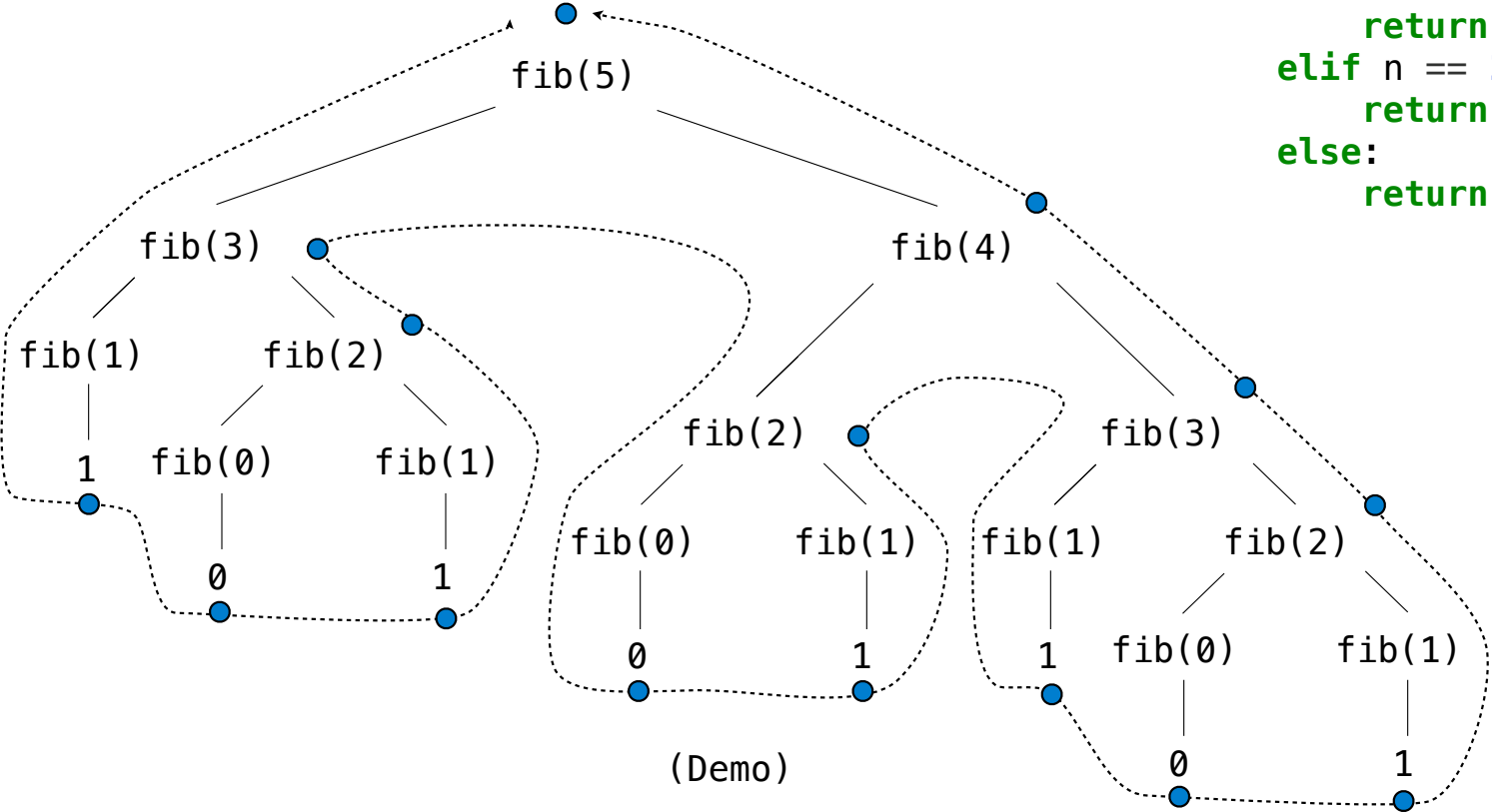
(Demo)

Memoization

Recursive Computation of the Fibonacci Sequence

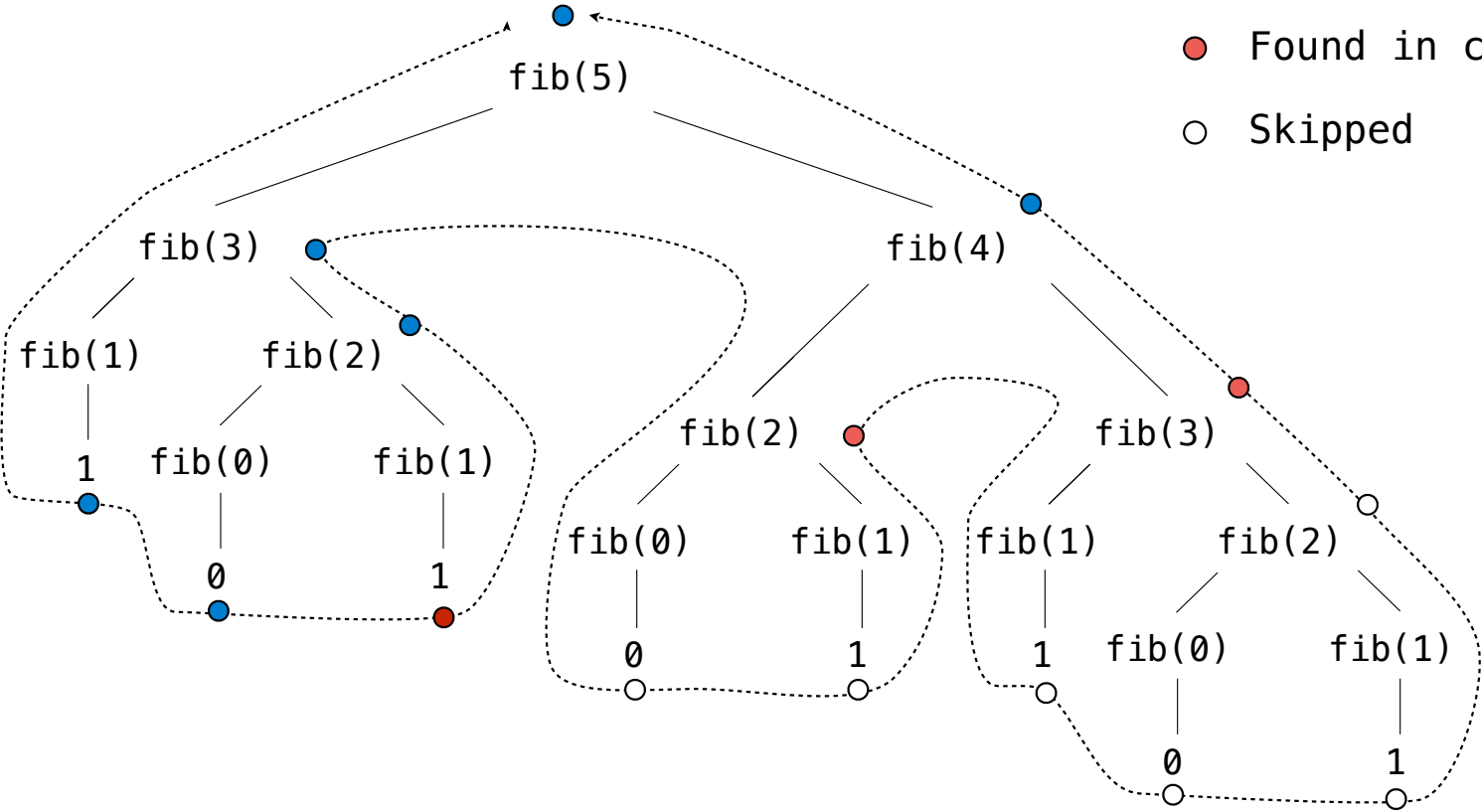
Our first example of tree recursion:

```
def fib(n):  
    if n == 0:  
        return 0  
    elif n == 1:  
        return 1  
    else:  
        return fib(n-2) + fib(n-1)
```



Memoized Tree Recursion

- Call to fib
- Found in cache
- Skipped



Twenty-One (Nim)

Twenty-One Rules

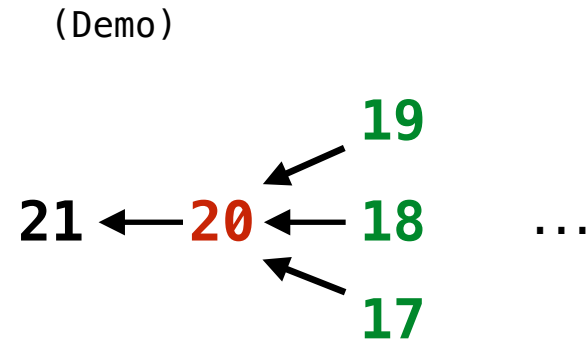
Two players alternate turns, on which they can add 1, 2, or 3 to the current total

The total starts at 0

The game end whenever the total is 21 or more

The last player to add to the total loses

Some states are good; some are bad



(Demo)

Hog Optimal Strategies

Church Numerals (Homework 2 Challenge Question)