Algorítimica y Programación

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Dr. Iván S. Razo Zapata
(ivan.razo@itam.mx)

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Contenido

- Recursividad
- Búsqueda binaria

Recursividad o recursión

- Cuando una función se llama/invoca a si misma
- Usualmente se aplica una técnica de divide y vencerás
- Dividir el problema en subproblemas
- Recombinar la solución de dichos subproblemas, i.e. vencer

Factorial

- Factorial de N
- N! = 1 * 2 * 3 * … *(N-1) * N
- N! = N * (N-1) * (N-2) * (N-3) * … * 2 * 1

Factorial

5! = 5 * 4 * 3 * 2 * 1 = 120

Divide

5! = 5 * factorial(4)

4 * factorial(3)

3 * factorial(2)

2 factorial(1)

1 factorial (0)

1

Factorial

- Caso base (trivial)
  - Factorial de cero = **1**
- Formula genereal
  - Factorial N = **n * factorial (n-1)**

Factorial

- Ejemplo

```
def factorial(n):
    if n == 0:
        return 1
    else:
        return n * factorial (n-1)
```

Caso base a.k.a. kick

Formula general

Sin caso base → Limbo

Fibbonacci

- Fibonacci
- 1, 1, 2, 3, 5, 8, 13, 21, …
- Fib(6) = 8
- Casos especiales 1 y 2
  - Fib(1) = 1
  - Fib(2) = 1
- Fib(3) = 2 <- Fib(2) + Fib(1)
- Fib(4) = 3 <- Fib(3) + Fib(2)

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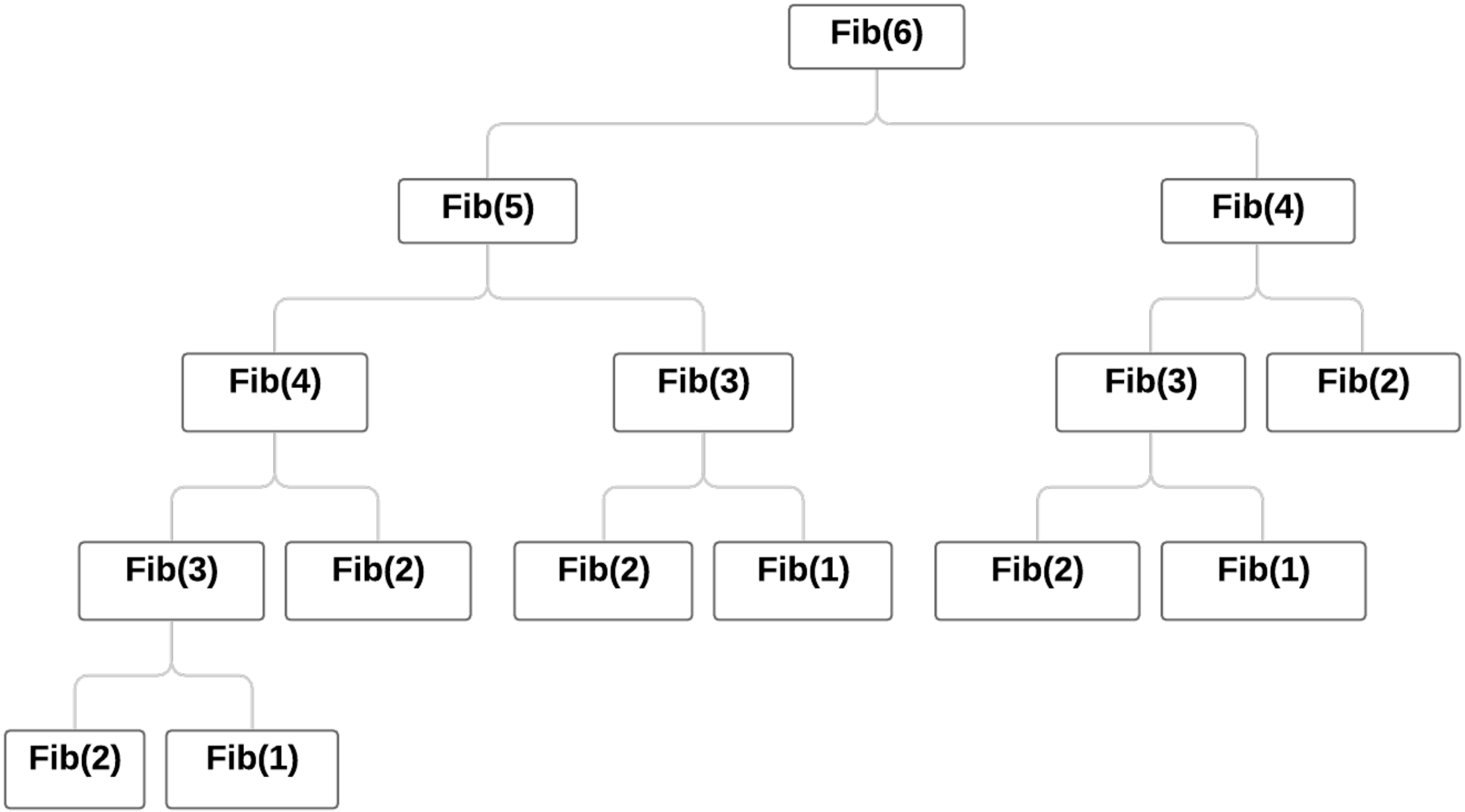
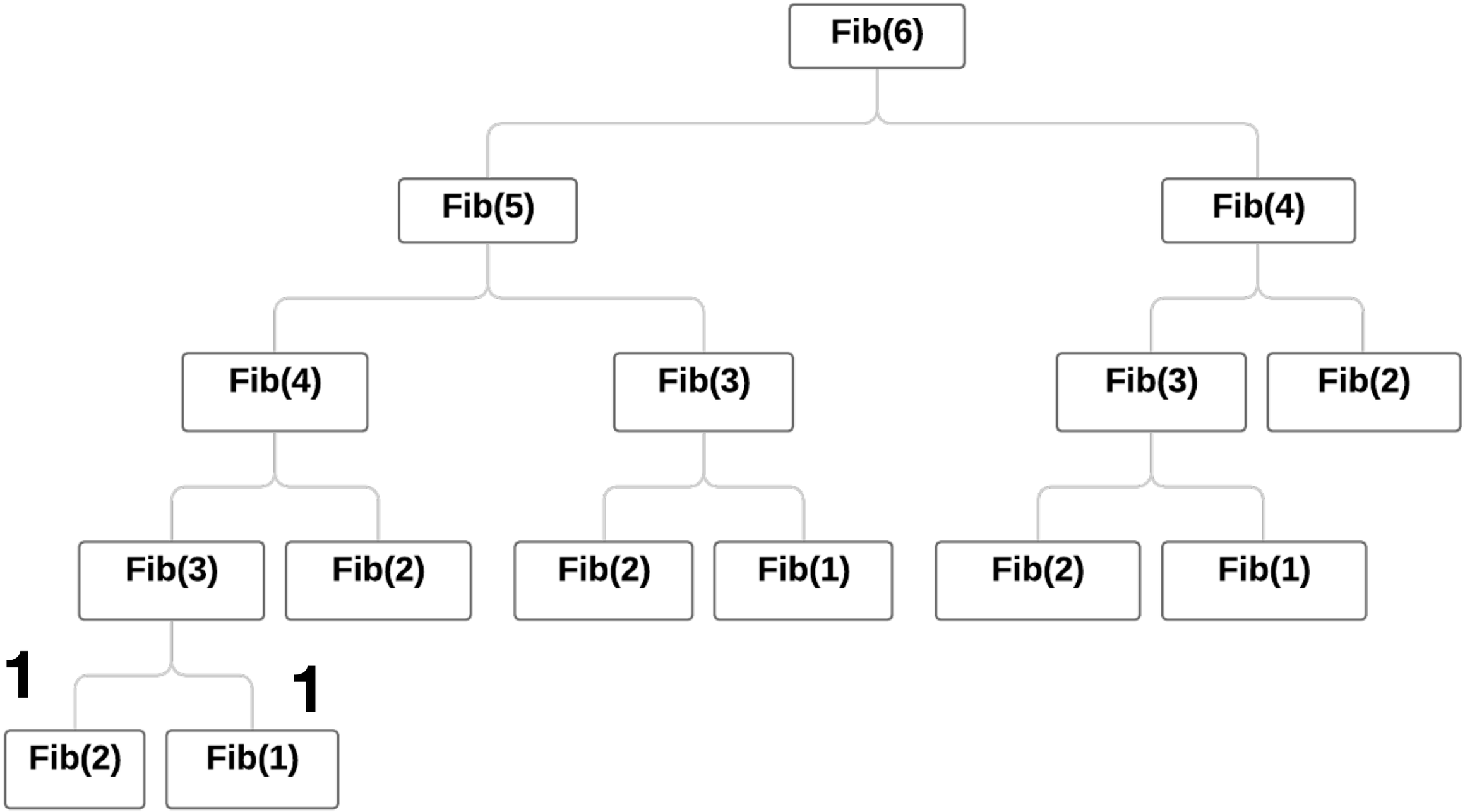
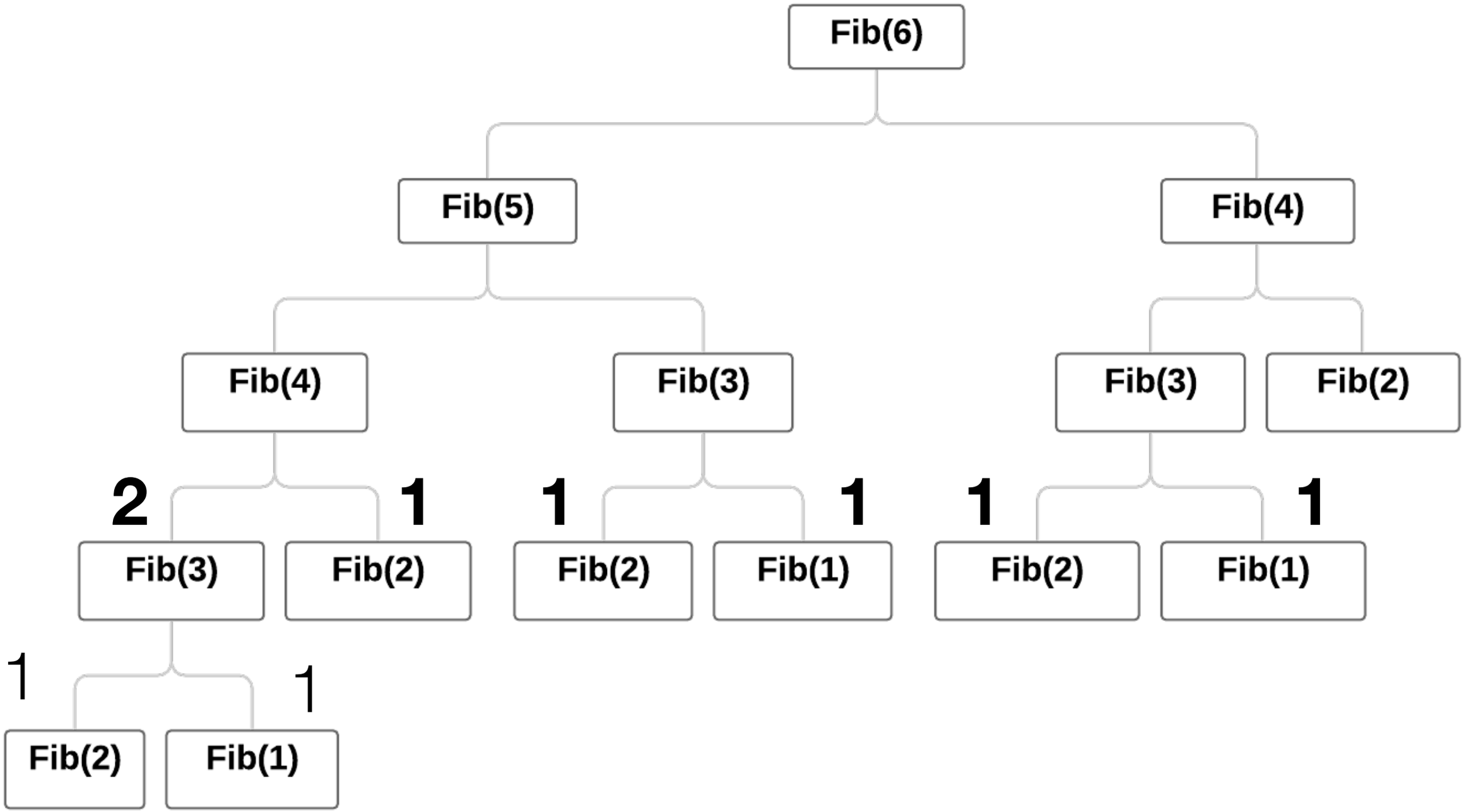
Fibbonacci


Fib(6)
Fib(5)
Fib(4)
Fib(4)
Fib(3)
Fib(3)
Fib(2)
Fib(3)
Fib(2)
Fib(2)
Fib(1)
Fib(2)
Fib(1)
Fib(2)
Fib(1)

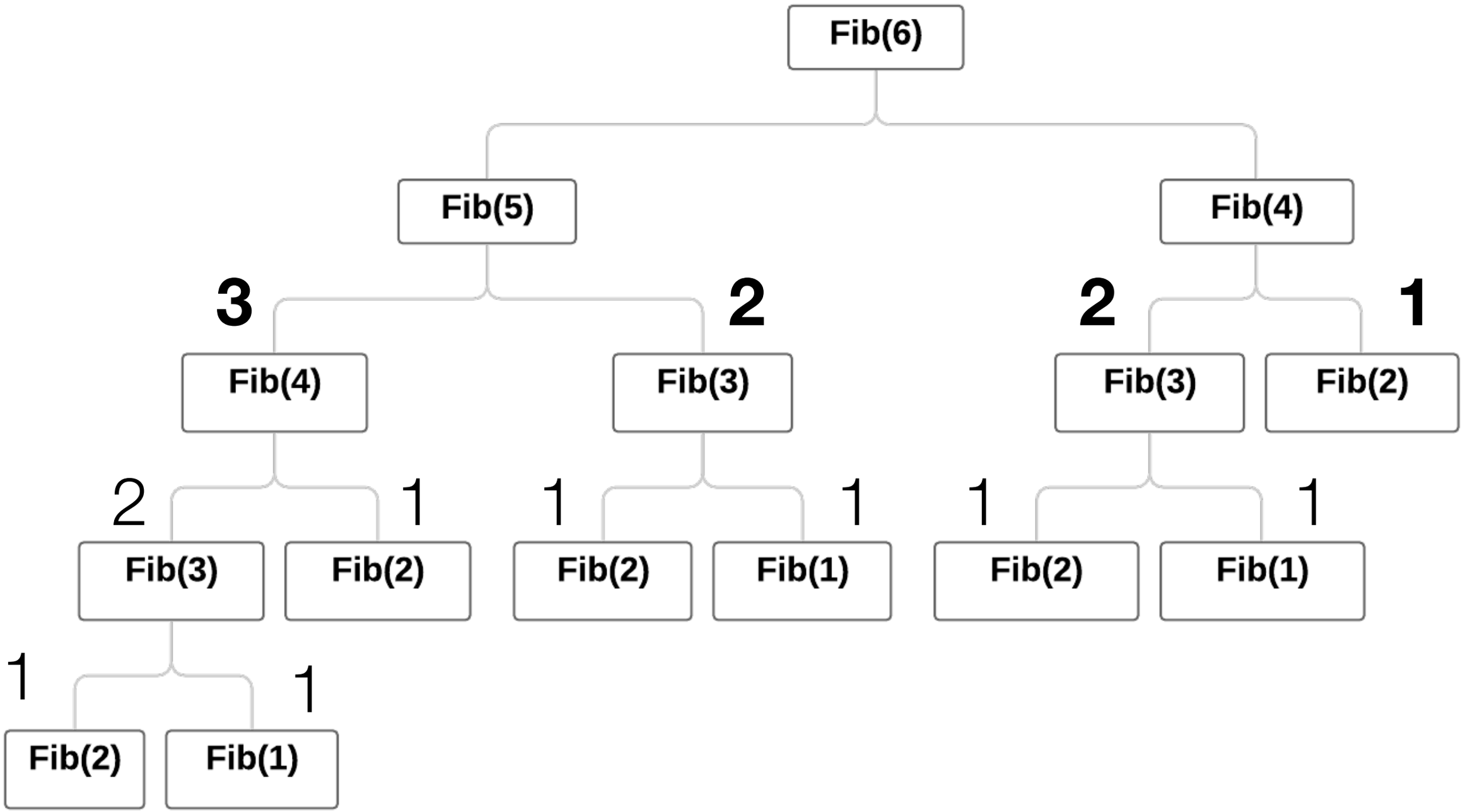
Fibbonacci


Fib(6)
Fib(5)
Fib(4)
Fib(4)
Fib(3)
Fib(3)
Fib(2)
Fib(3)
Fib(2)
Fib(2)
Fib(1)
Fib(2)
Fib(1)
1
1
Fib(2)
Fib(1)

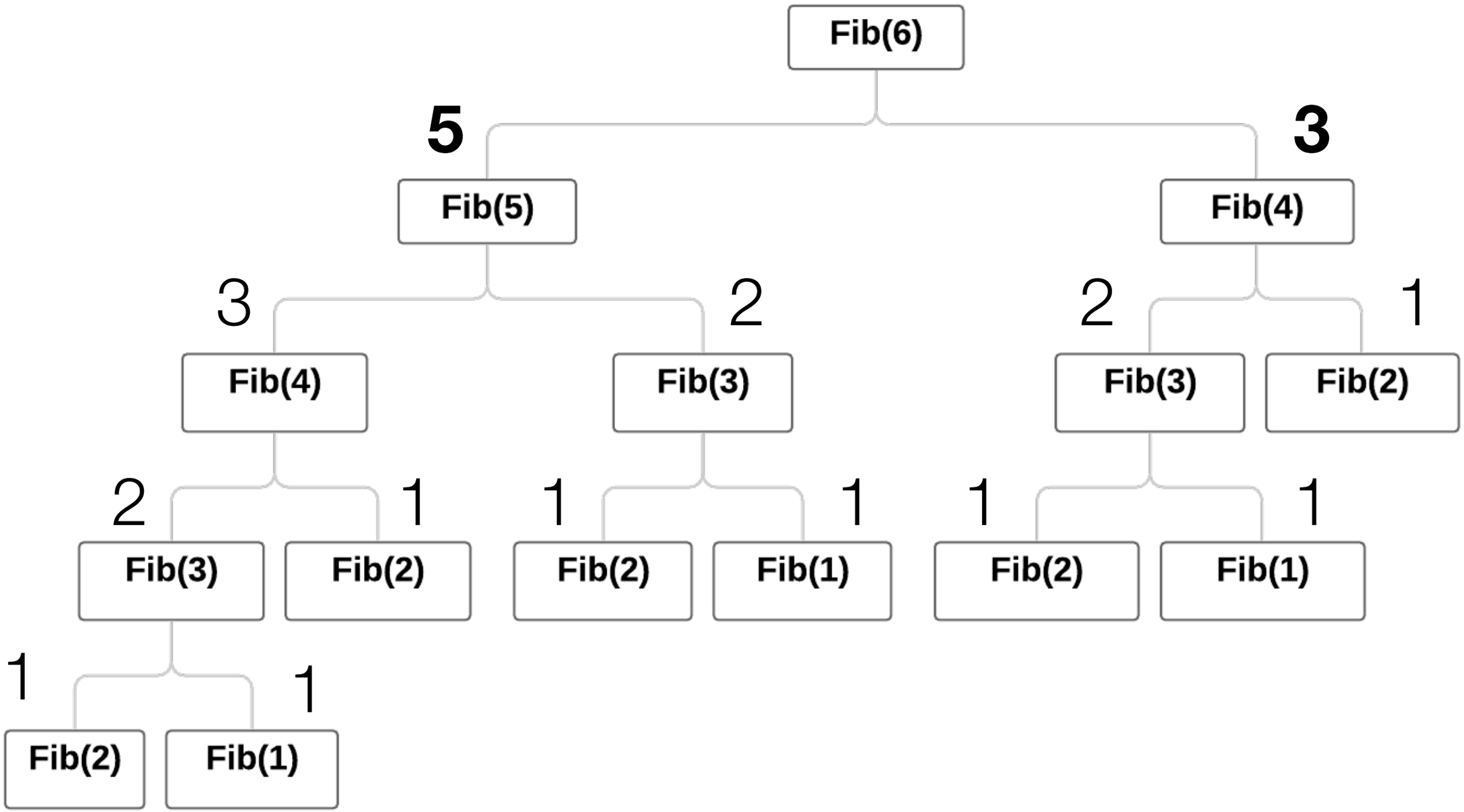
Fibbonacci


Fib(6)
Fib(5)
Fib(4)
2
Fib(3)
Fib(2)
1
1
Fib(2)
Fib(1)
1
Fib(2)
Fib(1)
Fib(4)
Fib(3)
1
Fib(2)
1
Fib(1)
Fib(3)
Fib(2)
1
Fib(2)
1
Fib(1)

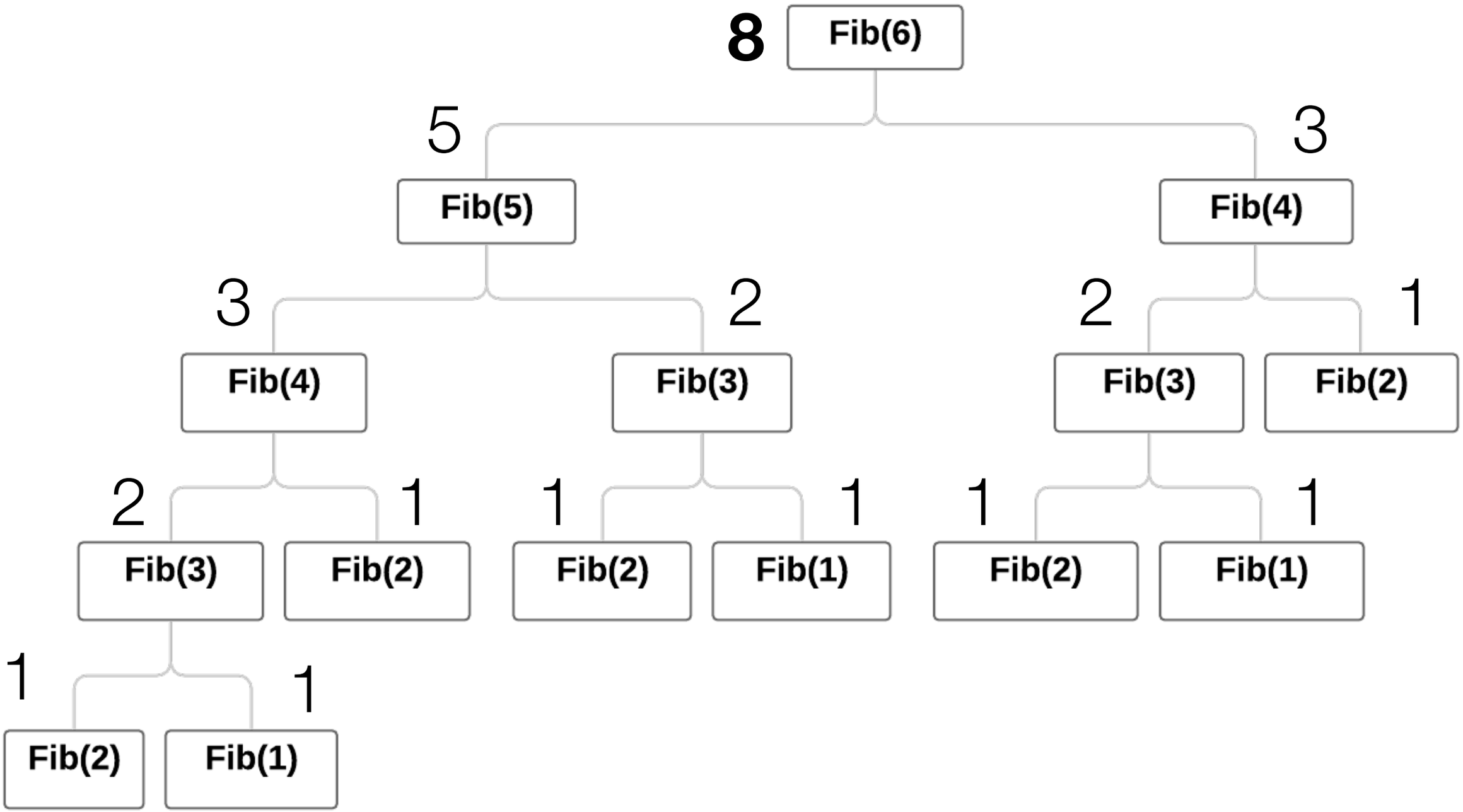
Fibbonacci


Fib(6)
Fib(5)
Fib(4)
3
2
2
1
Fib(4)
Fib(3)
Fib(3)
Fib(2)
2
1
1
1
1
1
Fib(3)
Fib(2)
Fib(2)
Fib(1)
Fib(2)
Fib(1)
1
1
Fib(2)
Fib(1)

Fibbonacci


Fib(6)
5
3
Fib(5)
Fib(4)
3
2
2
1
Fib(4)
Fib(3)
Fib(3)
Fib(2)
2
1
1
1
1
1
Fib(3)
Fib(2)
Fib(2)
Fib(1)
Fib(2)
Fib(1)
1
1
Fib(2)
Fib(1)

Fibbonacci


8
Fib(6)
5
Fib(5)
3
Fib(4)
3
Fib(4)
2
Fib(3)
2
Fib(3)
1
Fib(2)
2
Fib(3)
1
Fib(2)
1
Fib(2)
1
Fib(2)
1
Fib(1)
1
Fib(2)
1
Fib(1)
1
Fib(2)
1
Fib(1)

Fibbonacci

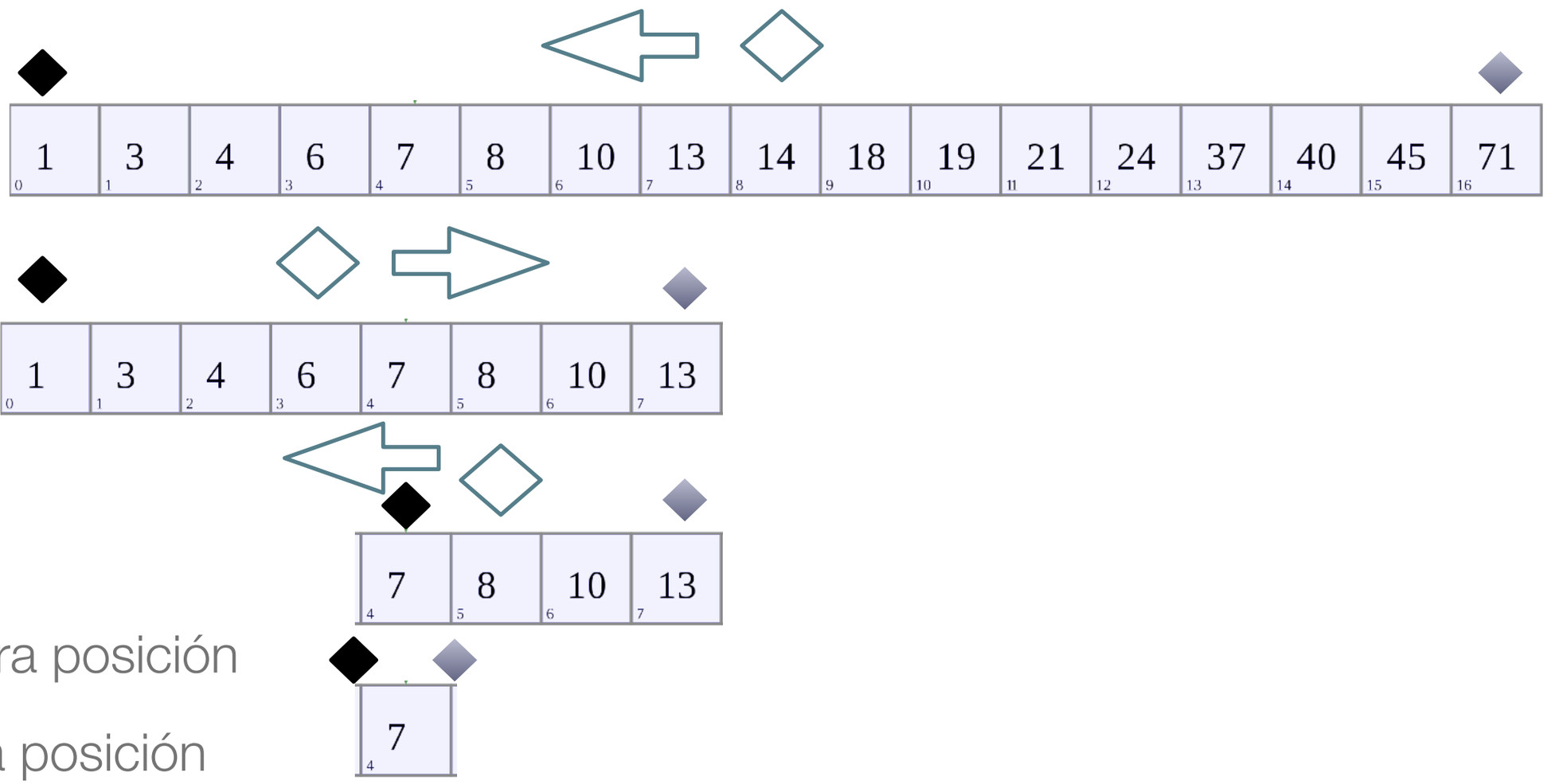
- Caso base (trivial)
  - Fibonnaci 1 y 2 = **1**
- Formula genereal
  - Fib (N) = **Fib(N-1) + Fib(N-2)**

Fibbonacci

```
def fibbonacci(n):
    if (n < 2):
        return n
    else:
        return fibbonacci(n-1) + fibbonacci(n-2)
```

Búsqueda binaria - con **recursividad**

Queremos saber si 7 está en el arreglo



- Primera posición
- Última posición

Búsqueda binaria

```
def busquedaBinaria(arreglo, elemento):
    encontrado = False
    primero = 0
    ultimo = arreglo.size - 1
    while (primero <= ultimo) and (encontrado == False):
        puntoMedio = (primero + ultimo) // 2
        if arreglo[puntoMedio] == elemento:
            encontrado = True
        else:
            if elemento < arreglo[puntoMedio]:
                ultimo = puntoMedio - 1
            else:
                primero = puntoMedio + 1

return encontrado, puntoMedio
```

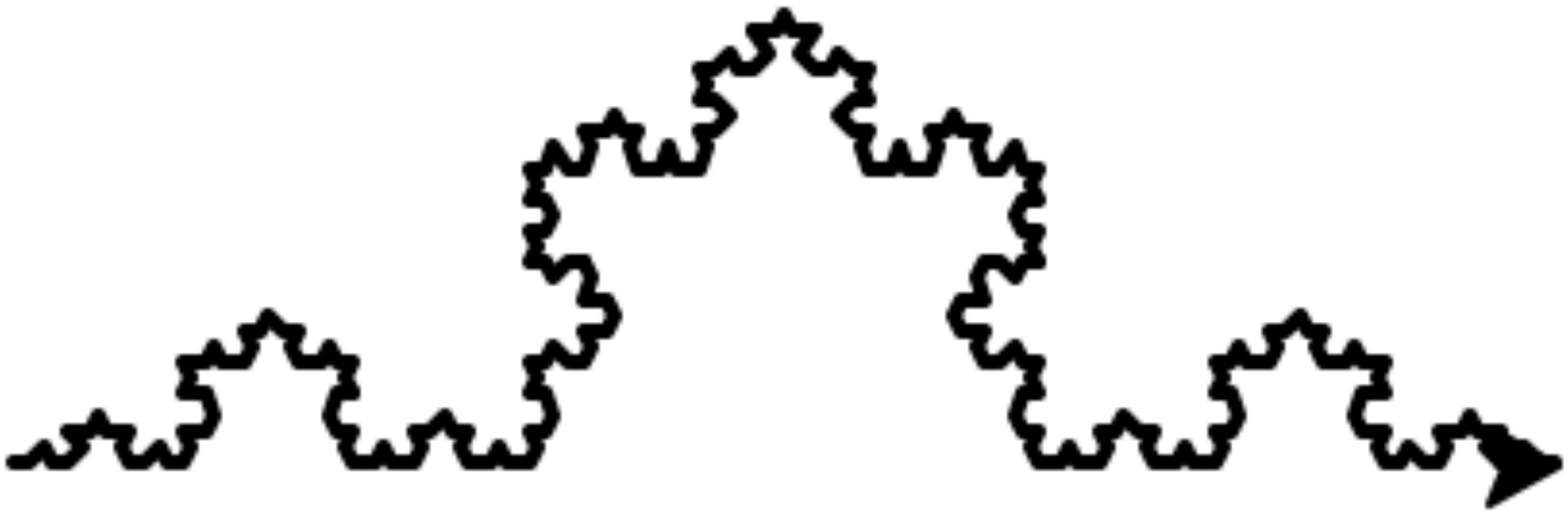
Búsqueda binaria - con **recursividad**

```
def busquedaBinariaRecursiva(arreglo, primero, ultimo, elemento):
    if (ultimo < primero):
        posicion = -1
```

- 10 minutos
- Caso base
- Formula general

Recursividad

Recursividad



Recursividad

```
import turtle

def koch(a, order):
    if order > 0:
        for t in [60, -120, 60, 0]:
            koch(a/3, order-1)
            turtle.left(t)
    else:
        turtle.forward(a)

turtle.speed(10)
turtle.pensize(2)
koch(200, 4)

turtle.done()
try:
    turtle.bye()
except turtle.Terminator:
    pass
```

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