```
int panas(int X){
if (X == 0) return 0;
else return (X % 10) + panas(X / 10);
}
```

12/10 = 1,2 → (int) → 1 (type cast)

Panas (12) → 12 mod 10 + P (12/10)

2 + P (1) = 2 + 1

= 3

Function Recursive

P (1) = 1 mod 10 + P (1/10)

= 1 + 0

= 1 ✓

By Abdan Hafidz

P (136987254321)

Cara	Waktu
	Mudah, Lama
	Mudah, Cepat
	Sulit, Lama
	Sulit, Cepat

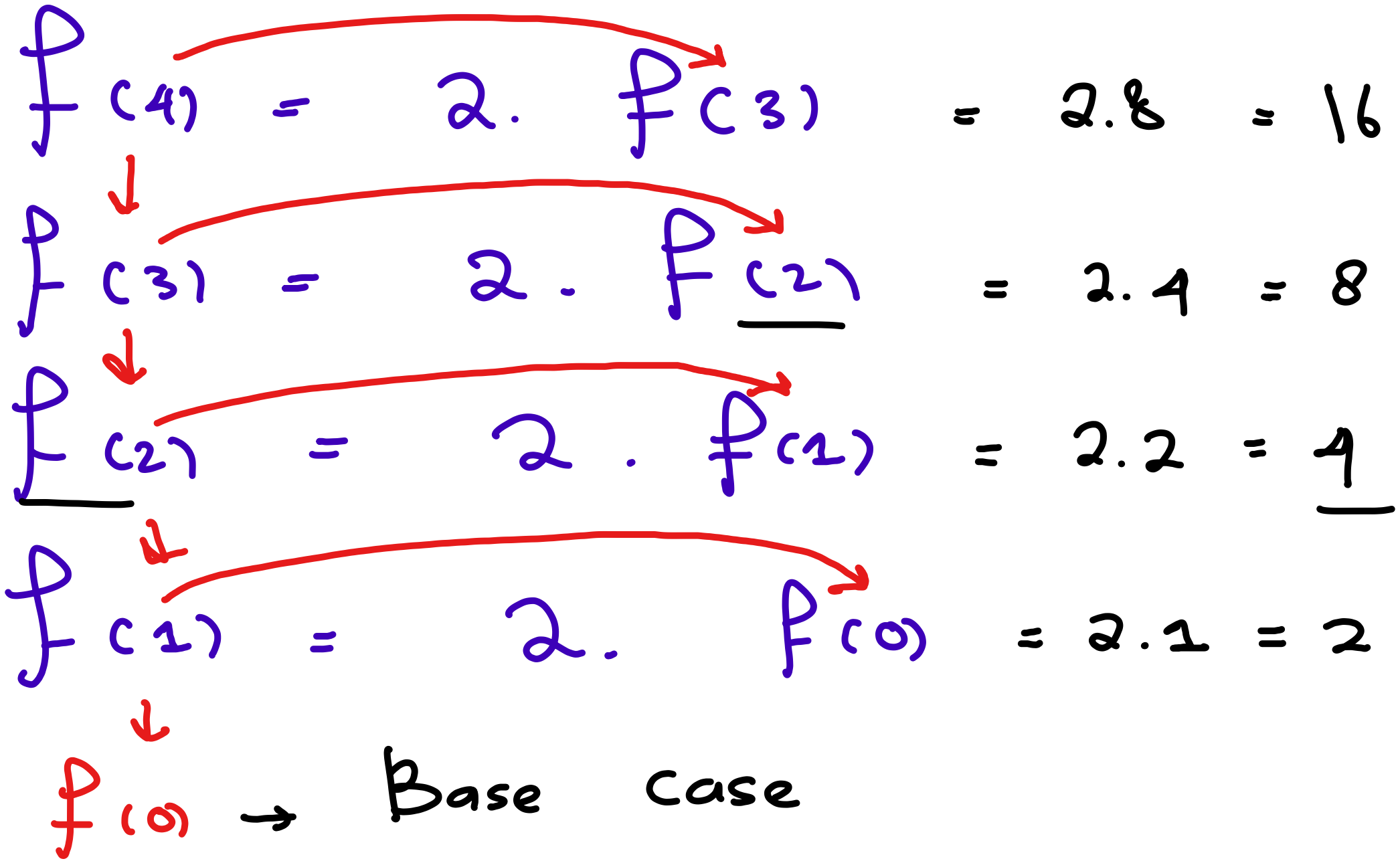
↳ inversi

$f(x) = x + 3$ → Linear Function

$f(x) = 2f(x-1)$, $f(0) = 1$

Recursive Function

$f(5) = 2 \cdot f(4) = 2 \cdot 16 = 32$


f(4) = 2 . f(3) = 2.8 = 16
f(3) = 2 . f(2) = 2.4 = 8
f(2) = 2 . f(1) = 2.2 = 4
f(1) = 2 . f(0) = 2.1 = 2
f(0) → Base case

$$f(x) = \begin{cases} 2f(x-1), & x > 0 \\ 1, & x = 0 \end{cases}$$

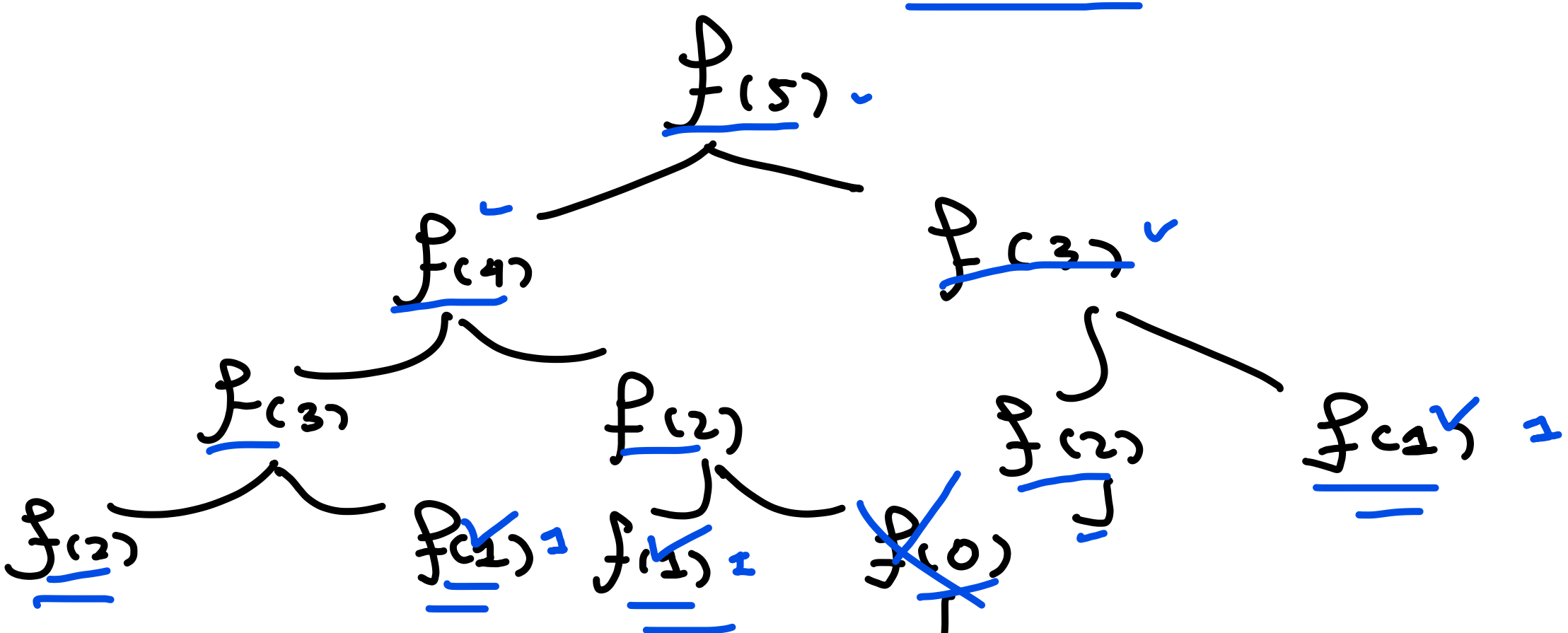
$$f(x) = 2f(x-1), \quad f(0) = 1$$

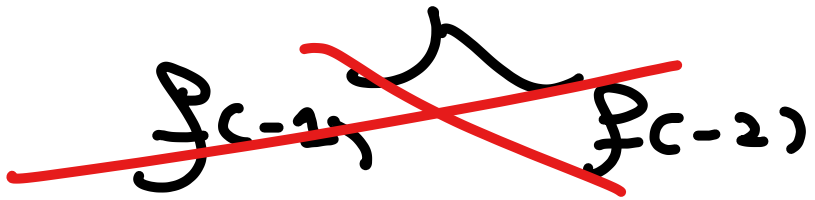
- Function
- Rekurens
- Base case

$$f(x-1) \subseteq f(x)$$

$$f(x) = f(x-1) + f(x-2)$$

$$f(1) = 1, \quad f(2) = 1$$





Maximum Depth Recursion Limit → TLE

$$f(x) = f(x-2) + f(x-2) + f(x-3) + \ldots + f(x-k)$$

↳ harus punya base case dari i s.d k $(1 \le i \le k)$ $(0 \le i < k)$

$$f(x) = f(x-1) + f(x-2)$$

Min. Base case $f(1)$, $f(2)$ ∨

$f(0)$, $f(1)$

0 1

$$f(x) = 2 \cdot f(x-3)$$

$f(0) \to f(2)$ ∨ $f(2) \to f(3)$

$$f(a, x) = a^x$$

$$a^x = a * a * a * \ldots * a$$

Sebanyak x

```
int f(int a, int x){
   int hasil = 1;
   for(int rep = 1; rep <= x; rep++){
    hasil *= a;
  }
  return hasil;
}
```

} loop → iterasi

$f(a, x) = a^x$ → $f(a, x-1) = a^{x-1}$

$a^x = a \cdot a^{x-1}$

$f(a, x) = a \cdot f(a, x-1)$

Function — Recurrens

Base case → $a^0 = 1$ → $f(a, 0) = 1$ ↳ if $x = 0$

```
// fungsi a^x
int f(int a, int x){
    if(x == 0) return 1;
    else return a * f(a, x - 1);
}
```

Rekursif

$f(9,3)$

9^3

$9 \cdot (3-1)!$

$n! = n \cdot (n-1) \cdot (n-2) \cdot \ldots \cdot 1$

Tentukan fungsi rekursif :

1) f(n) = n!
2) f(x,y) = x + y
3) f(x,y) = x * y

$5! = 5 \times 4 \times 3 \times 2 \times 1$

$4 \cdot 3 \cdot 2 \cdot 1 = 4!$

$5! = 5 \cdot 4!$

$n! = n \cdot (n-1)!$

$f(x,y) = x + y$

$f(2,1) = 2 + 1$

$f(2,4) = (2 + 3) + 1$

$f(2,3) + 1$

$f(n) = n \cdot f(n-1)$

Base case

$f(1) = 1$

$1! = 1$

$f(x,0) = x$

$f(x,y) = f(x,y-1) + 1$ → if(y==0) ret x

Computational Thinking

- Decomposition
- Abstraction ✓
- P. Recognition
- Algorithm

$f(x,y) = xy$

$f(5,3) = 5 \times 3$

$= 5 + 5 \times 2$

$5 + f(5,2)$

$f(x,y) = x + f(x,y-1)$

$f(x,1) = x$

Base case

SOAL → $f(x)$ Recursive

Dynamic Programming (DP), Dnc