Competive Programing
Workshop @ MANIT

Factorial

$5! = 120$

$n! = 1 \times 2 \times 3 \ldots n$

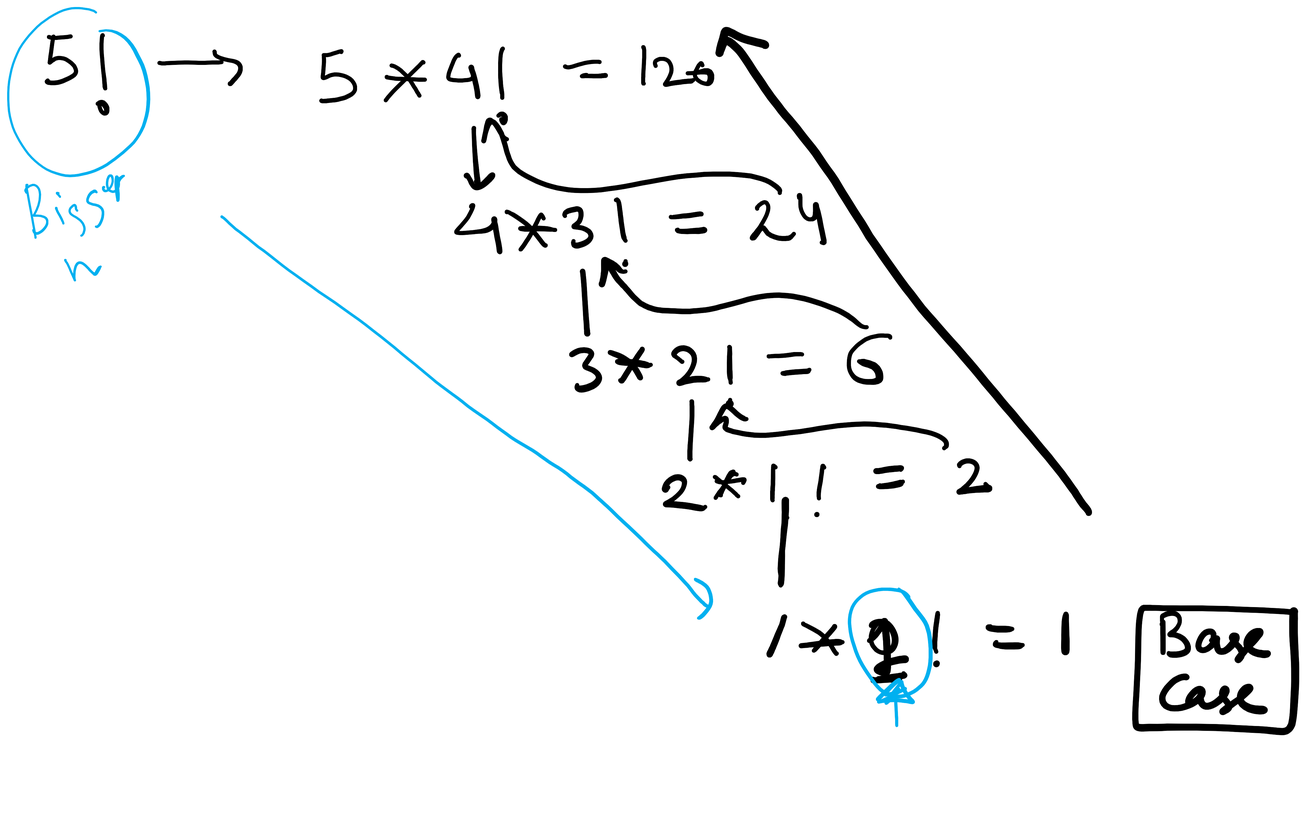
Recurrence

$$f(n) = n * f(n-1)$$

$f(n)$ → $n!$

$f(n-1)$ → $(n-1)!$

n ↓


5!
Bigger
n
5 * 4! = 120
4 * 3! = 24
3 * 2! = 6
2 * 1! = 2
1 * 0! = 1
Base Case

PMI

1. Solve for smallest case. Prove $f(0) = True$.] Base Case

Assumption

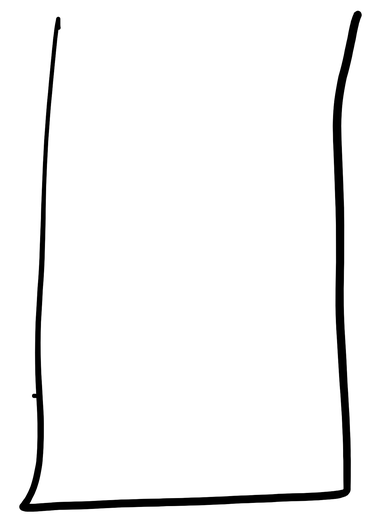
2. $f(K)$ is TRUE] Hypothesis

3. $f(K+1)$ is also True Prove] Rec Case

Call Stack

```
fun2(){
  =30
}

main(){
  a=10
}
```



inc 1, 2, 3. . . . . , n

Rec { inc (n)
      dec (n)

n, n-1, ——— 1

inc (n-1)

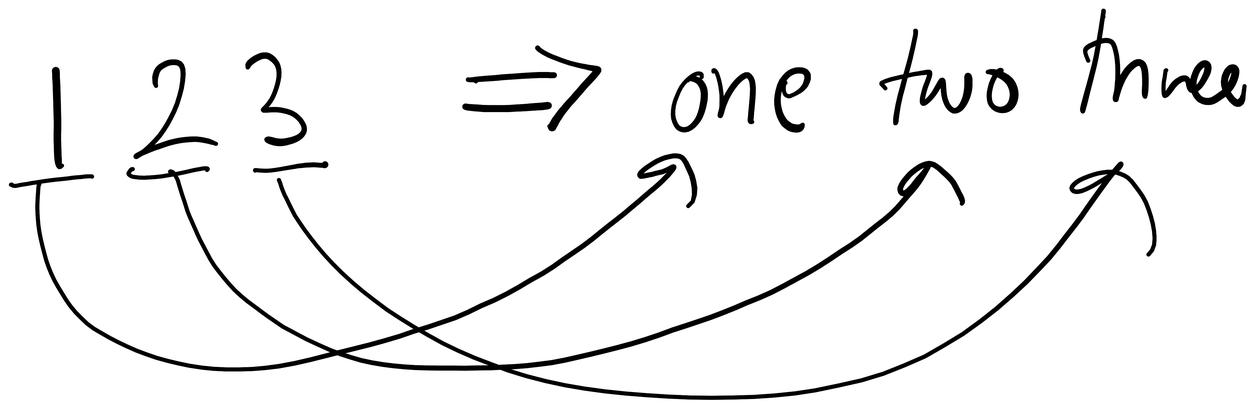
1. - - . . n-1 (n)

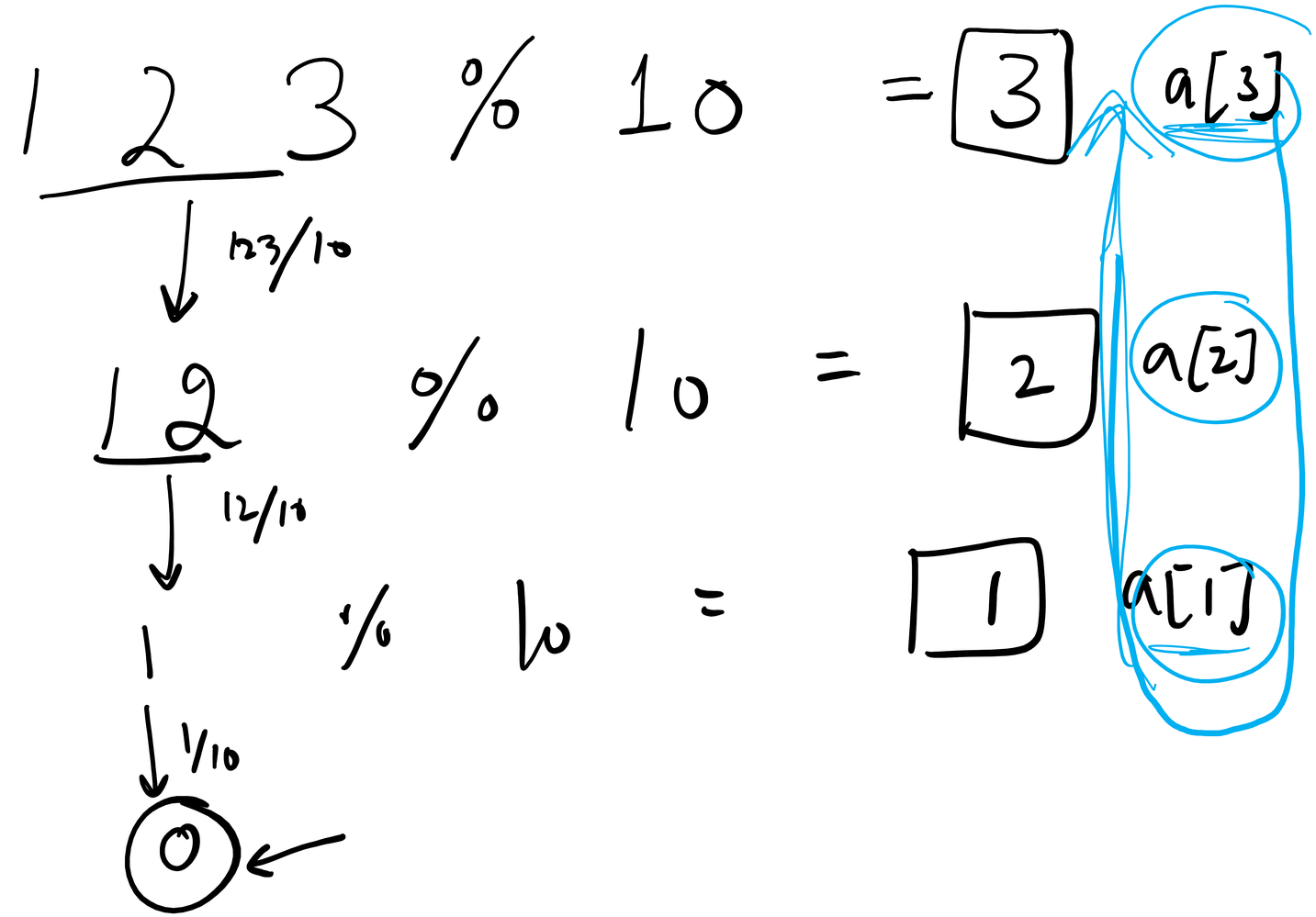
call(n-1) print(n)

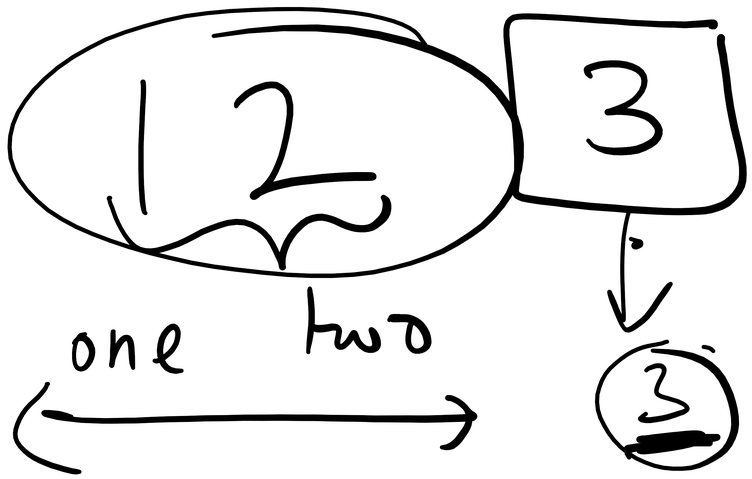
5 ——— 1

5 dec(4)

4, 3, 2, 1


1 2 3
one two three


123 % 10 = 3
a[3]
123/10
12 % 10 = 2
a[2]
12/10
1 % 10 = 1
a[1]
1/10
0


1 2
3
one
two
3

$$5^4 = 625$$

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

Power

$$f(a,n) = a\, f(a, n-1)$$

$$f(a, n) \longrightarrow f(a, n/2)$$

$$a^n = \left(a^{n/2}\right)^2 \quad n \text{ is even}$$

$$= a\left(a^{n/2}\right)^2 \quad n \text{ is odd}$$

a^9

$a\left(a^4\right)^2$

$\left(a^2\right)^2$

8 → 4 → 2 → 1 — Log N

8 → 7 → 6 → 5 → 4 → ... → 1 — N

$(a^1)^2$

$a(a^0)^2$

$\frac{n}{2^0}$ 0

$\frac{n}{2^1}$ 1

$\frac{n}{2^2}$ 2

$\frac{n}{2^k} = 1$

$\frac{n}{2^k} = 1$

$n = 2^k$

$\log_2 n = \log_2 2^k$

$k = \log_2 N$

k