Doubts

① ⇒ gcd(a, b) = gcd(B%.A, A)

Same

gcd(a, b) = gcd(b, a%.b)

in out

Base case

② ⇒ gcd(A, B) = gcd(B, A%.B)

A ⟌ B

B%.A ⟌ A

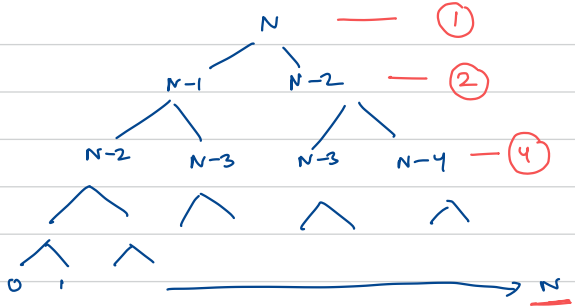
B ⟌ A

A%.B ⟌ B

0 ⟌ 0

Fibonacci

Recursive Approach



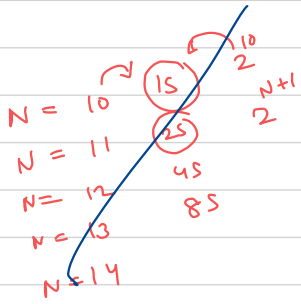
2^{N-1}

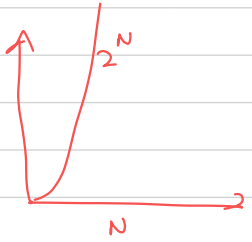
Total calls = $1 + 2 + 4 + \dots 2^{N-1}$ (GP)

$= \frac{a(r^n - 1)}{r - 1}$

$= \frac{1(2^n - 1)}{2 - 1}$

Time $\propto$ work $\propto$ 2^N





Loop

N = 30

steps = 2^{30}

$= (2^{10})^3$

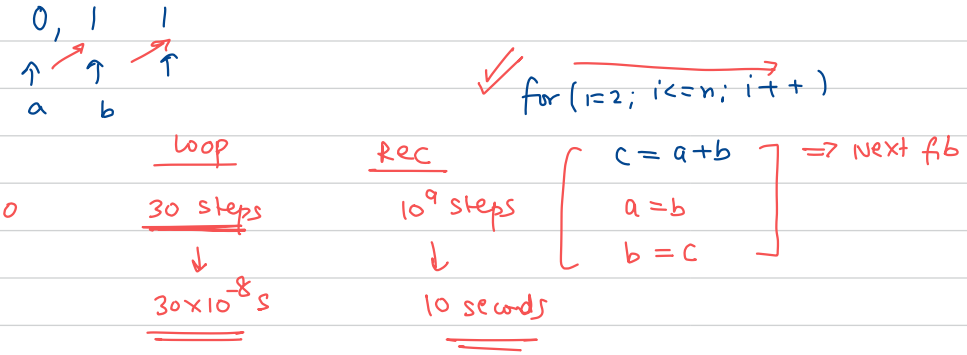
$= (1000)^3$

$= 10^9$ steps

1s → 10^8 ops

10s → 10^9 ops

Time Limit



Magic Number Problem

Given an integer A, find and return the Ath magic number. A magic number is defined as a number which can be expressed as a power of 5 or sum of unique powers of 5. First few magic numbers are 5, 25, 30(5 + 25), 125, 130(125 + 5), ….

Powers of 2 →

$5^4\ 5^3\ 5^2\ 5^1$ (58)

$2^2\ 2^1\ 2^0$

1	0 0 1	(2^0)
2	0 1 0	(2^1)
3	0 1 1	(2^0+2^1)
4	1 0 0	(2^2)
5	1 0 1	(2^2+2^0)
6	1 1 0	(2^2+2^1+0)
7	1 1 1	$(2^2+2^1+2^0)$
8	1 0 0 0	(2^3)
9	1 0 0 1	(2^3+2^0)
10	1 0 1 0	(2^3+2^1)

(5)

(25)

30 — (5^2+5^1)

125 — $[5^3]$

130 — (5^3+5^1)

150 — $(125+25)$

155 —

⋮ ⋮

Decimal → Binary

N

rem = N%.2

p=1 ans

2 | 12			
2 | 6	,	0	0 x 1
2 | 3	,	0	0 x 10
2 | 1	,	1	1 x 100
	0	, 1	1 x 1000

1100

$2^3\ 2^2\ 2^1\ 2^0$

1 1 0 0

$= 8+4+0+0 = 12$

1000

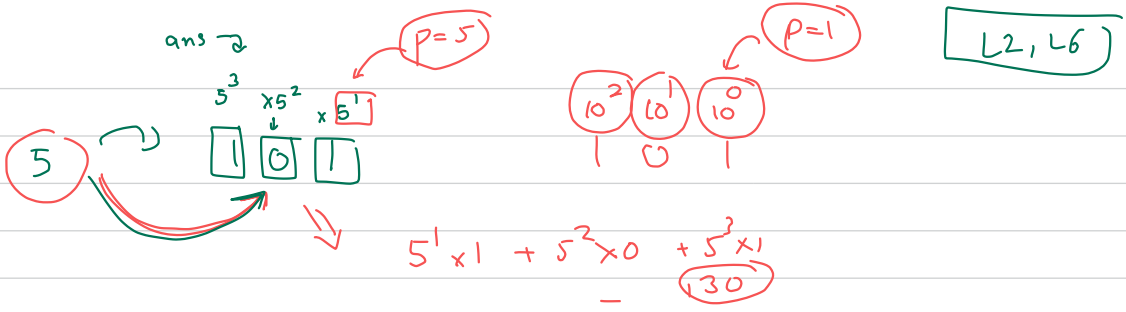
+100

+00

+0

1100

```
L1  N = 12
L2  p = 5, ans = 0
L3  while ( N > 0 ) {
L4      rem = N%2 ;
L5      ans = ans + rem * p;
L6      p = p * 10;5 ←
L7      N = N/2; ←
    }
L8  return ans;
```


ans
p=5
5^3
$\times 5^2$
$\times 5^1$
5
1
0
1
p=1
10^2
10^1
10^0
1
0
1
$5^1 \times 1 + 5^2 \times 0 + 5^3 \times 1$
130
L2, L6

ARRAY (list) [Data Structure]

collections of items of same Type

100 students = [80, 72, 64, 58, 33, 91, ...]

impractical

S1
S2
:
S100

10^6

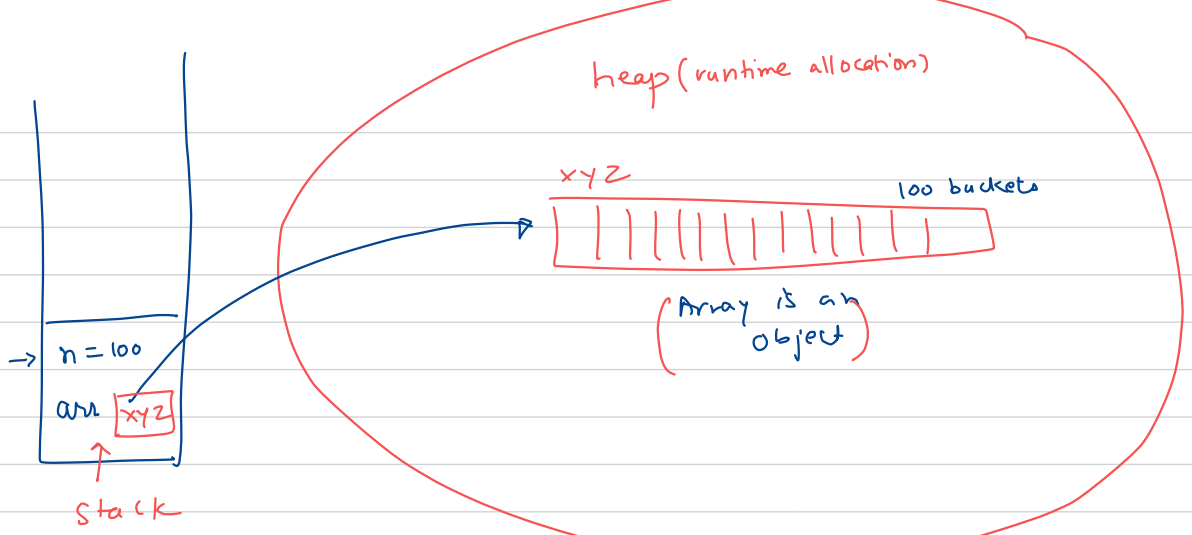
n buckets

size

```
int [] arr = new int [n];
```

arr: Object Ref

new int [n]: objects

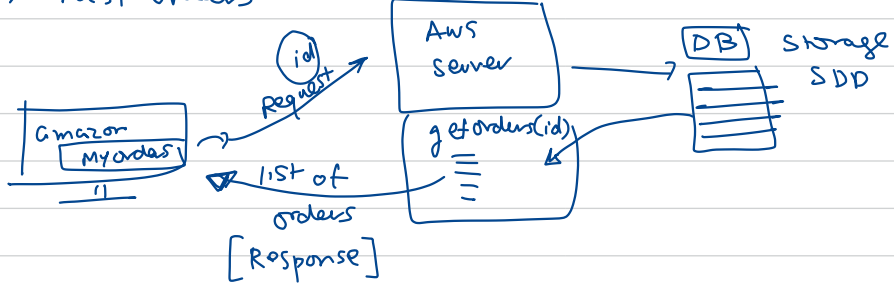


Real Life App

→ Amazon cart ⇒ Collection of "ORDER" ⇒ Contact list

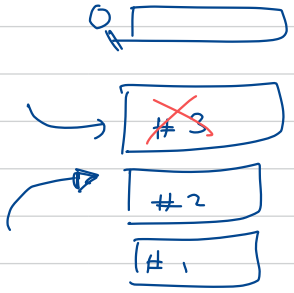
→ Past Orders

Background



Few Ops: ← freq used ops

1. Insertion ✓
2. Deletion ✓
3. Search ✓
4. Update ✓

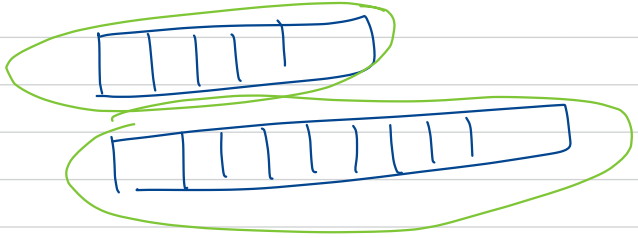


Java is

- Pass By Value (everything)

C++
- ↳ Pass by Value
- ↳ Pass by Reference.

inc the size of Arr?



int [] arr ;

arr = new int[5]; ⇐ Garbage collected

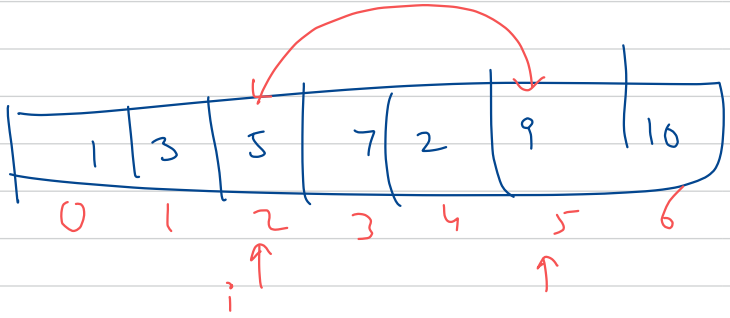
arr = new int[11];

heap → when there is no ref.

arr = null;

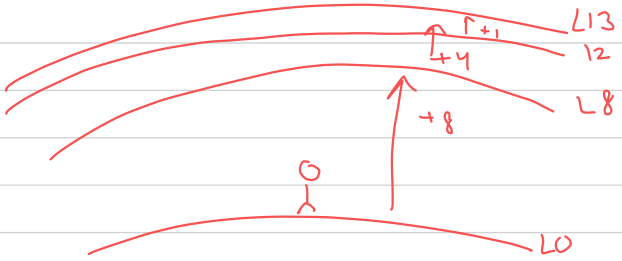
Swaps

↳ arr
→ i
→ j



⇒ [1, 3, 9, 7, 2, 5, 10]

Q. There is a fight going above N levels from the earth level (L0). There is superhero on Earth which can take jumps in powers of 2. Tell me the min jumps required to reach level N.

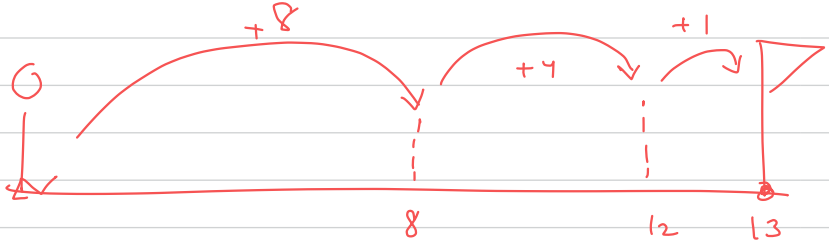


1, 2, 4, (8), 16, 32 ...

13 = 8 + 4 + 1

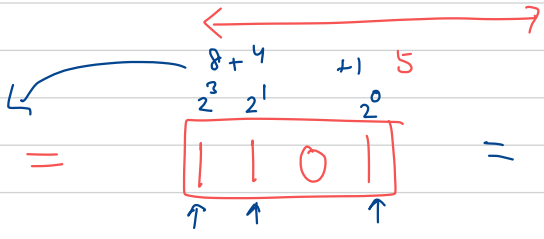
8 + 4 2 1

13 = 1 1 0 1



1, 2, (4), 8, 16, 32, 64

2^3



= No of SetBit (1) in Bin Rep of (N)