

6 - 10 Feb (2 day window)

4-5 coding Questions 2-3 hrs

↳ 1 Full Question
↳ 1 Partial Question]

Test : 99% Pass, 1% Fail → Repeat Beg 1 month

↳ Question ⑤ Coding
↳ Easy - medium

Topics

Patterns
Loops
Arrays
Matrix

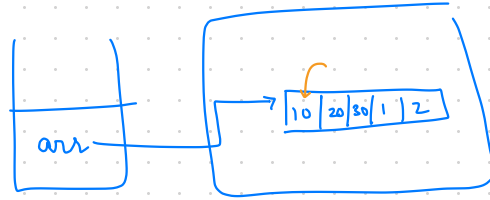
if-else

ARRAYS

int [] arr = new int [n];

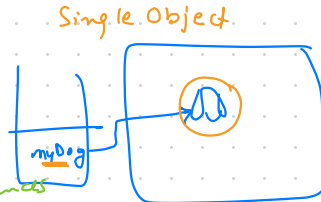
stack Heap

Array {
 Primitives
 Objects (array itself stores object references)



```
class Dog {
    == color
    == ht
    == wt
}
```

Single Dog Dog myDog = new Dog();



Multiple Dogs

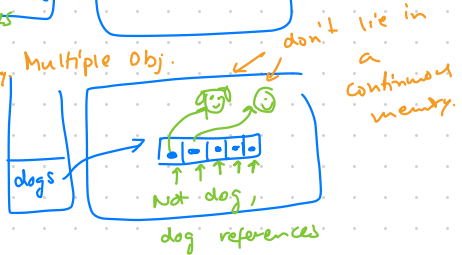
4 Dog [] dogs = new Dog [10]; // empty

stack only creates 10 references

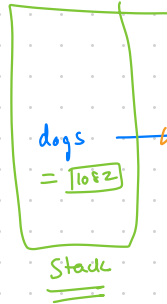
[2] → dogs[0] = new Dog(); ← actual Dog Object

[3] → dogs[2] = new Dog();

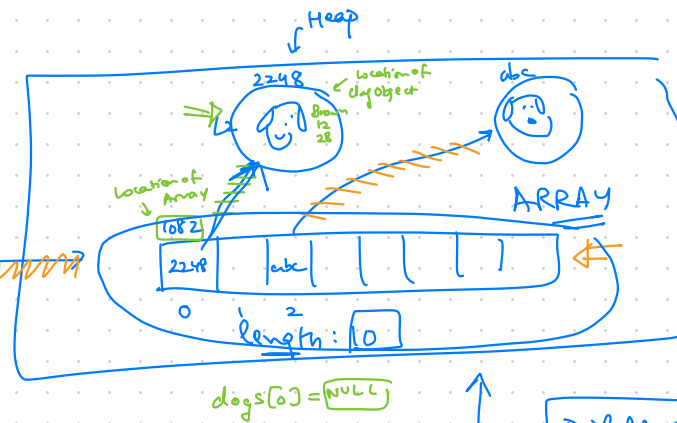
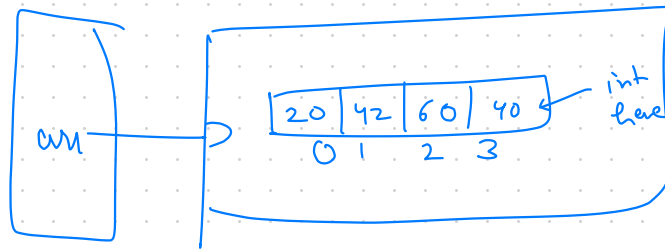
dogs[0] = null; ⚡



Array of objects



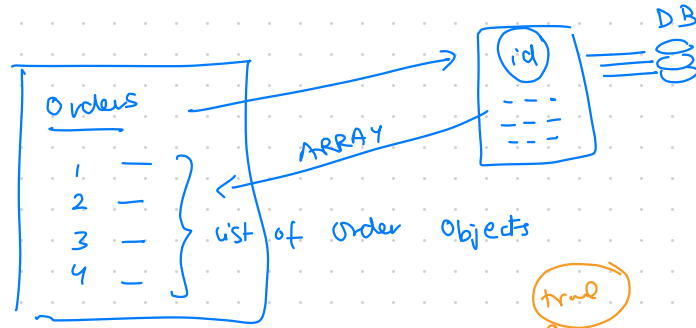
Array of ints / Primitives



`dogs[0] = new Dog()`

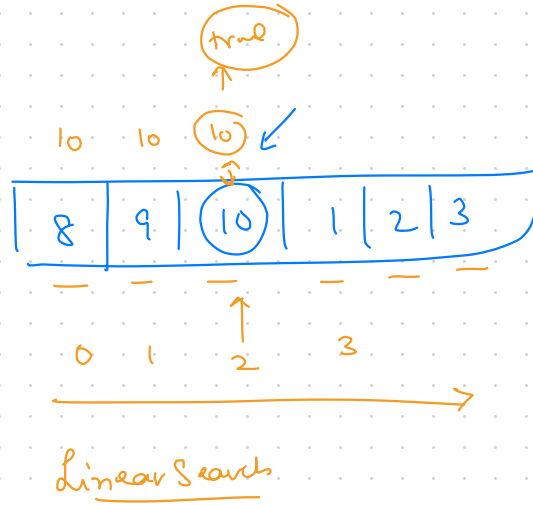
returns the address of the memory where the object is created

ARRAY \rightarrow objects
 Array of int \rightarrow object contain primitives
 Array of objects \rightarrow object ref.



Q

- 1 _____
- 2 _____
- 3 _____
- 4 _____
- 5 _____



Linear Search All

↳ how big?

- ① Count for (—) ② Create


--	--	--

 ③ Store the indices for

1	2	5
---	---	---

- make the array for worst case. \rightarrow atleast $N+1$ elements

$$1 \leq q \leq 5$$



 5 | 5 | 5 | 5 | 5

 0 1 2 3 4

0 1 2 3 4 -1

key = 3

$$\begin{array}{ccccc} & \xrightarrow{\quad} & & & \\ 6 & 1 & 2 & 3 & 4 \\ \hline -1 & 9 & 3 & 8 & 1 \\ \hline & & & & \\ & \xrightarrow{\quad} & & & \end{array}$$

3 4 1 2 1

Diagram illustrating a queue implemented with an array. The array contains elements 0, 2, 4, 0. An arrow points from the first element to the second, and another from the second to the third. A green bracket is under the last two elements.

-1 as marker at the end to signify the array end

• Arraylist (Dynamic Array) \Rightarrow

Data

Already Sorted

1, 2, 3, 5, 8

⇒ Binary Search
⇒ Linear Search

Less iterations / steps

↑ (Same Time)

Unsorted

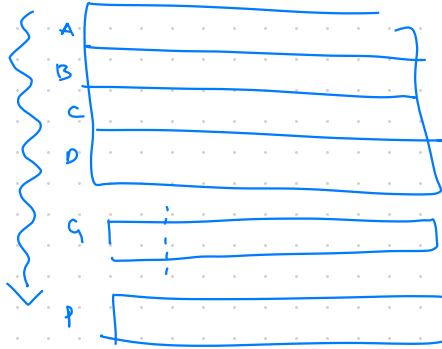
3, 1, 2, 5, 8

Linear Search N steps

1 steps → $N/2$ ✓ select S

Key = 17

①



S=0

mid

S=4

mid

e=6

$$m = \frac{6+0}{2} = 3$$

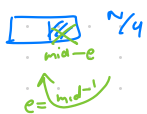
15 → 17
S = mid + 1

$$m = \frac{6+4}{2} = 5$$

17 → 22
e = mid - 1

$$mid = \frac{4+4}{2} = 4 \leftarrow \text{ans}$$

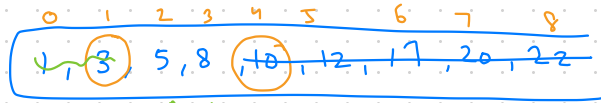
17 → 17



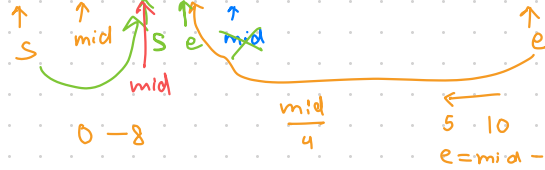
4-6

4-4

$$\frac{0+7}{2} = 3$$



5 Key
↑



When middle > key
go left
 $e = mid - 1$
middle < key
go right
 $s = mid + 1$

0-3

$$mid = \frac{0+3}{2}$$

3

2-3

$$mid = \frac{2+3}{2} = 2$$

5 = 5 → mid ya

→ first occ
→ last occ

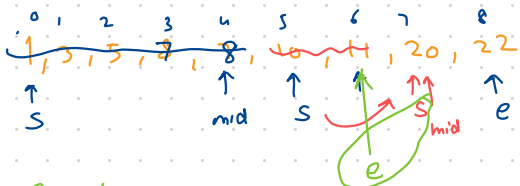
⇒ Any occ ✓



→ 1, 3, 6, 8
↑
1



✓ Part of Question

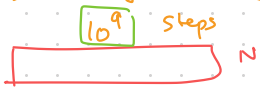


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$$\log 10^9 = \log_2 (10^3)^3$$

$$= 3 \log_2 1000 = 3 \times 10 = 30$$

BS $\rightarrow \log_2 10^9 \approx 30 \text{ steps}$



$$1 = \frac{N}{2} = \frac{N}{2^1}$$

$$2 = \frac{N}{4} = \frac{N}{2^2}$$

$$3 = \frac{N}{8} = \frac{N}{2^3}$$

$$\dots$$

$$K = \frac{N}{2^K} = 1$$

$$\Rightarrow K = \log_2 N$$

$$m = \frac{8+5}{2} = 6$$

$$m = \frac{7+8}{2} = 7$$

$$e = \text{mid} - 1 = 6$$



$$N = 2^K$$

$$\log_2 N = \log_2 2^K$$

$$\log_2 N = K \log_2 2$$

10 Min Break

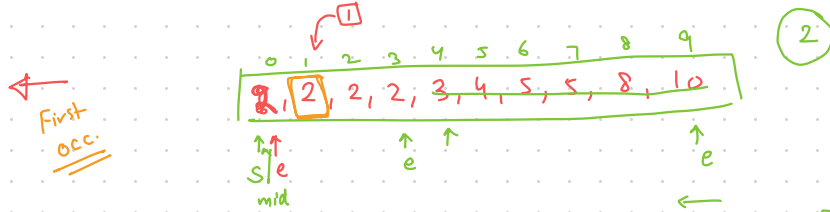


Doubts: Repeating elements (First occ & last occ)

→ Practical use

→ Breakpoint

→ Recursion



ans = 10

Stop
e = s

$$\text{mid} = \frac{9+0}{2} = 4$$

$$\text{mid} = \frac{0+3}{2} = 1 ?$$

$$\text{mid} = \frac{0+0}{2} = 0$$

$$e = \text{mid} - 1$$

$$e = -1 \quad s = 0$$





10

1, 3, 5, 10, 12, 20, 30

~~20~~ 12

12, 20, 30

12
↑
s
↑
e
↑
mid

Square Root

without using lib

26

$$\sqrt{2}$$

$$\sqrt{20} = 4$$

$0 \text{ --- } \text{ans}^2 > N$
 $\text{---} \text{ans} > \sqrt{N}$
 $6 \text{ --- } \sqrt{N}$

JN iterations

$0^2 \leq 20$
 $1^2 \leq 20$
 $2^2 \leq 20$
 $3^2 \leq 20$
 $4^2 \leq 20$
 $5^2 \leq 20$

A green wavy arrow points down the left side of the list. A red arrow points up from the bottom left towards the 4^2 entry. The entry $4^2 \leq 20$ is enclosed in a red rectangle. A green box with the text "No!" is at the bottom right.

ans = 0

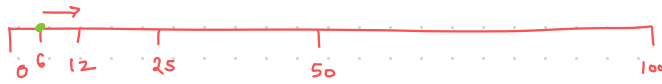
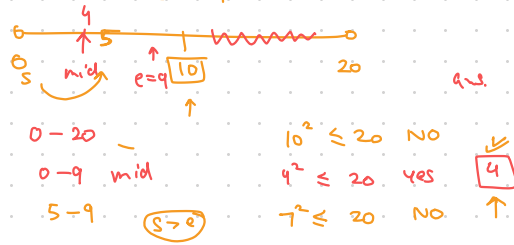
Linear Search $\left\{ \begin{array}{l} \text{while } (ans * ans \leq N) \{ \\ \quad ans = ans + 1; \end{array} \right.$

ans = ans - 1

$$S = 0$$

$$e = 20$$

Search Space



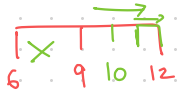
$$10^{16}$$

$$\log N$$

$\sim 30 \text{ to } 40$

$$\sqrt{N}$$

10^5



$$50^2 \leq 100 \quad \text{No}$$

$$25^2 \leq 100 \quad \text{No}$$

$$12^2 \leq 100 \quad \text{No}$$

$$6^2 \leq 100$$

$$9^2 \leq 100$$

$$10^2 \leq 100$$

$$11^2 \leq 100 \quad \text{No}$$

$$6$$

$$9$$

$$10$$

- 2D Arrays.
- Array Lists
- In-built Sorts