

## L20

# Dynamic Arrays (Vector/ArrayList)

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## Recap

1. The right way to measure time & space complexity
2. Different Notations
3. Importance of Time Complexity in DSA
4. How to calculate Time Complexity
5. Some Practice

Let's warm up!

Ok, let's get started

Let's go back to our beloved exam papers example



[81, 72, 15, 25, 42, 31, 100]

↙  
find the median marks

[15, 25, 31, 42, 72, 81, 100]

Example continued

$$\{81, 72, 15, 25, 42, 31, 100\}$$

↙  $\{81, 72, 42, 100\}$

$$\{42, 72, 81, 100\}$$



$$76.5$$

find median  
of only those  
marks that are  
greater than or  
equal to 33.

# Introduction



*vector*



*ArrayList*

vector  $\Rightarrow$  arr

arr. push-back (int)

arr. pop-back()

arr[i]

arr[i] = some-num

arr. size()

ArrayList  $\Rightarrow$  arr

arr. add (int)

arr. remove (int)

arr. get (i)

arr. set (i, some-num),

arr. size();

How are these implemented?

## Possible Solution 1

Just use a really large Array -

Pro: → problem solved (good time complexity  
while adding / deleting at  
the end)

Cons: 1) How large is large enough?

2) Memory & time waste while creating the array

## Possible Solution 2

Create an array of size, let's say 100.



↓  
New array created

↳ The elements from  
old array will be copied  
to the new array

102<sup>nd</sup>  $\Rightarrow$  new array (102)



Pro: No memory wastage

Copy from  
array of  
size 102

Con: Terrible time complexity

## The Middle Ground

- 1) Not too much memory wastage
- 2) Still able to maintain a good time complexity

arr [ ] = [1, 5, 4, 3, 10, 0, 0, 0]

size = 5, cap = 8  
||  
||

push-back(1); push-back(10);

The current size of ArrayList/  
Vector

push-back(5); pop-back();

The size of the Array  
that you're  
using internally

push-back(4); push-back(0);

push-back(3);

push-back(10);

Java  $\Rightarrow$  Default initial capacity = 10

10, 20, 40, 80, 160 - - -

C++  $\Rightarrow$  Default initial capacity = 0

0, 1, 2, 4, 8, 16, 32, 64 - - -

# Thank You!

Reminder: Going to the gym & observing the trainer work out can help you know the right technique, but you'll muscle up only if you lift some weights yourself.

So, PRACTICE, PRACTICE, PRACTICE!