

DSA through C++

Array data structure



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Agenda

- ① About Arrays
- ② When to use Arrays ?
- ③ Conventional approach to solve a problem
- ④ Conclusion
- ⑤ Array data structure

About Arrays

- Array is a linear collection of similar elements.
- Array elements are indexed
- The name of the array is treated as a constant which represents address of the first byte of the array.
- [] is called subscript operator

`int a[5];`

5 is not an index

$a \approx 1000$

index

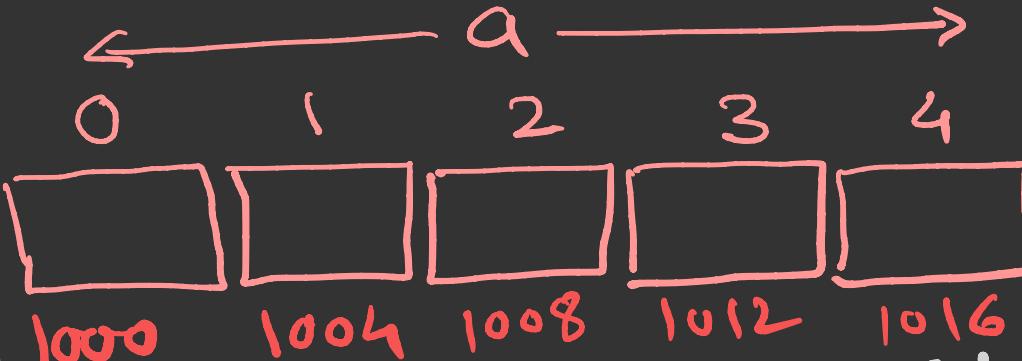
$a[0]$

$a[1]$

$a[2]$

$a[3]$

$a[4]$



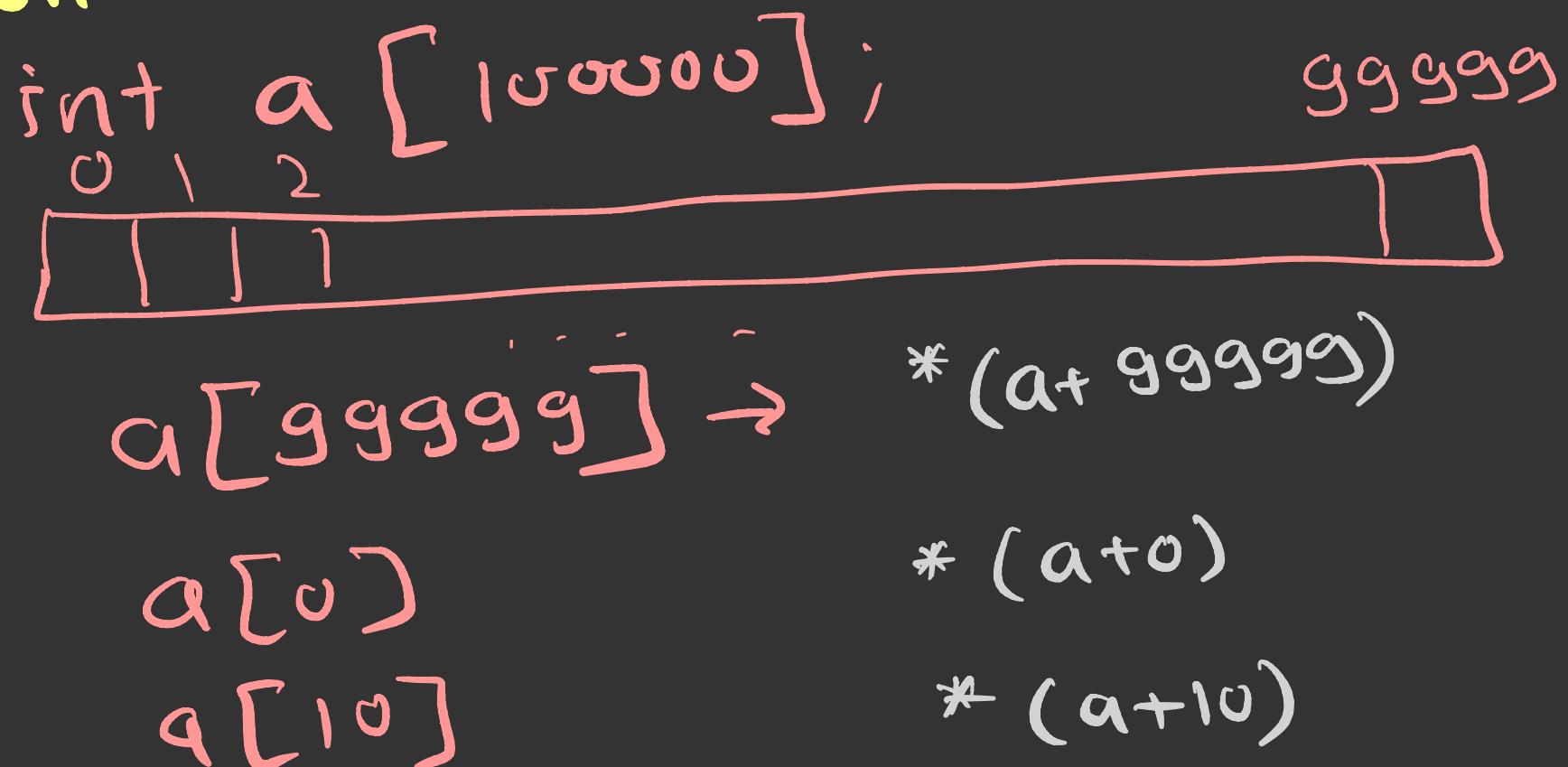
Total no.
of variables
in an array

[] Subscript
operator

$a[2]$
↓ ↑
operands

$*(\&a + 2)$
↑
 $(1000 + 2)$
 $\&(1008)$

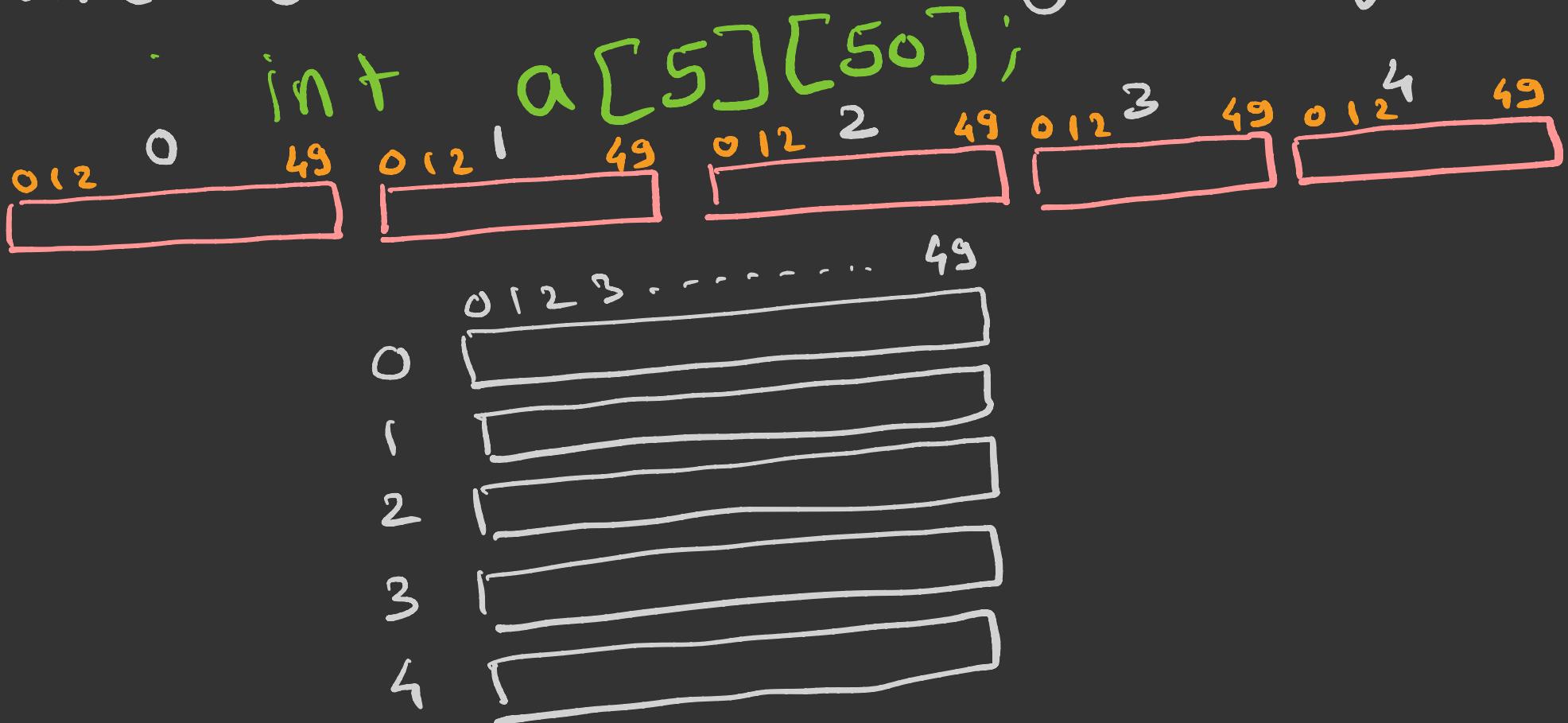
- Accessing Array elements is fast.
- It takes constant time to access any item of the array if index is known.



When to use array?

whenever group of related data is need to be stored

when data is in a group of groups.



To solve a programming problem,
you have to store marks of 100
students. How can you implement it?

```
int a[100];
```

Suppose you have created an array as:

```
int a[100];
```

And assume that you have stored some
out of 100 data in this array.

Now answer following questions:

1. How many elements are stored in the array?
2. If suppose 10 elements are stored and then I want to store one more element at index 2. Can we do it as
 $a[2] = \text{data};$

3. How to guard against overflow or underflow?

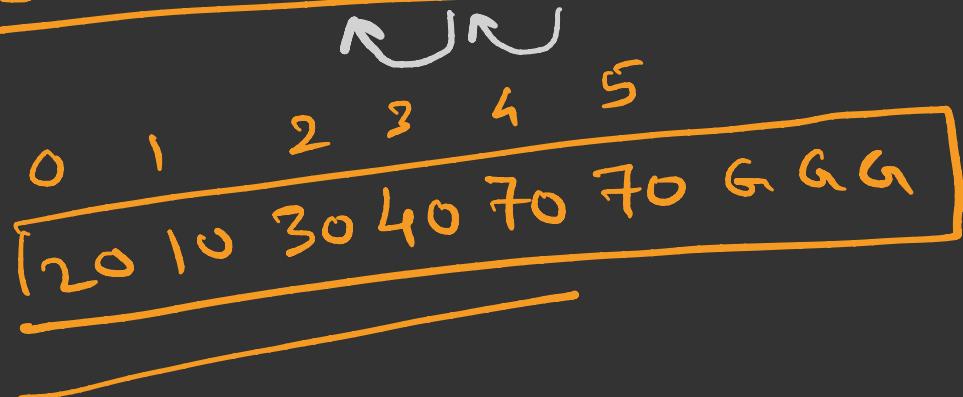
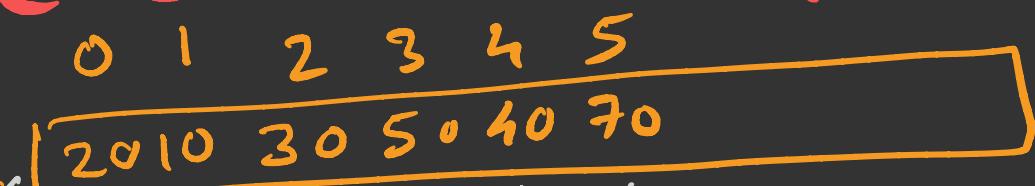
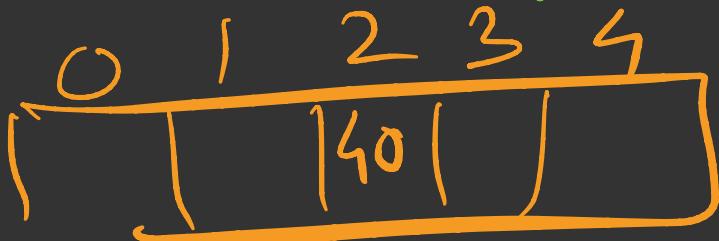
4. How to know that whether a value at a given index is valid or garbage?

5. How to delete an element?

Policy

lastIndex $\leftarrow \text{count} = 6$

capacity $\leftarrow 5$



Conclusion

- Normal array is not good enough to efficiently handle such situations.
- We need to keep extra information like capacity of array to guard from overflow, index of last filled block (assume elements are filled from left to right) to track the number of elements present in the array as well as where are the valid values and where are the garbage values.

We need to create an array data structure in C++.

Define a class Array with appropriate number of variables and functions.

Abstract Data Type

Properties

capacity
lastIndex
ptr
createArray()

Methods

append()
insert()
del()
edit()
search()
constructor
destructor

Array should be
created
dynamically
ptr = new int[^{size} + _{too}];