Arrays: Introduction

Course on Basic Data Structures (C++)

Pulkit Chhabra • Lesson 1 • Jan 21, 2021

Declare 10 diff integers.

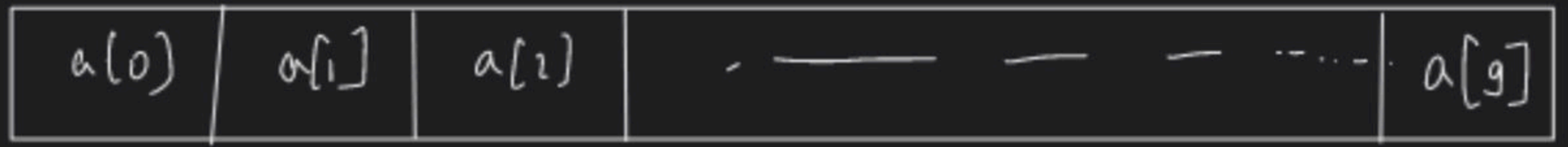
Declare an array of size 10

$a[0] \leftarrow 1^{st}$

$a[1] \leftarrow 2^{nd}$

$a[9] \leftarrow 10^{th}$.

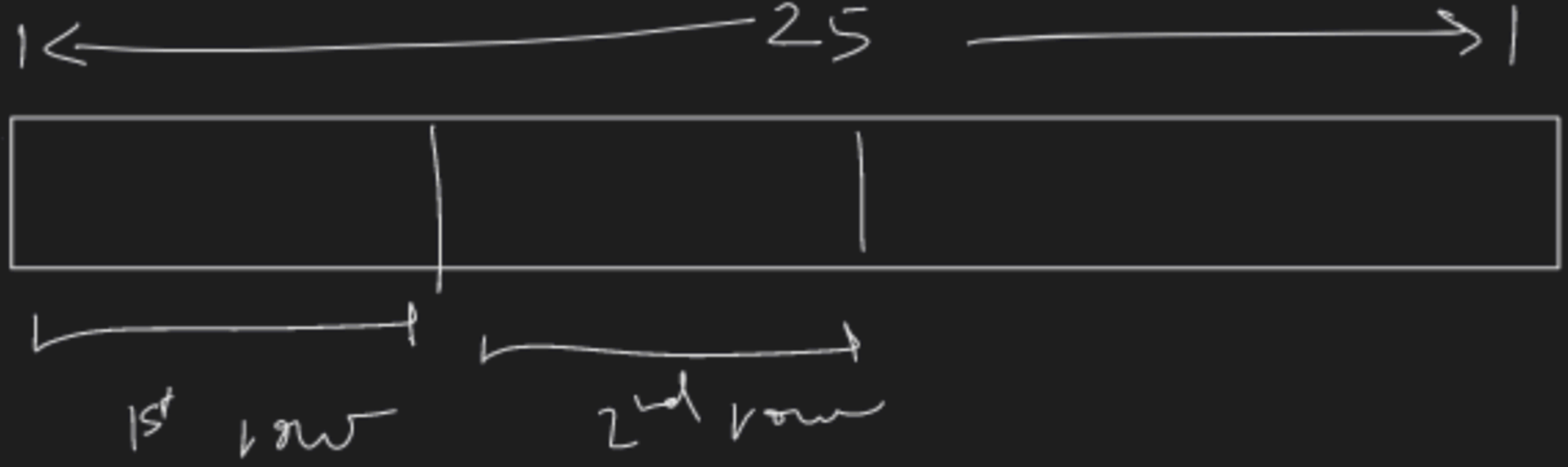
a



stack Memory => int a[10];

Heap Memory => int *a = new int [20];

delete [] a;


1
25
1
15th row
2nd row

V → cap → D.

push_back (1); ⇒ (2)

fun —— (2); ⇒ (2)

fun —— (3); ⇒ (4)

b — (4) ⇒ (4)

b —— (5) ⇒ (8)

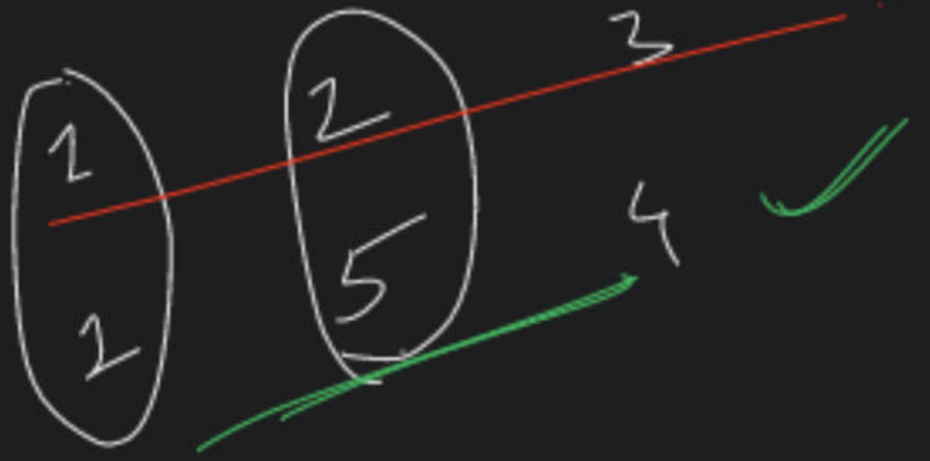
V_1 V_2

size → same → all clause also same

size → same → ——

size → same → 5

size → diff.



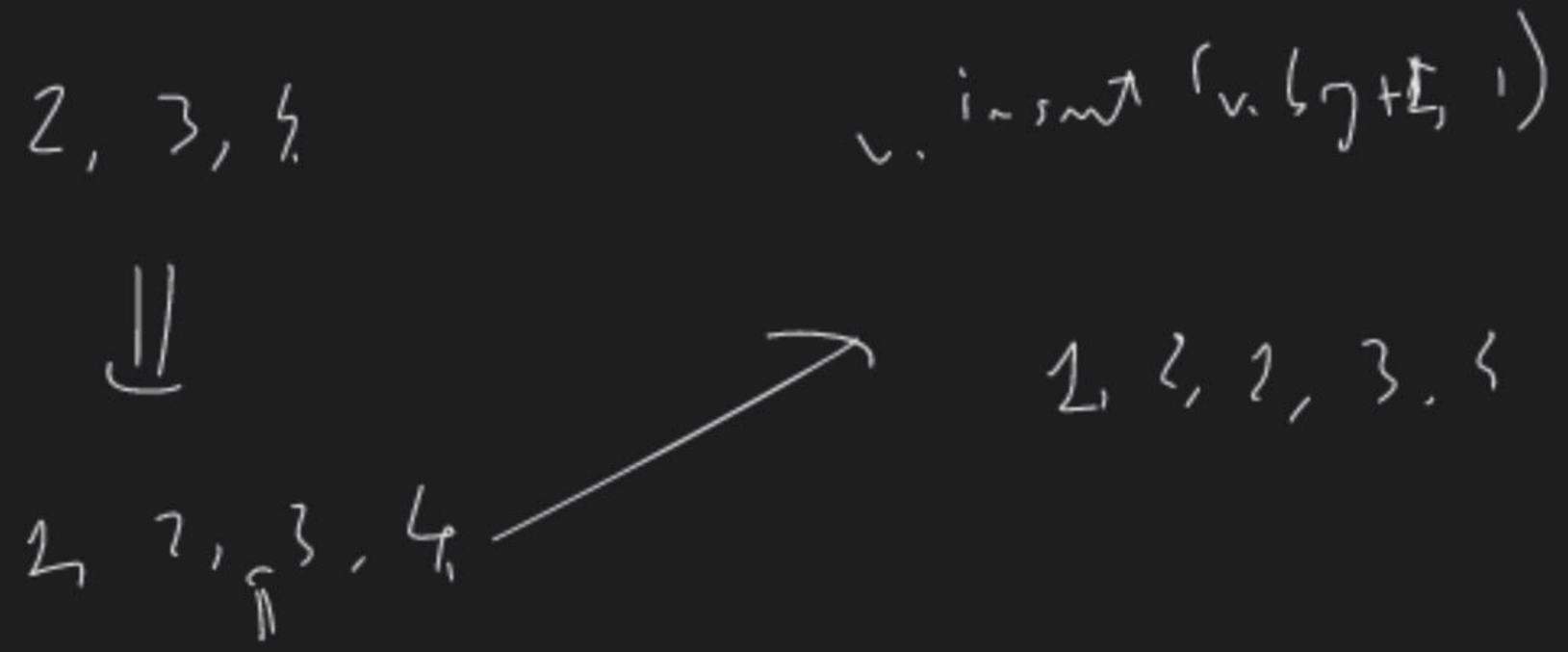
1 , 2 , 3 . 1 , 2 ⇒ 1st one

1 , 2 , 3

ab, a

ac

ab < ab



Amortized T.C. Analysis

1, 2, 1, 1, 5, 1, 1, 1, 9, ... 1, 17, ... 1, 33

$(2^k + 1) \Rightarrow O(N)$

Otherwise $\Rightarrow O(1)$

$1 + 1 + 2 \underbrace{\uparrow\uparrow^{N} \ldots \uparrow\uparrow^{N}}_{N \text{ times}} 1 \rightarrow \underbrace{2 \uparrow\uparrow^{2N} 2 + 2 + 2^{2} + 2^{3} \ldots\ldots 2^{\log_2 N}}$

$\Rightarrow 3N \rightarrow O(3)$ μs to operation

$\frac{a \times (r^{no} - 1)}{r - 1}$

$2N \leq 2 \times 2^{\log_2 N} - 1 \Leftarrow \frac{1 \times \left(2^{\log_2 N + 1} - 1\right)}{2 - 1}$

Arrays: Introduction

With Pulkit Chhabra

Let's crack Competitive Programming together!

1. Which of the following declaration of array gives a compilation error?

A. `int arr[4] = {};`
B. `int arr[] = {};`
C. `int arr[];`
D. `int arr[4];`

1. Which of the following declaration of array gives a compilation error?

A. `int arr[4] = {};`
B. `int arr[] = {};`
C. **`int arr[];`**
D. `int arr[4];`

{,,,,,};

int a[]={1,2,3};

Solution : The error is : `storage size of 'arr' isn't known`

2. Which of the following is not a valid index of ***int arr[5];***

A. 0
B. 5
C. 2
D. 3

2. Which of the following is not a valid index of ***int arr[5];***

A. 0
B. 5
C. 2
D. 3

Solution : The set of valid indices is : {0, 1, 2, 3, 4}

3. Where would the memory corresponding to `int arr[4] = {};` (inside the ***main*** function) be allocated?

A. Stack
B. Heap

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4. If the base address of array of type int (*sizeof(int)* is ***4***), ***arr*** is 0, what would be the address of ***arr[4]***?

A. 4
B. 8
C. 16
D. 32

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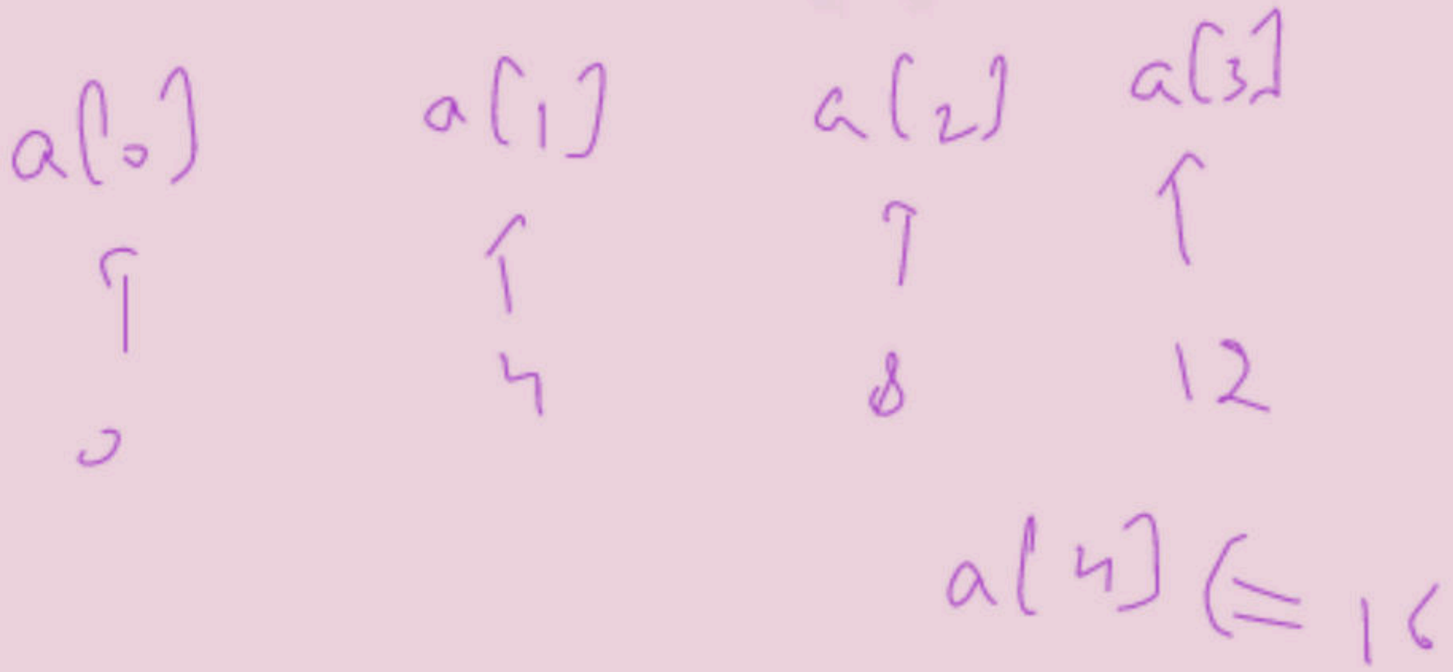

Solution : Size of one ***int*** object is 4 bytes, thus the address of ***arr[4] = 0 + 4 * 4 = 16***.

5. What is the time complexity for accessing memory from an index of array allocated in heap memory? (***n*** is the length of array)

A. O(1)
B. O(n)
C. O(nlogn)
D. O(logn)

cout << a[i];

5. What is the time complexity for accessing memory from an index of array allocated in heap memory? (***n*** is the length of array)

A. O(1)
B. O(n)
C. O(nlogn)
D. O(logn)

Solution : No matter the origin of allocation, access time for an array is ***O(1)***

6. What would be the output for the given block of code?

```
int main() {
   { int arr[5] = {}; }
   cout << arr[1];
   return 0;
}
```

A. 0
B. -736521
C. 1
D. Compilation Error

6. What would be the output for the given block of code?

```
int main() {
   { int arr[5] = {}; }
   cout << arr[1];
   return 0;
}
```

A. 0

B. -736521

C. 1

D. Compilation Error

Solution : The braces around the declaration of ***arr*** limits the scope to its local, and ***arr[1]*** results into a compilation error:

```
'arr' was not declared in this scope
```

7. Memory corresponding to dynamic arrays is allocated in?

A. Stack
B. Heap

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A. Stack
B. Heap

Solution : Memories for a ***dynamic*** array is ***dynamically*** allocated, thus it points us to the usage for heap memory.

8. Amortized time complexity for vector ***push_back*** and ***pop_back*** is?

A. O(1)
B. O(n)
C. O(nlogn)
D. O(logn)

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A. O(1)
B. O(n)
C. O(nlogn)
D. O(logn)

Solution : Vectors possess the property of dynamic arrays, time complexity of ***push_back*** and ***pop_back*** is derived from the same

9. Initial ***capacity*** of a dynamic array ***d*** is ***1***. If at ***push_back*** the data overflows, the capacity gets doubled. What would the capacity of ***d*** be after 3 ***push_back***? (initially the array is empty)

A. 3
B. 4
C. 6
D. 8

9. Initial ***capacity*** of a dynamic array ***d*** is ***1***. If at ***push_back*** the data overflows, the capacity gets doubled. What would the capacity of ***d*** be after 3 ***push_back***? (initially the array is empty)

A. 3

B. 4

C. 6

D. 8

Solution : Initially, size = 0, capacity = 1,

After first ***push_back***: size = 1, capacity = 1; after second : size = 2, capacity = 2; at last: size = 3, capacity = 4

10. Which of the following pointer is used for a 2D array?

A. `int arr;`
B. `int *arr;`
C. `int **arr;`
D. `int ***arr;`

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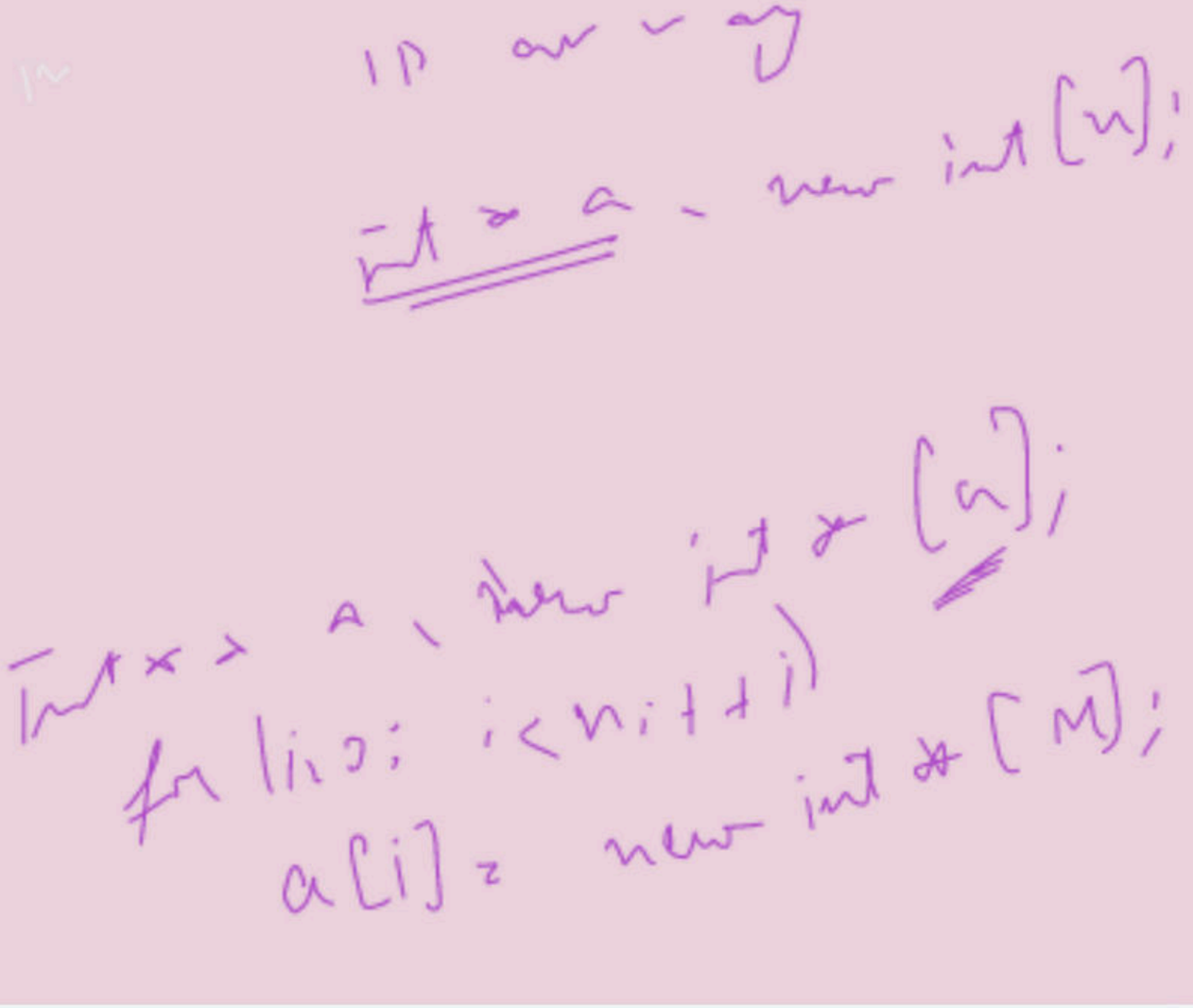

Thank You

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K size k subarrays k sums k max

6 9 12

n = 5 , k = 3

1 2 3 4 5

12

$n = 8, k = 3$

1 2 3 4 5 6 7 8

(REMOVED) Which of the following declaration of array is correct?

A. `int arr;`
B. `array arr[5];`
C. `int arr[5];`
D. `int arr{0, 1, 2, 3, 4};`

(REMOVED) Which of the following declaration of array is correct?

A. `int arr;`

B. `array arr[5];`

C. `int arr[5];`

D. `int arr{0, 1, 2, 3, 4};`

Solution : Option ***A*** declares an integer, and ***B*** & ***D*** are syntactically wrong

$1^{st} \rightarrow 1$

$2^{nd} \rightarrow 1 + 1$

$3^{rd} \rightarrow 1 + 2$

$4^{th} \rightarrow 1$

$5^{th} \rightarrow 1 + 4$

$6^{th} \rightarrow 1$

$7^{th} \rightarrow 1$

$8^{th} \rightarrow 2$

$9^{th} \rightarrow 1 + 8$

$\vdots \quad \vdots \Rightarrow 1$

$1?^{th} \rightarrow 1 + 2^{?}$

N elements

$$1 + 2^1 + 2^2 \cdots \cdots 2^{\log_2 N}$$

$$2 \times N - 1$$

$\log_2 N$

Π

2 ki power
main kitna
rakhein k
ans 2 N aaye

$2^K \leq N$

$1 + 2^1 + 2^2 \cdots\cdots 2^K$

$2 \sim N - 1$

$N = 156$

$2^K \Rightarrow 128$