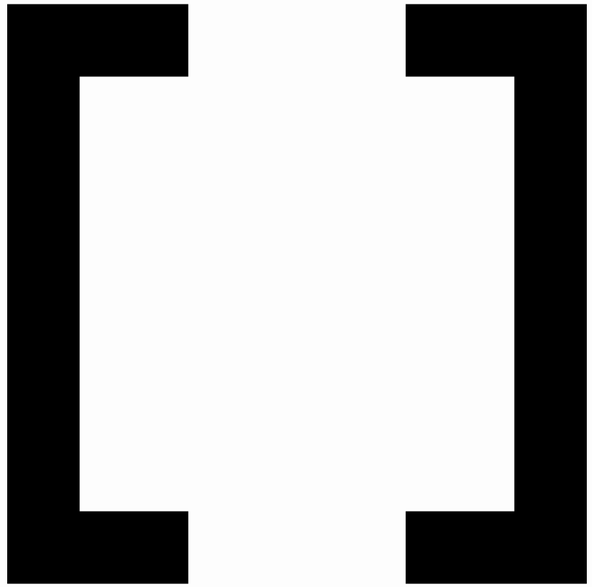
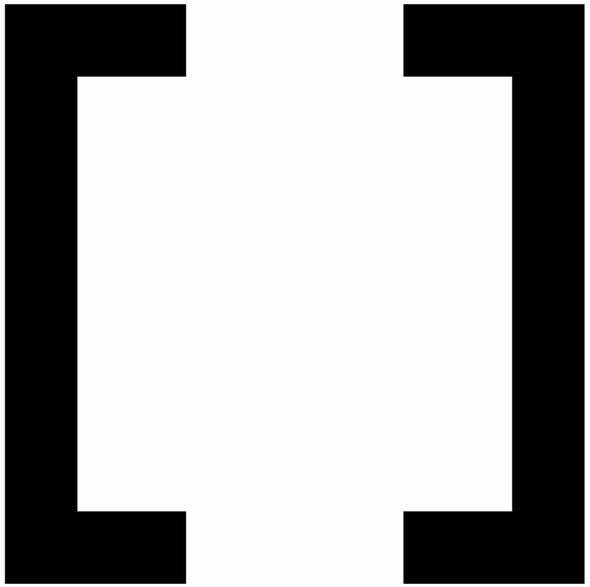


ARRAYS

INTRODUCTION TO PROGRAMMING

Anirudh Kalyan



WHAT IS AN ARRAY?

An array is a collection of **similar type** of data items stored at **contiguous memory locations**

WHY DO WE NEED AN ARRAY?

Every nifty tool or data structure you see today is a solution of a problem that needed to be solved at some point.

- **Need to store different kinds of data for computation? Variables!**
- **Need to iterate multiple times over the same line of code? *Loops*!**
- **Need to establish conditions that lead to different blocks of code being executed? *Conditional Statements*!**

WHY DO WE NEED AN ARRAY?

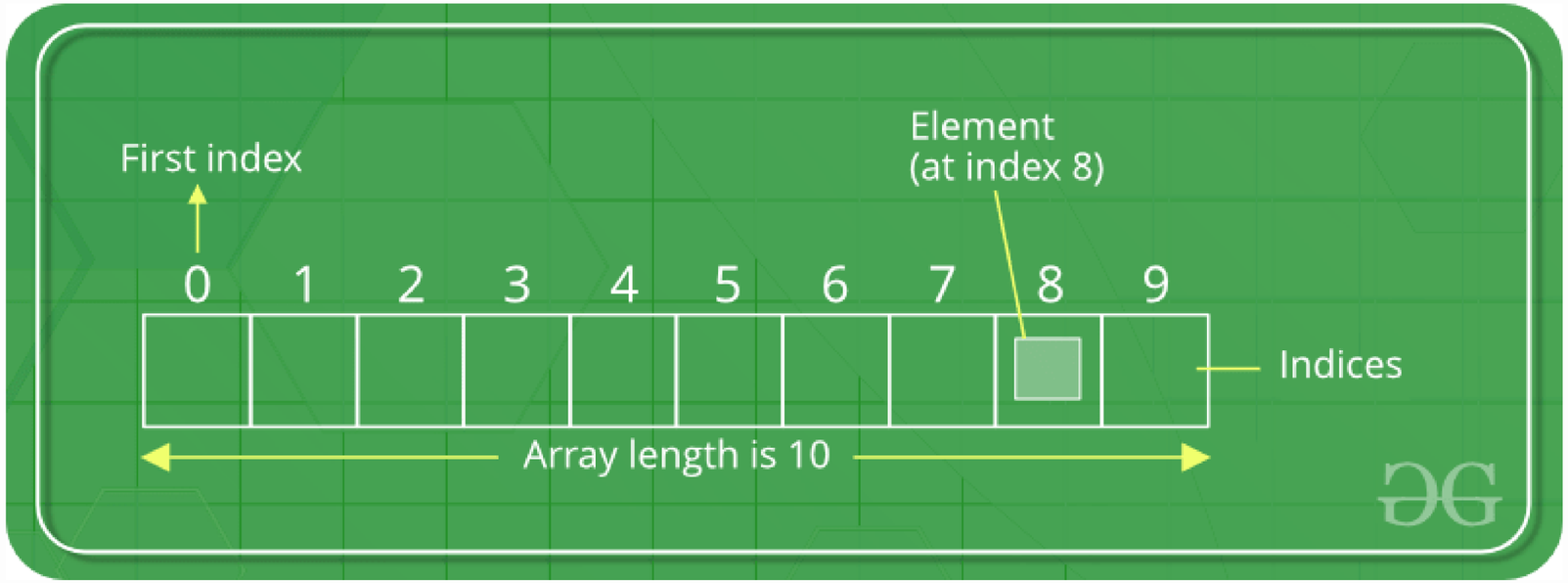
So the real question you have to ask yourself is, what problem is an array really trying to solve?

- **An array lets you group multiple variables of the same datatype under one roof, or one big variable. This is of incredible use when you want to group data from same datatype.**

- **So clearly, arrays are huge for several uses, especially use cases involving large amounts of data.**

- **You'll also realise that multidimensional arrays help speed up math due to the magic of parallel computing**

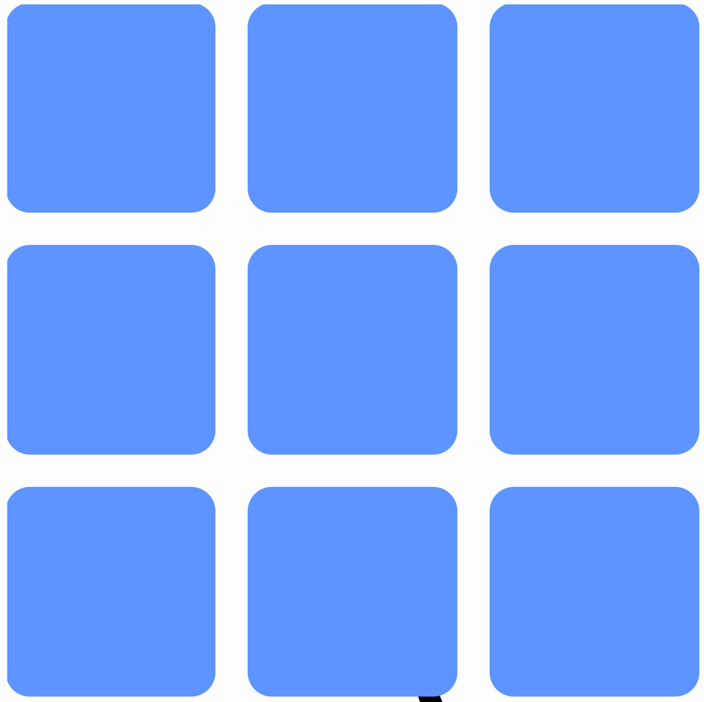
BASIC FEATURES OF ARRAYS



- **Each of these boxes denote an element in an array, and the key is that these elements are stored right next to each other physically (remember the "*contiguous memory locations*" part)**

- **This makes accessing and indexing any element super quick. Also note that arrays are indexed from 0, not 1!**

BASIC FEATURES OF ARRAYS



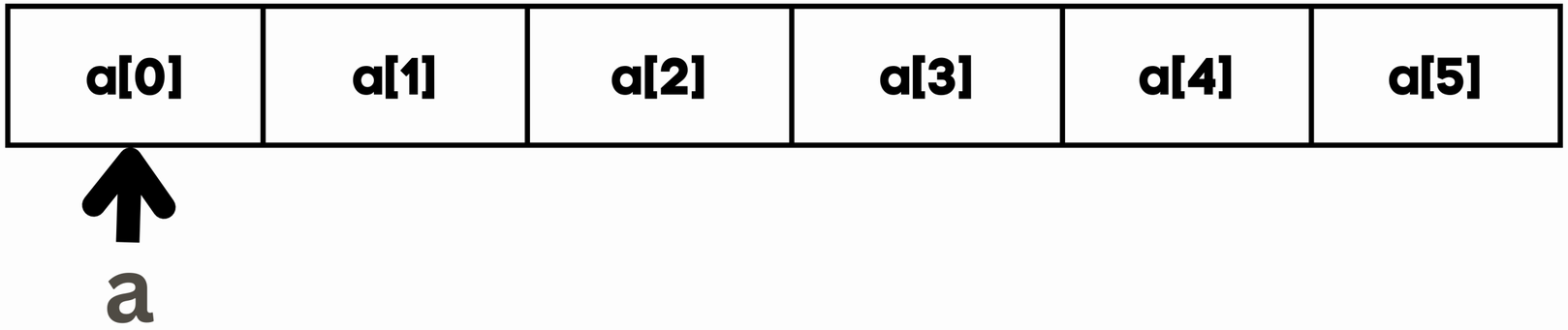
Example of a 3x3 array

- **The form of arrays we will be looking at today is called "Static Arrays". These arrays cannot change their shape once initialised.**
- **So, if your static array can hold 10 elements, and you need to make it store another element, your only way is to delete an element.**
- **Arrays can be multidimensional; however we will stick to a 1D array in this session.**

BASIC FEATURES OF ARRAYS

HOW DO YOU ACCESS AN ARRAY?

- **Arrays can be universally accessed by indexing as alluded to before. Now if we have an array a = {1,2,3,4,5} we can access the element "3" by using the following notation**
  - $\text{element}\#3 = \text{a}[2]$
- **The square brackets will contain the index number of the element you'd want to access.**



IMPLEMENTING ARRAYS

Out of all the programming languages, C has the most basic implementation of Arrays. So let us look at some code

Code

```c
#include <stdio.h>

int main() {
    int a[11] = {1,2,3,4,5,6};
    printf("The address of the third location of the array is: %p\n",&a[2]);
    printf("The address of the fourth location of the array is: %p\n",&a[3]);
    printf("the size of one integer value is %i bytes\n",sizeof(a[3]));
    printf("Address of the first element of the array is %p",&a[0]);
    printf("Location of the array is %p\n",&a);

    return 0;
}
```

Output

```
The address of the third location of the array is: 0x7ffc52c572a8
The address of the fourth location of the array is: 0x7ffc52c572ac
the size of one integer value is 4 bytes
Location of the array is 0x7ffc52c572a0
Address of the first element of the array is 0x7ffc52c572a0
```

IMPLEMENTING ARRAYS

Before we conclude, I would like to introduce you to Character and multidimensional arrays

Character Arrays

- A commonly used kind of array where all elements are individual letters. Usually used to store words so that we can index them letter by letter.

Multidimensional Array

- Much like matrices, these arrays can be extended to multiple dimensions. While we usually limit ourselves to 2/3 dimensions, the C programming language can support up to a 32-dimension array!

- Multidimensional arrays can be really useful to store data and compute complex math problems and equations, where the data cannot be understood by us per se.

PROGRAMMING QUESTION

Adding 2 arrays

Write a program that takes 2 arrays of the same dimensions and prints out the resultant element-wise sum of the 2 arrays.

Array 1: {1,2,3,4,5}

Array 2: {6,7,8,9,10}

Expected Sum: {7,9,11,13,15}

Bonus Question: What kind of a data type is the array variable in C?

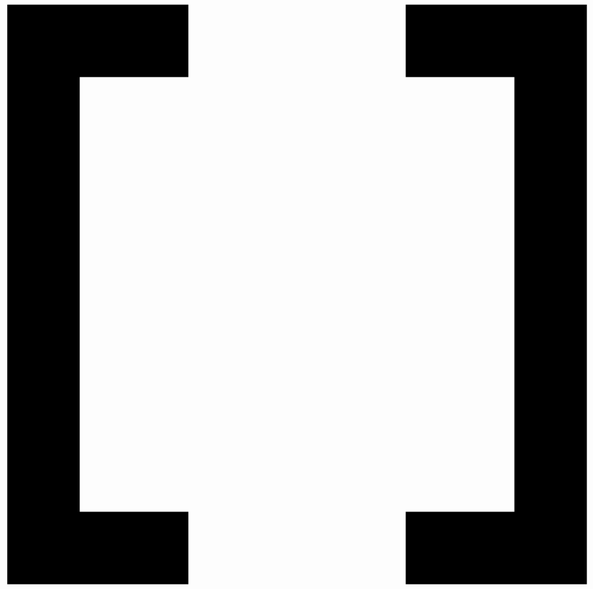
PSEUDOCODE ANSWER

```
initialise array 1
initialise array 2
initialise array 3 (final answer array)

start for loop with num_iterations = length of array
  array3's ith element = array1's ith element + array2's ith element

print out array 3
```

Bonus Question: An array is actually just a pointer that points to the first element of the array



QUESTIONS?