Unit 1: Problem Solving

Part 5: Arrays and Linear Search

Topic 3: Sorting and Searching Algorithms

Lecture Contents

- Arrays
  - Definition
  - Defining an Array
  - Reading an Array
  - Writing to an Array

Array – Definition

- ***Array*** **–** a collection of elements in a ***contiguous*** block of memory
  - The size of the array is ***fixed***
    - *fixed* = determined when it is created, and cannot be changed
  - Elements are of the same type (all numbers, or all strings, etc.)
  - Each element accessed by its ***index***

This should make more sense with examples...

Array – Definition

- An array of numbers:

myNumbers

1	3	5	7	9

- An array of strings:

myStrings

apple
banana
peach

Defining an Array

- Defining an array
  - Pearson pseudocode:

```
SET numbers TO [ 1, 3, 5, 7, 9 ]
```

Defining an Array

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```
SET numbers TO [ 1, 3, 5, 7, 9 ]
```

  - We'll worry about the exact syntax later, but just so you've seen it, here's how to define this array in Java, Python, and C#:
    - Java:

```
int[] numbers = { 1, 3, 5, 7, 9 };
```

    - C#:

```
int[] numbers = { 1, 3, 5, 7, 9 };
```

    - Python:

```
numbers = [ 1, 3, 5, 7, 9 ]
```

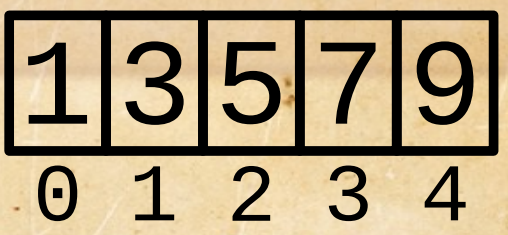
Reading an Array

- Reading an array
  - Pearson pseudocode:

```
SET numbers TO [ 1, 3, 5, 7, 9 ]
SET value TO numbers[ 2 ]
SEND value TO DISPLAY
```

  - What do you expect the output to be?

Reading an Array

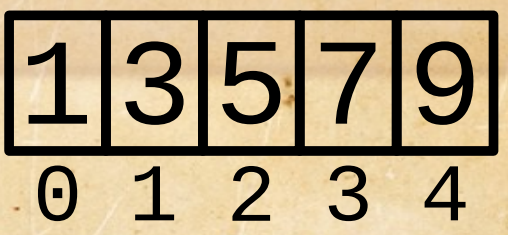


- Reading an array
  - Pearson pseudocode:

```
SET numbers TO [ 1, 3, 5, 7, 9 ]
SET value TO numbers[ 2 ]
SEND value TO DISPLAY
```

  - What do you expect the output to be?
  - Arrays are zero-based in most programming languages
    - not zero-based in R, COBOL, MATLAB, and a few others
  - So the output of the above pseudocode will be: 5

Reading an Array

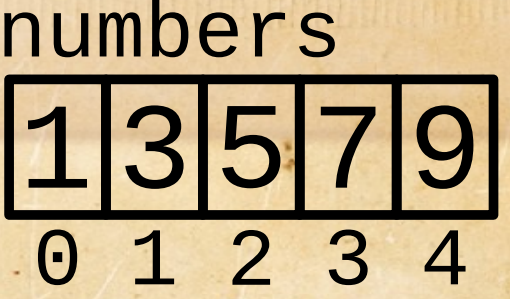


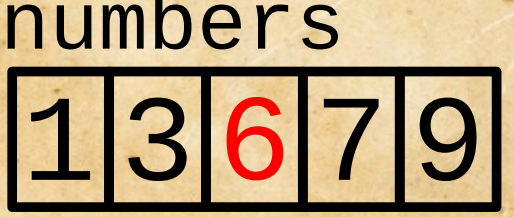
- Reading an array
  - Pearson pseudocode:
    - **`SET value TO numbers[ 2 ]`**

  - We'll worry about the exact syntax later, but just so you've seen it, here's how to read and element of this array in Java, Python, and C#:
    - Java: **`value = numbers[ 2 ];`**
    - C#: **`value = numbers[ 2 ];`**
    - Python: **`value = numbers[ 2 ]`**

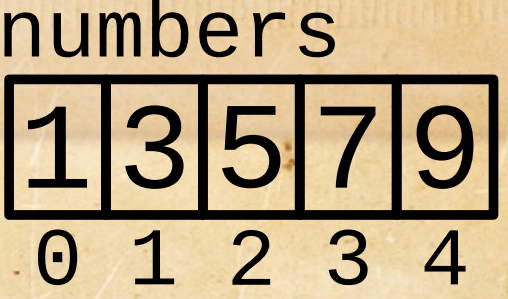
Writing to an Array

- Writing to an array
  - Pearson pseudocode:
    - **`SET numbers[ 2 ] TO 6`**

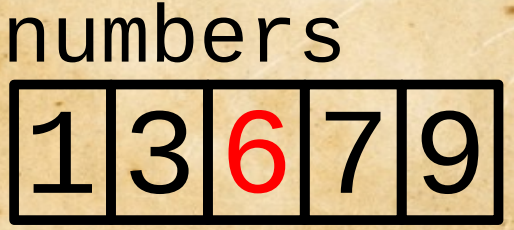




Writing to an Array

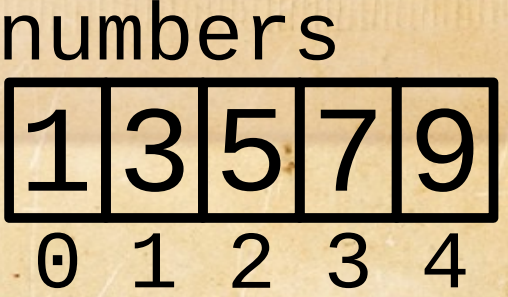


- Writing to an array
  - Pearson pseudocode:
    - **`SET numbers[ 2 ] TO 6`**



  - We'll worry about the exact syntax later, but just so you've seen it, here's how to write a value this array in Java, Python, and C#:
    - Java: **`numbers[2] = 6;`**
    - C#: **`numbers[2] = 6;`**
    - Python: **`numbers[2] = 6`**

Length of an Array



- Getting the length of an array
  - Pearson pseudocode:
    - **`SET length TO LENGTH(numbers)`**

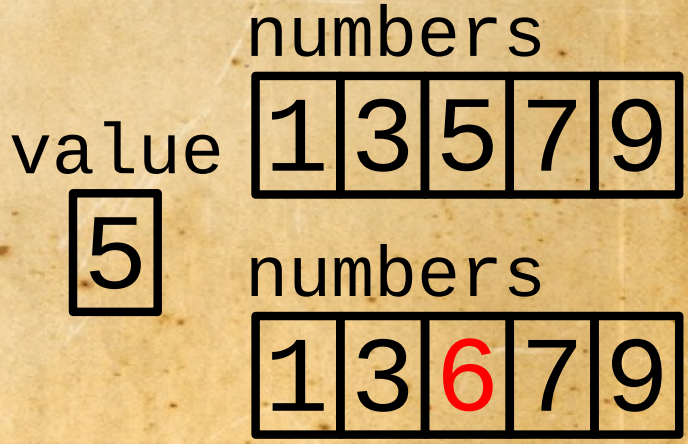
  - We'll worry about the exact syntax later, but just so you've seen it, here's how to get the length of an array in Java, Python, and C#:
    - Java: **`length = numbers.length;`**
    - C#: **`length = numbers.Length;`**
    - Python: **`length = len(numbers)`**

Arrays – Summary

- ***Array*** – a collection of elements in a ***contiguous*** block of memory
  - The size of the array is ***fixed***
    - *fixed* = determined when it is created, and cannot be changed
  - Elements are of the same type (all numbers, or all strings, etc.)
  - Each element accessed by its ***index***

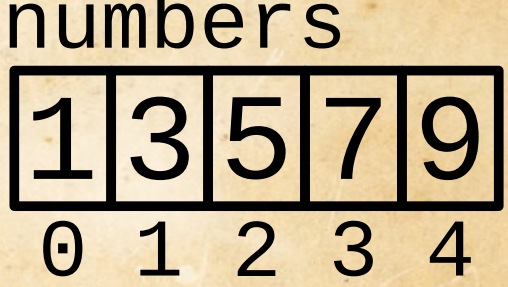
Pseudocode:

```
SET numbers TO [ 1, 3, 5, 7, 9 ]
SET value TO numbers[ 2 ]
SET numbers[ 2 ] TO 6
SEND value TO DISPLAY
```



Linear Search

- Not very efficient
- Frequently used because it’s very simple
- Start at the beginning and go through each element step by step



Linear Search – Assignment 1

- Draw a flowchart that searches for the largest value in an array using the *linear search* algorithm
  - Inputs: the array
  - Output: the largest value found in the array
- Write the Pearson pseudocode for the linear search algorithm
  - it must match your flowchart

Linear Search – Assignment 2

- Draw a flowchart to search for a specific value in an array using the *linear search* algorithm
  - Inputs: the array, and the value to search for
  - Output: the ***index*** in the array where the value is found
    - If the value is not found, return the value `-1`
- Write the Pearson pseudocode for the linear search algorithm
  - it must match your flowchart

Unit 1: Problem Solving

Part 5: Arrays and Linear Search

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