Array **Recap** and Lab Solutions

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Topics list

- RECAP of **Arrays**
- 5a - Lab Solutions
- **Length** Property

Arrays (fixed-size collections)

- Arrays are a way to collect associated values.

- Programming languages usually offer a special fixed-size collection type: an *array*.

- Java arrays can store
  - objects
  - primitive-type values.

- Arrays use a special syntax.

Primitive types

Primitive type

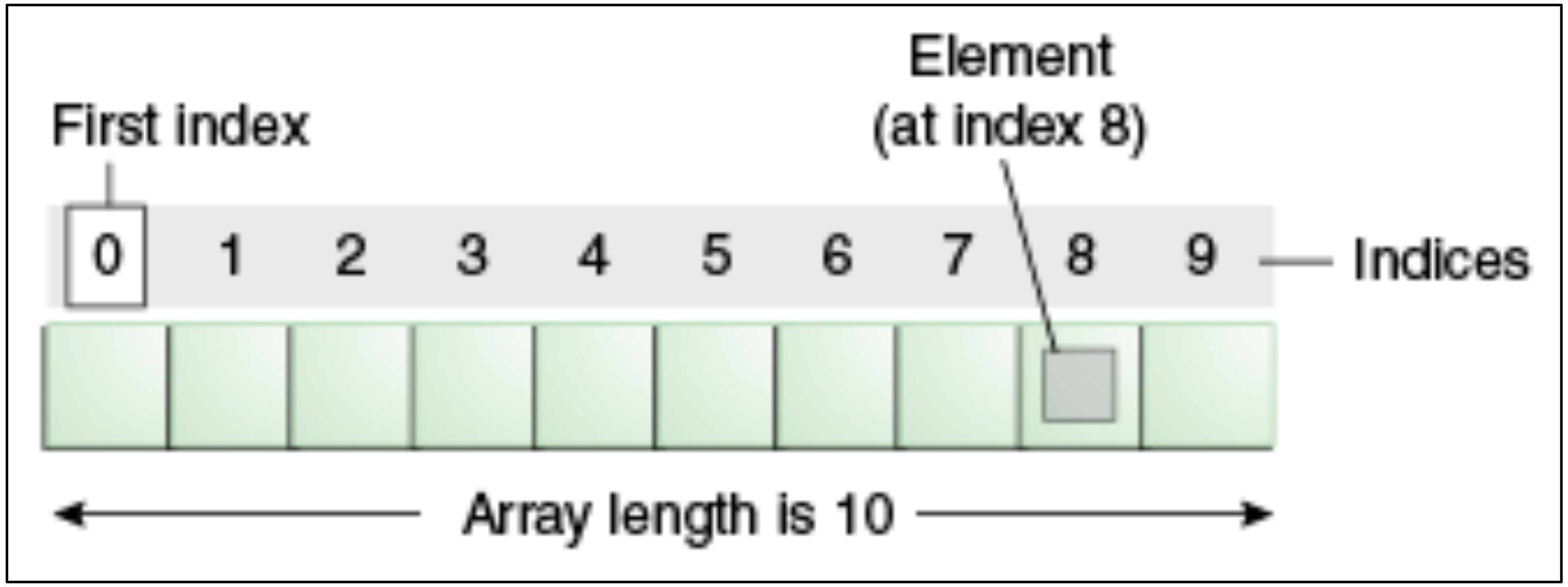
```
int num = 17;
```

Directly stored in memory…

$\boxed{17}$

- We are now going to look at a **structure** that can **store many values** of the **same type**.
- Imagine a structure made up of sub-divisions or sections…
- Such a structure is called an **array** and would look like:

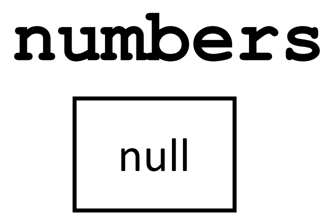
Structure of a primitive array



http://docs.oracle.com/javase/tutorial/java/nutsandbolts/arrays.html

Structure of a primitive array

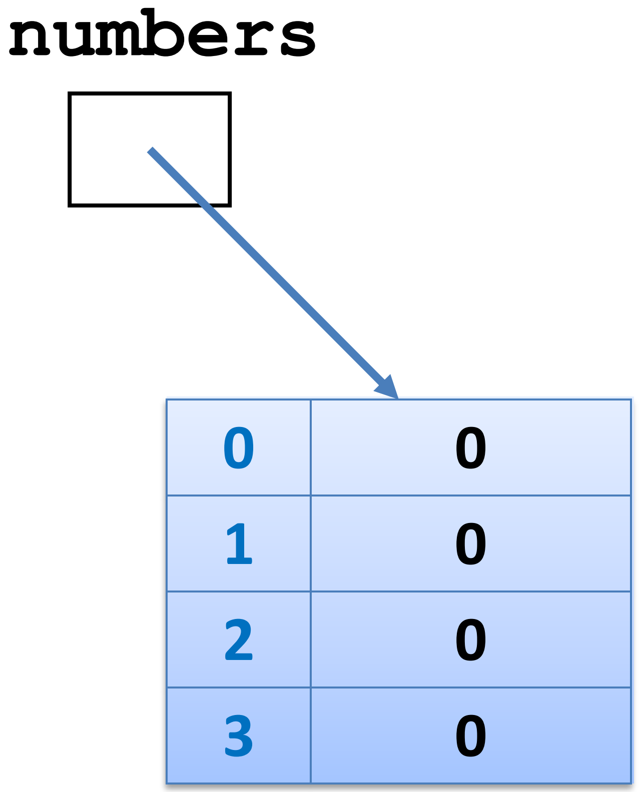
```
int[]  numbers;
```



Structure of a primitive array

```
int[]  numbers;
```

```
numbers = new int[4];
```



Structure of a primitive array

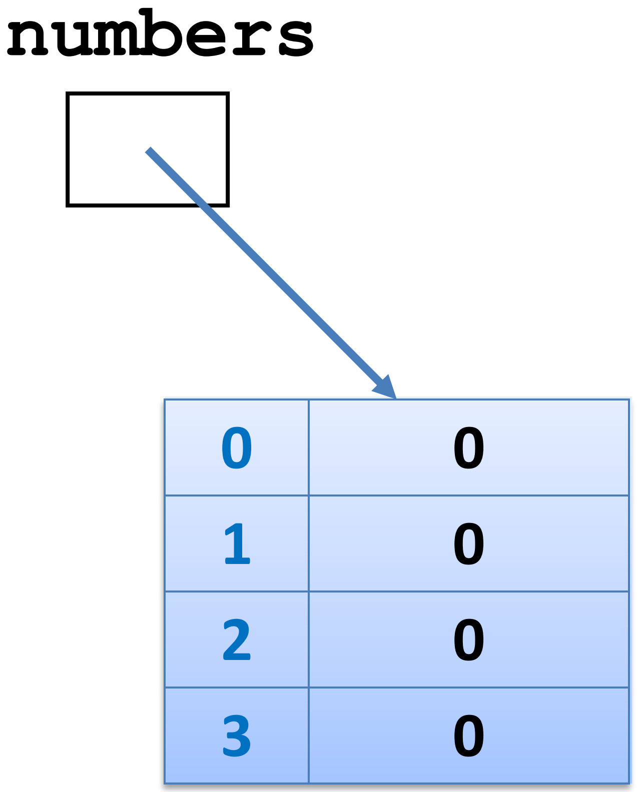
```
int[]  numbers;
```

```
numbers = new int[4];
```

We have declared an array of int, with a capacity of four.

Each element is of type **int**.

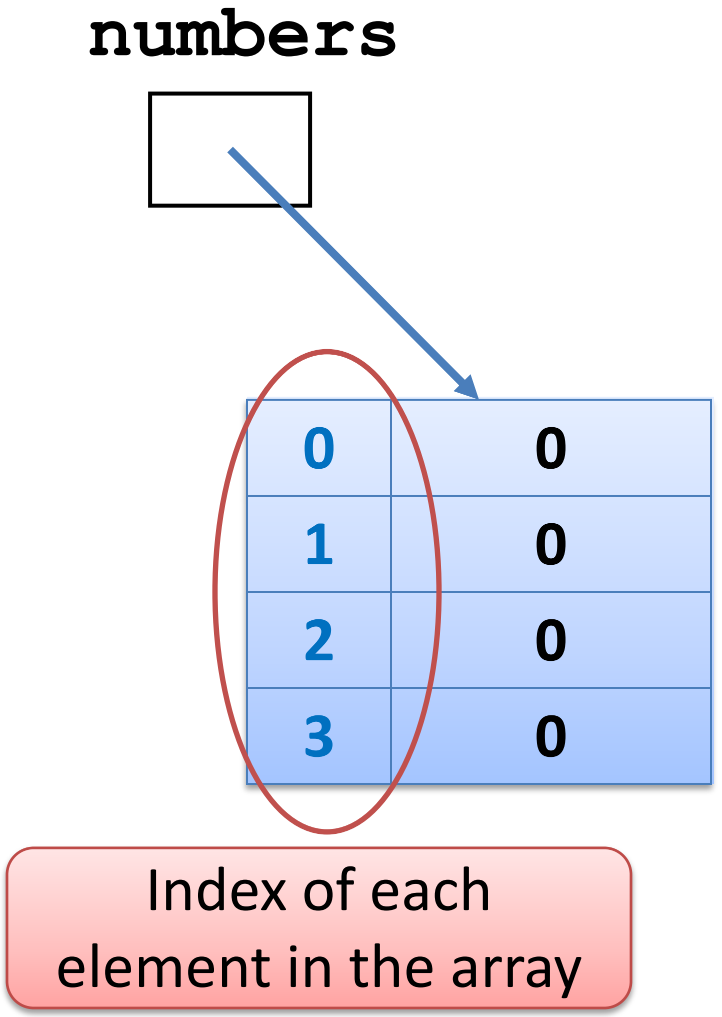
The array is called **numbers**.



Structure of a primitive array

```
int[]  numbers;
```

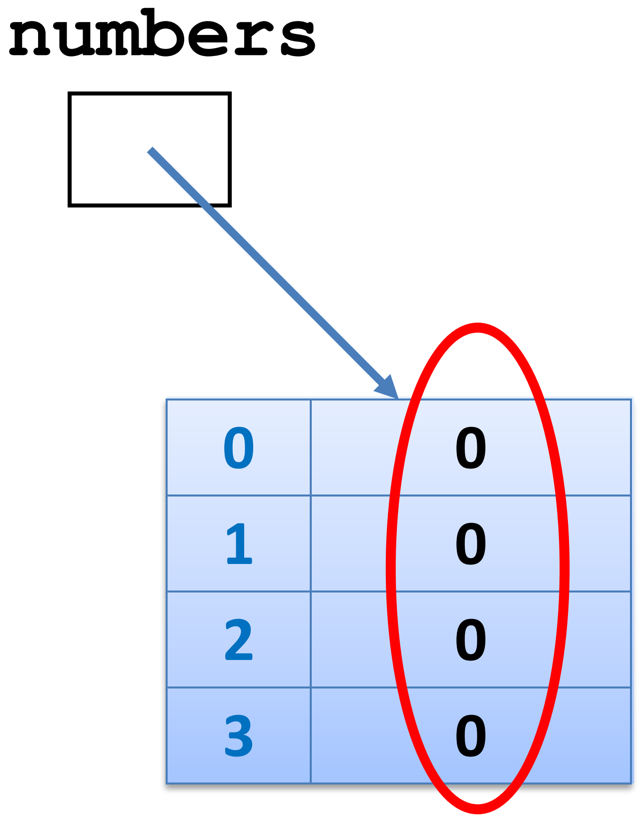
```
numbers = new int[4];
```



Structure of a primitive array

```
int[]  numbers;
```

```
numbers = new int[4];
```



Default value for each element of type **int**.

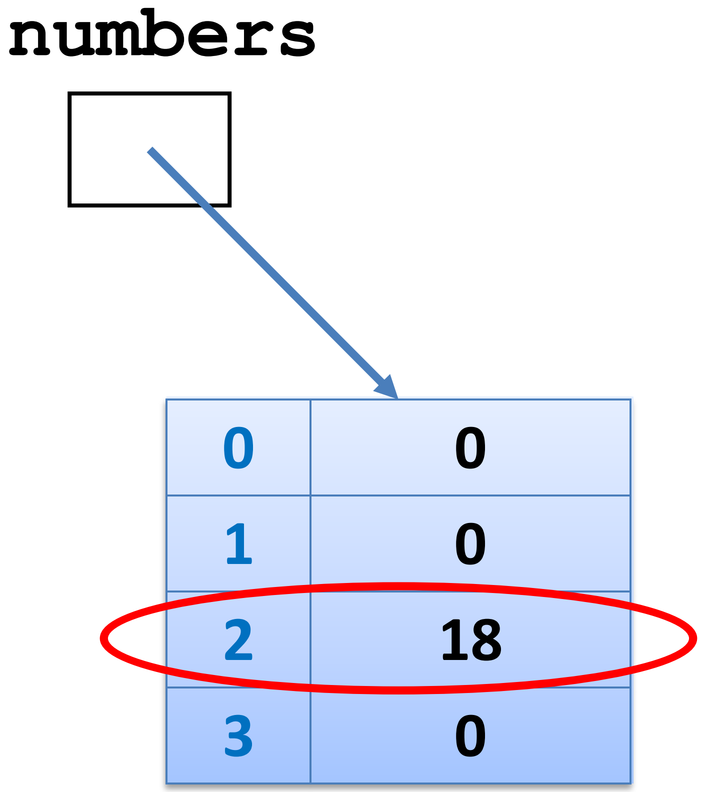
Structure of a primitive array

```
int[]  numbers;
```

```
numbers = new int[4];
```

```
numbers[2] = 18;
```

We are directly accessing the element at index **2** and setting it to a value of **18**.



Structure of a primitive array

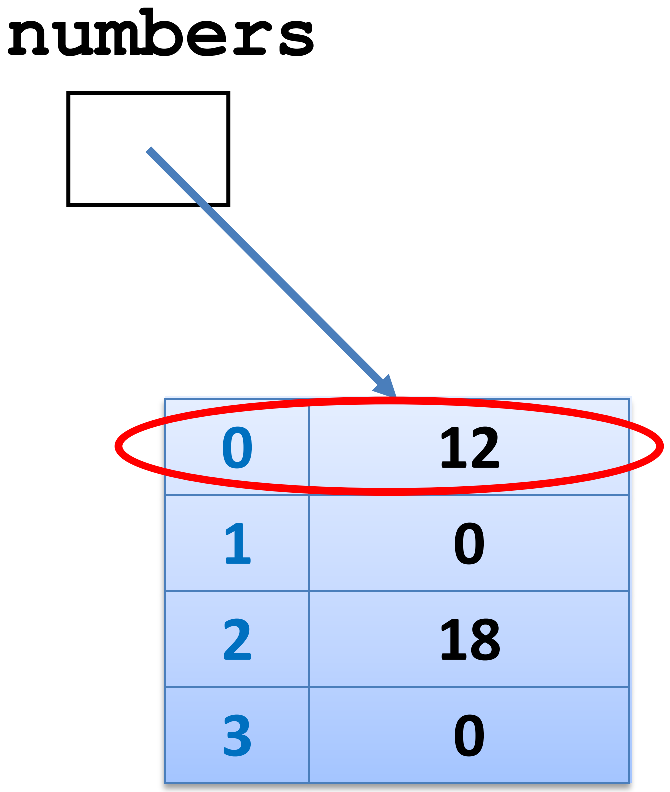
```
int[]  numbers;
```

```
numbers = new int[4];
```

```
numbers[2] = 18;
```

numbers[0] = 12;

We are setting the element at index **0** and to a value of **12**.



Structure of a primitive array

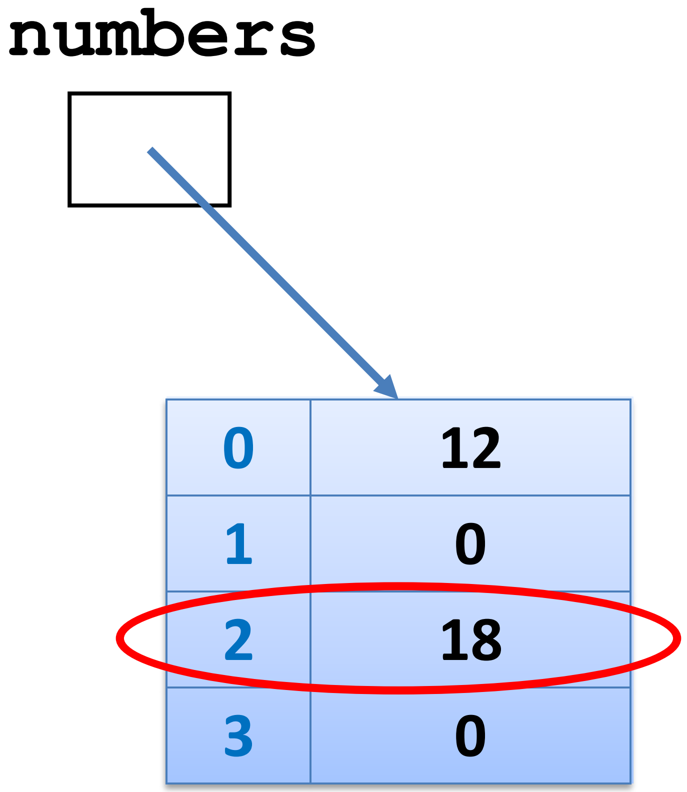
```
int[]  numbers;
```

```
numbers = new int[4];
```

```
numbers[2] = 18;
```

```
numbers[0] = 12;
```

print(numbers[2]);

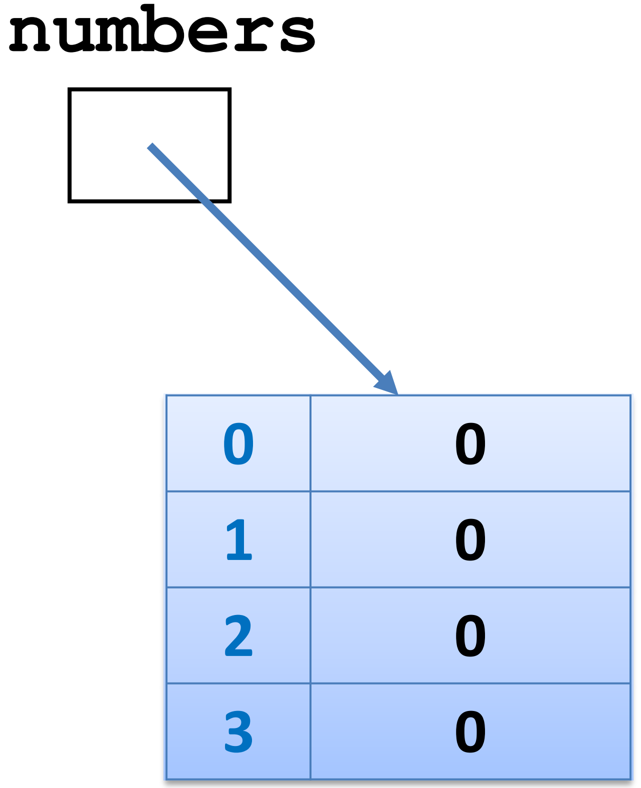


Here we are printing the contents of index location 2
i.e. 18 will be printed to the console.

Declaring a primitive array

```
int[]  numbers;
//somecode
numbers = new int[4];
```

This is how we previously declared our array of four **int**, called **numbers**.



Declaring a primitive array

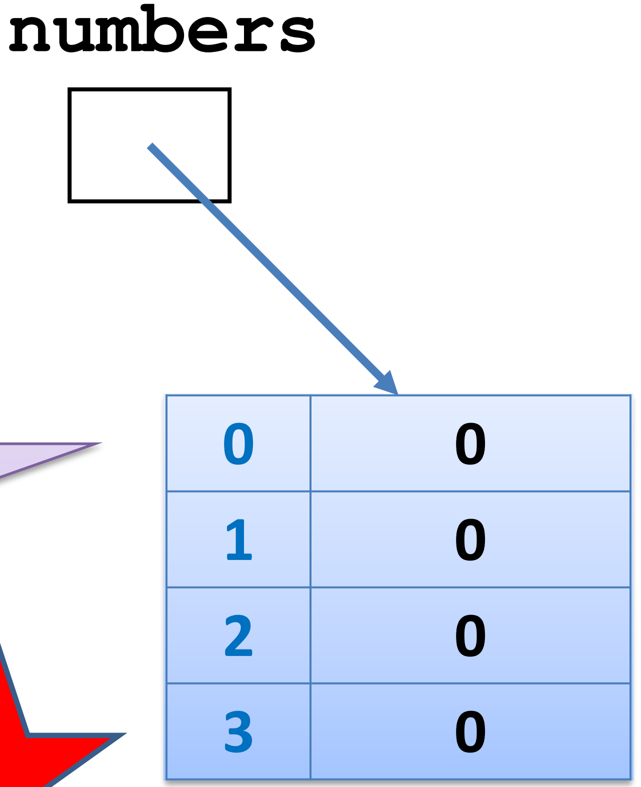
```
int[]  numbers;

//somecode

numbers = new int[4];
```

We can also
(combine both statements)
and declare it like
this…

```
int[]  numbers = new int[4];
```



An array can store ANY TYPE of data.

Primitive Types

```
int numbers[] = new int[10];

byte smallNumbers[] = new byte[4];

char characters[] = new char[26];
```

OR

Primitive Types

```
Int[] numbers = new int[10];

byte[] smallNumbers = new byte[4];

char[] characters = new char[26];
```

Object Types

```
String words[] = new String[30];

Spot spots[] = new Spot[20];
```

OR

Object Types

```
String[] words = new String[30];

Spot[] spots = new Spot[20];
```

Summary - Arrays

- Arrays are structures that can store many values of the same type
- Rule – Never lose input data
  - Arrays enable us to store the data efficiently
  - We can use loops with arrays
- Arrays can store ANY type
- Declaring arrays

```
int[]  arryName;
//somecode
arryName= new int[4];
```

OR

```
int  arryName[];
//somecode
arryName = new int[4];
```

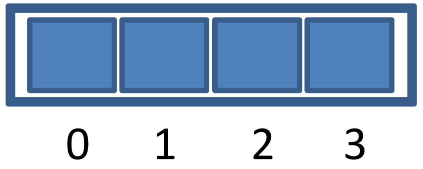
OR

```
int[]  arryName= new int[4];
```

OR

```
int  arryName[] = new int[4];
```

- Index goes from 0 to size-1

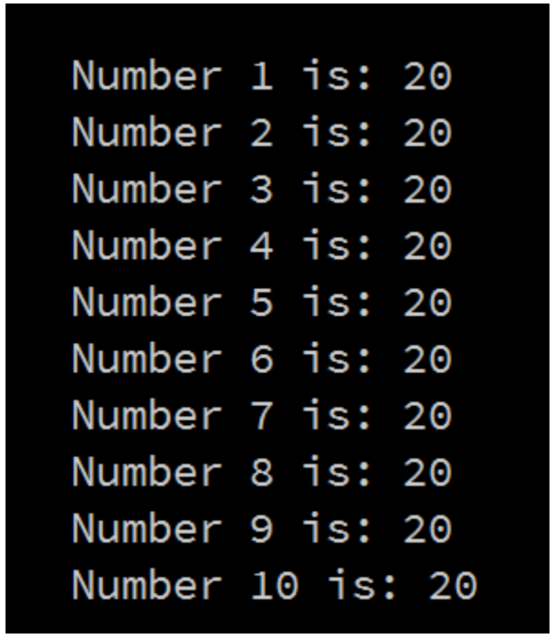


Topics list

- Recap of Arrays
- 5a - Lab Solutions
- Length Property

Exercise 1 – what’s required?

- Write a program to **declare and construct an int array** (called numbers) of **size 10**.
- **Initialise** the array by putting 20 in each of the elements of the array.
- **Print out** the values to the console (each value should be printed to a new line).



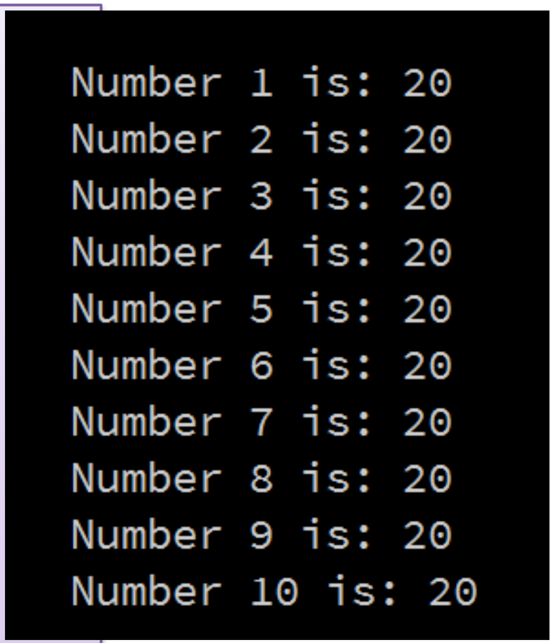
```
Number 1 is: 20
Number 2 is: 20
Number 3 is: 20
Number 4 is: 20
Number 5 is: 20
Number 6 is: 20
Number 7 is: 20
Number 8 is: 20
Number 9 is: 20
Number 10 is: 20
```

Exercise 1 – solution

```
int numbers[] = new int[10];

// initialise each element to 20.
for (int i = 0; i < 10 ; i ++)  {
  numbers[i] = 20;
}

// now we print each value
for (int i = 0; i < 10 ; i ++)   {
      println("Number " + (i+1) + " is: " + numbers[i]);
}
```



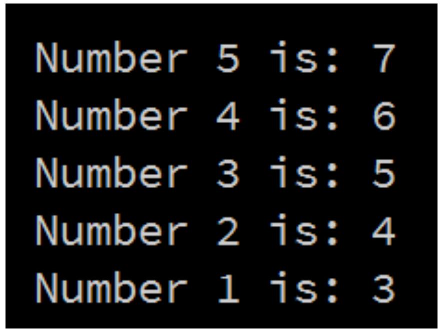
```
Number 1 is: 20
Number 2 is: 20
Number 3 is: 20
Number 4 is: 20
Number 5 is: 20
Number 6 is: 20
Number 7 is: 20
Number 8 is: 20
Number 9 is: 20
Number 10 is: 20
```

Exercise 2 – what's required?

- Write a program to **declare and construct an int array** (called **numbers) of size 5**.

- **Read in** 5 values and store them in the array.

- **Print out** the values to the console (one line at a time) in the **reverse order** to the order they were entered in. For example, if we entered 3, 4, 5, 6 and 7, the output should be:



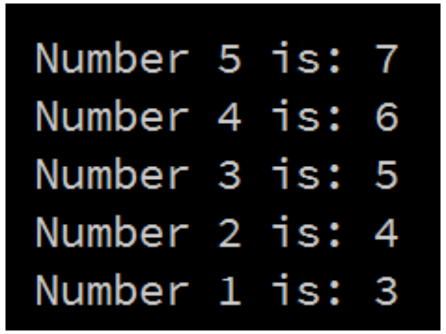
```
Number 5 is: 7
Number 4 is: 6
Number 3 is: 5
Number 2 is: 4
Number 1 is: 3
```

Exercise 2 – solution

```
import javax.swing.JOptionPane;

int numbers[] = new int[5];

//populate the array with user input
for (int i = 0; i < 5 ; i ++)   {
  numbers[i] = Integer.parseInt(
      JOptionPane.showInputDialog(
      "Please enter a number ", "3"));
}
// print each value in reverse order
for (int i = 4; i >= 0 ; i --)   {
      println("Number " + (i+1) + " is: " + numbers[i]);
}
```



```
Number 5 is: 7
Number 4 is: 6
Number 3 is: 5
Number 2 is: 4
Number 1 is: 3
```

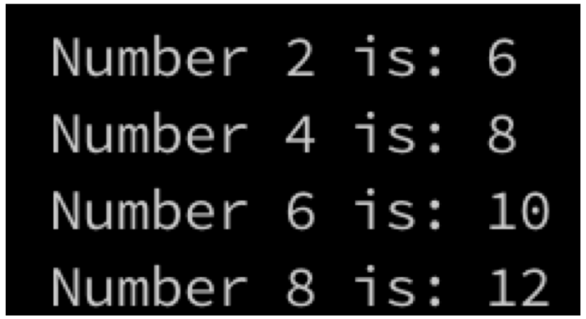
Exercise 3 – what's required?

- Write a program to **declare and construct an int array** (called numbers) with the **size determined by the user**.

- **Read in** a value for each element in the array and store it.

- Use a for loop to print out **every second value** stored in the array to the console.

  For example, if we choose to enter 8 numbers and then enter the following numbers: 5, 6, 7, 8, 9, 10, 11, 12, we should expect our output to be:



```
Number 2 is: 6
Number 4 is: 8
Number 6 is: 10
Number 8 is: 12
```

Exercise 3 – solution

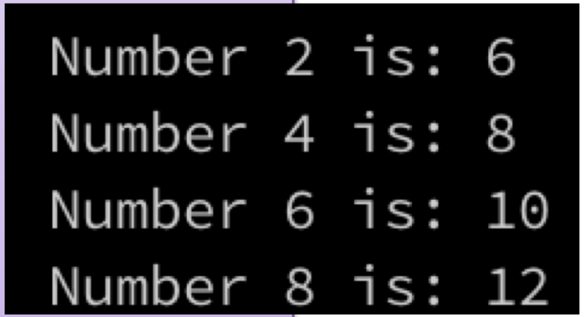
```
import javax.swing.*;

int numbers[];
int numData = Integer.parseInt(
        JOptionPane.showInputDialog("How many values do you wish to
sum? ", "3"));

//now, use this value to make the array this size.
numbers = new int[numData];

for (int i = 0; i < numData ; i ++)  {
  numbers[i] = Integer.parseInt(
        JOptionPane.showInputDialog("Please enter a number ", "3"));
}

// print out every second value
for (int i = 1; i < numData ; i=i+2)   {
    println("Number " + (i+1) + " is: " + numbers[i]);
}
```



```
Number 2 is: 6
Number 4 is: 8
Number 6 is: 10
Number 8 is: 12
```

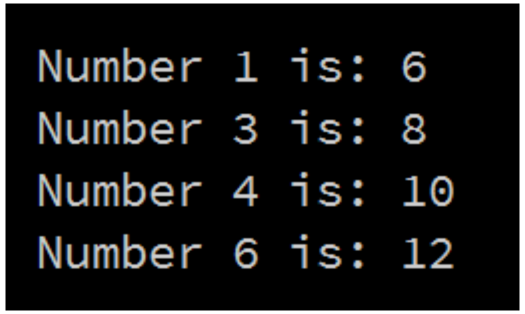
Exercise 4 – what’s required?

- Write a program to declare and construct an
  int array (called numbers)
  with the **size determined by the user**.

- **Read in** a value for each element in the array and store it.

- Print out only the **even numbers** stored in the array to the console
  (hint: use the **% operator**).

  For example, if we choose to enter 6 numbers
  and then enter the following numbers: 6, 7, 8, 10, 11, 12,
  we should expect our output to be:



```
Number 1 is: 6
Number 3 is: 8
Number 4 is: 10
Number 6 is: 12
```

Exercise 4 – solution

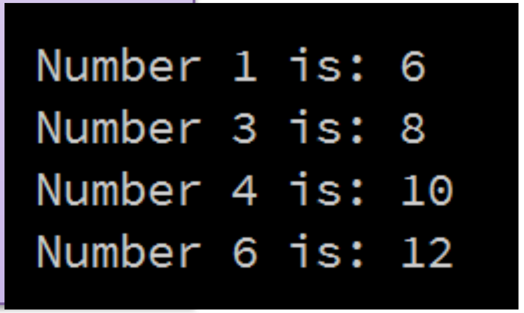
```
import javax.swing.*;

int numbers[];
int numData = Integer.parseInt(JOptionPane.showInputDialog(
              "How many values do you wish to sum? ", "3"));

//now, use this value to make the array this size.
numbers = new int[numData];

for (int i = 0; i < numData ; i ++)  {
  numbers[i] = Integer.parseInt(JOptionPane.showInputDialog(
              "Please enter a number ", "3"));
}

// print out only even numbers
for (int i = 0; i < numData ; i++)   {
    if (numbers[i] % 2 == 0){
        println("Number " + (i+1) + " is: " + numbers[i]);
    }
}
```



```
Number 1 is: 6
Number 3 is: 8
Number 4 is: 10
Number 6 is: 12
```

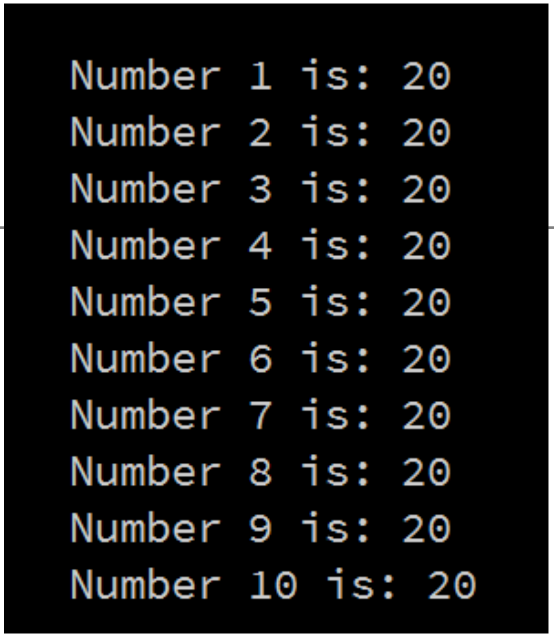
% the modulo operator

- x **%** y
  - The remainder (modulus) after dividing x by y
  - E.g.
    - 0 % 2 = 0
    - 1 % 2 = 1
    - 2 % 2 = 0
    - 3 % 2 = 1
    - 4 % 2 = 0

Topics list

- Recap of Arrays
- 5a - Lab Solutions
- **Length** Property

Returning to Exercise 1



```
Number 1 is: 20
Number 2 is: 20
Number 3 is: 20
Number 4 is: 20
Number 5 is: 20
Number 6 is: 20
Number 7 is: 20
Number 8 is: 20
Number 9 is: 20
Number 10 is: 20
```

We:

- declared an int array (called numbers) of **size 10**.

- initialised the array by putting 20 in each of the elements of the array.

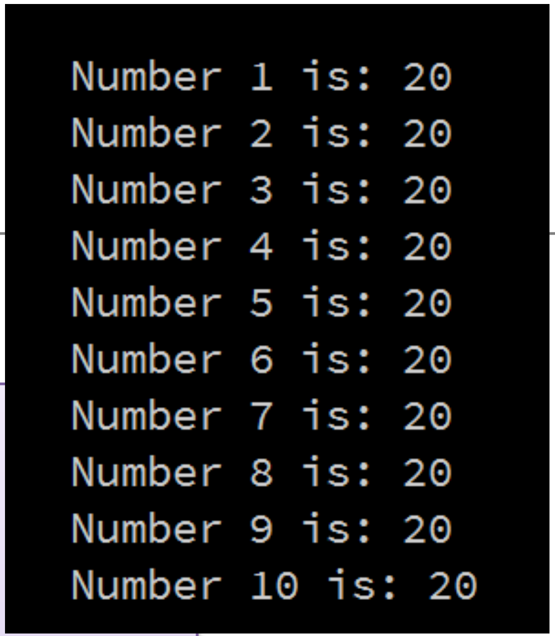
- Printed out the values to the console.

Exercise 1 – solution

```
int numbers[] = new int[10];

// initialise each element to 20.
for (int i = 0; i < 10 ; i ++)  {
  numbers[i] = 20;
}

// now we print each value
for (int i = 0; i < 10 ; i ++)   {
     println("Number " + (i+1) + " is: " + numbers[i]);
}
```



```
Number 1 is: 20
Number 2 is: 20
Number 3 is: 20
Number 4 is: 20
Number 5 is: 20
Number 6 is: 20
Number 7 is: 20
Number 8 is: 20
Number 9 is: 20
Number 10 is: 20
```

Q: What changes do we have to make to process 15 elements?

A: We need to change the code in 3 places!!!

There is a better way…

length Property

- We will use the **length** **property** of an array.

```
int numbers[] = new int[15];

// initialise each element to 20.
for (int i = 0; i < numbers.length ; i ++)  {
  numbers[i] = 20;
}

// now we print each value
for (int i = 0; i < numbers.length; i ++)   {
     println("Number " + (i+1) + " is: " + numbers[i]);
}
```

Instead of hard coding the number of elements in the array,
we will use **numbers.length** in place of it.

length Property

- We will use the **length property** of an array.

```
int numbers[] = new int[30];

// initialise each element to 20.
for (int i = 0; i < numbers.length ; i ++)  {
  numbers[i] = 20;
}

// now we print each value
for (int i = 0; i < numbers.length; i ++)   {
      println("Number " + (i+1) + " is: " + numbers[i]);
}
```

Then,
if we need to change
the number of elements,
we can simply change it
in the declaration
and the for loops will still work!

Questions?