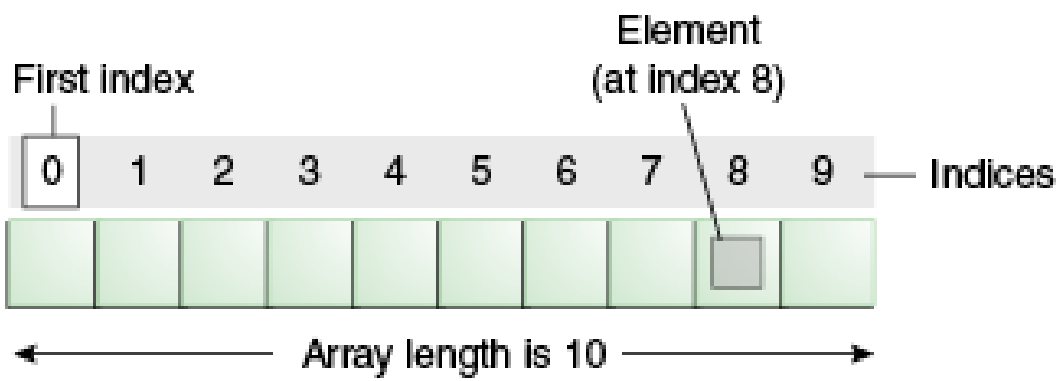
CSN-103: Fundamentals of Object Oriented Programming

Array

- An array is a collection of same type variables that are referred to by a common name
  - It is a **Data Structure**: It is a data organization, management, and storage format that enables efficient access and modification.
- Arrays of **any type** can be created. Arrays may have **one or more** dimensions
- A specific element in an array is accessed by its **index**



- Array Index vs. Array Size

Array

- Array declaration (Example: int Array)

```
int marks[];  // marks is an array variable, no memory allocated
```

- We must allocate memory using **new** keyword

```
marks = new int[5];
```

OR

```
int marks[] = new int[5];          //Automatic initialization to 0
```

- Accessing the element: Using array index (starts with 0)

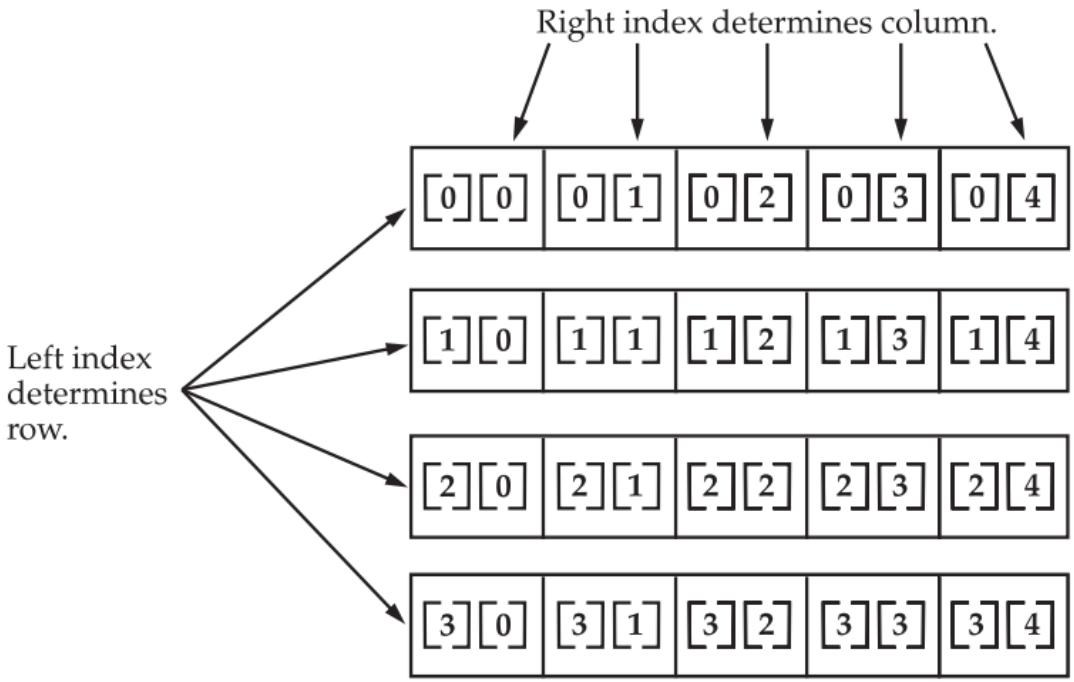
```
marks[1] = 60;                     // Assigning a value
System.out.println(marks[3]);      // Printing a value
```

New keyword is used to allocate memory.

Multidimensional Arrays

- Multidimensional arrays: Arrays of arrays
- **Example:** Declare a two-dimensional array variable

```
int twoD[][] = new int[4][5];
```



Arrays

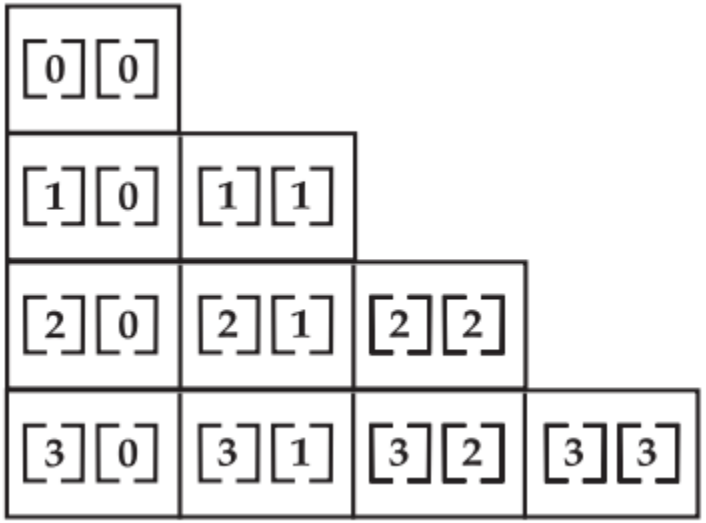
- For a multidimensional array, we only need to specify the size for the first (leftmost) dimension

```
int twoD[][] = new int[4][];
twoD[0] = new int[5];
twoD[1] = new int[5];
twoD[2] = new int[5];
twoD[3] = new int[5];
```

Arrays

- No need to allocate the same number of elements for each dimension

```
int twoD[][] = new int[4][];
twoD[0] = new int[1];
twoD[1] = new int[2];
twoD[2] = new int[3];
twoD[3] = new int[4];
```



TwoDAgain.java

Alternative Array Declaration Syntax

- Examples:

```
int a1[] = new int[3];
int[] a1 = new int[3];
int []a1 = new int[3];
```

Equivalent

```
int a2[][] = new int[3][4];
int[][] a2 = new int[3][4];
int [][]a2 = new int[3][4];
```

Equivalent

```
int[] a1, a2, a3;
int a1[], a2[], a3[];
int []a1, []a2, []a3;
```

Equivalent

Array Length and Cloning

- **length**: A variable that contains the size of the array
  - No need to declare, directly available for use

```
int a[] = new int[5];
System.out.println(a.length);

int a1[][] = new int[3][4];
System.out.println(a1.length);
System.out.println(a1[0].length);
```

- Cloning and Printing: **clone()** **and** **toString()**

```
import java.util.Arrays;
int ia1[] = {1, 2, 3, 4, 5, 6};
int ia2[] = ia1.clone();
System.out.println(Arrays.toString(ia1));
System.out.println(Arrays.toString(ia2));
```

Strings

Creating Strings

- A String can be created in many ways (Constructors)
  - Empty string

```
String s = new String();
```

  - String using a char array

```
char chars[ ] = { 'a', 'b', 'c' };
String s = new String(chars);                    // ”abc”
```

  - String using another String

```
String str = new String(s);                      // ”abc”
```

- The length of a string is the number of characters that it contains

```
System.out.println(s.length());
```

String Operations

- Creating String literal/constant

```
String s2 = "abc";                    //CAUTION: String Pool
```

- String Concatenation with Other Data Types

```
int age = 9;

String s = "He is " + age + " years old";

System.out.println(s);
```

- Character Extraction

```
String s = “Hello World”;

ch = s.charAt(0);

ch = “Hello World”.charAt(0);          //First character at location/index 0
```

String Operations

- To extract more than one character at a time: **getChars( )**

```
class getCharsDemo {
        public static void main(String args[]) {
        String s = "This is a demo of the getChars method";
        int start = 5;
        int end = 10;
        char buf[] = new char[5];
        s.getChars(start, end, buf, 0);
        System.out.println(buf);
        }
}
```

String Operations

- To convert a String object into a character array
  - Use **`toCharArray( )`**
- String Comparison
  - For equality: **`equals( )`** and **`equalsIgnoreCase( )`**
- **`equals( )`** vs. **`==`**
  - **`equals( )`** method compares the characters inside a String object
  - **`==`** operator compares two object references to see whether they refer to the same instance

Other String Operations: For Self Study

- `startsWith() and endsWith()`
- `compareTo()`
- `indexOf() and lastIndexOf()`
- `substring()`
- `concat()`
- `replace()` `//Do not use for Assignment 1 and 2`
- `trim()`
- `toLowerCase() and toUpperCase()`
- `isEmpty()`

Command-Line Arguments

- Pass information into to the main( ) when you run it
  - **Command-line arguments**

```
class CommandLine{
    public static void main(String args[]) {
            for(int i=0; i<args.length; i++)
                    System.out.println("args[" + i + "]:"+ args[i]);
    }
}
```

- Stored as strings in a String array passed as parameter of ***main( )***

Parsing Strings

- Java uses primitive types (simple types)
  - Such as int or double
  - Holds and manipulates the basic data types
- Primitive type provides performance benefit
  - Java provides equivalent objects for these primitive types (type wrappers)
  - Unacceptable overhead even for simplest of calculations
- Type Wrappers or Wrapper Classes
  - Double, Float
  - Integer, Short, Byte, Long
  - Character
  - Boolean