Computer Programming Fundamentals

CS 152
Professor: Leah Buechley
TAs: Melody Horn, Noah Garcia, Andrew Geyko, Juan Ormaza
Time: MWF 10:00-10:50am
https://handandmachine.cs.unm.edu/classes/CS152_Fall2021/

UNM BUILDINGS LOCKED

ASSIGNMENT 3 DUE FRIDAY

questions?

PICKING UP WHERE WE LEFT OFF
OPEN CODE FROM LAST CLASS

CREATE A METHOD FOR PRINTING

METHOD WITH ARRAY PARAMETER

```
static void printArray (int[] myArray) {

    for (int i=0;i<myArray.length;i++) {
        System.out.print(myArray[i] + "\t");
    }

}
```

METHOD WITH ARRAY PARAMETER

```
static void printArray (int[] myArray) {

    for (int i=0;i<myArray.length;i++) {
        System.out.print(myArray[i] + "\t");
    }

}
```

you use your input parameter inside your method

USE IT IN THE MAIN METHOD

```
import java.lang.Math;
import java.util.Scanner;

public class Wednesday {

    public static void main(String[] args) {
        Scanner scan = new Scanner(System.in);
        System.out.print("Enter a size for the array: ");
        int size = scan.nextInt();

        int [] randomArray = new int[size];

        for (int i=0;i<randomArray.length;i++) {
            randomArray[i] = (int)(Math.random()*100);
        }
        printArray(randomArray);
    }
}
```

questions?

WHEN THE CODE EXECUTES

```
printArray(randomArray);
```

```
static void printArray (int[] myArray) {

    for (int i=0;i<myArray.length;i++) {
        System.out.print(myArray[i] + "\t");
    }

}
```

randomArray is “passed” to the printArray method

WHEN THE CODE EXECUTES

```
printArray(randomArray);
```

```
static void printArray (randomArray) {

    for (int i=0;i<randomArray.length;i++) {
        System.out.print(randomArray[i] + "\t");
    }

}
```

randomArray is substituted for myArray

questions?

VARIABLE SCOPE IN METHODS

```
static void printArray (int[] myArray) {

    for (int i=0;i<myArray.length;i++) {
        System.out.print(myArray[i] + "\t");
    }

}
```

scope of myArray
determined
by these { }

CREATE A NEW PROJECT

NAME IT Week5

CREATE A NEW JAVA CLASS NAME IT Monday2DArrays

CREATE A MAIN METHOD

```
public class Monday2DArrays {

    public static void main(String[] args) {

    }

}
```

TODAY WE'RE GOING TO EXPLORE 2D ARRAYS

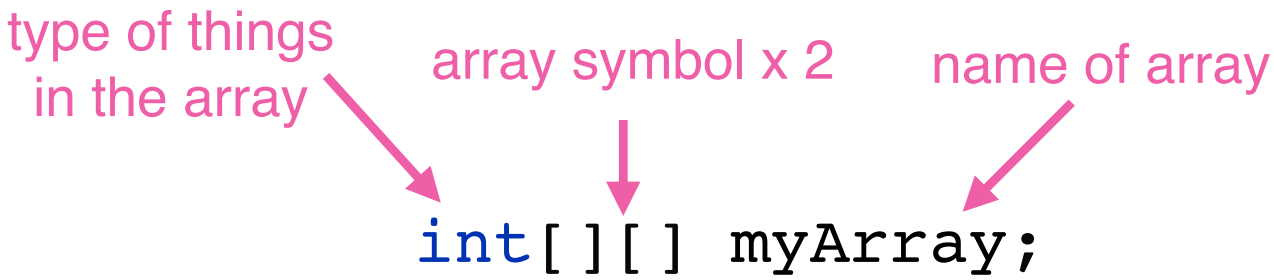
EXAMPLES OF 1D ARRAYS

```
{1, 2, 3, 4, 5}

{5.0, 6.0}

{"cat", "dog", "llama", “bear"}

{'a', 'b', ‘c'}
```

EXAMPLES OF 2D ARRAYS

```
{{1, 2, 3, 4, 5},
 {1, 2, 3, 4, 5},
 {1, 2, 3, 4, 5}}

{{9.1, 6.2},
 {12.5, 1.3}}


{{‘a', 'b', ‘c’},
 {'d', 'e', ‘f’},
 {'g', 'h', ‘i’},
 {'j', 'k', ‘l’}}
```

DECLARING A 2D ARRAY

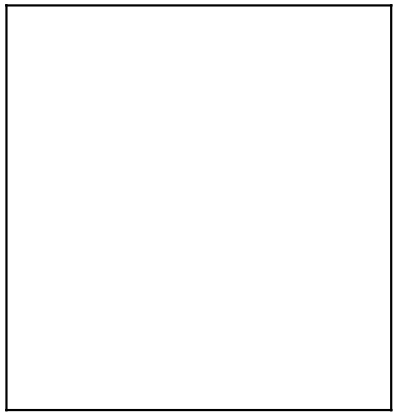


this tells your program you'll be using an array and declares its name

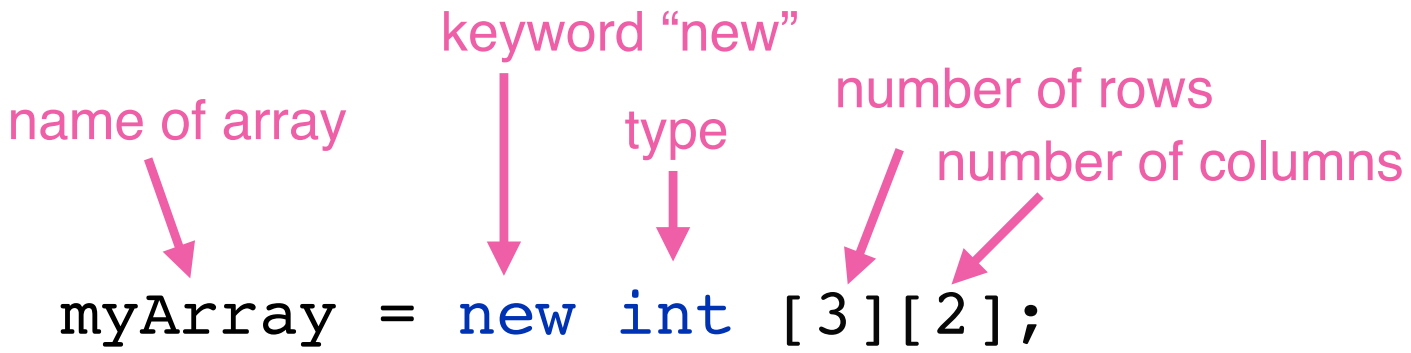
```
int[][] myArray;
```

in the computer's
memory somewhere

myArray



THEN YOU CREATE THE ARRAY

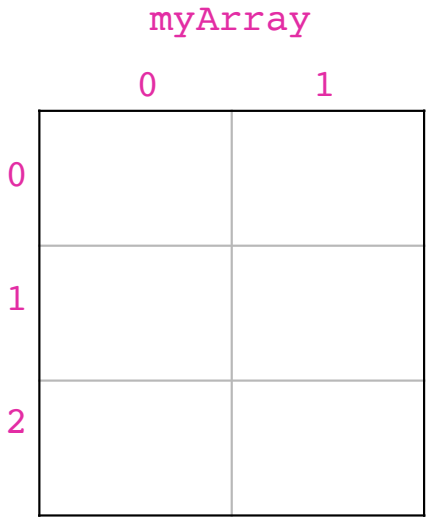


this tells your program the size of your array
and allocates space in memory for the array

in java the size of the array cannot change

```
int[][] myArray;
myArray = new int [3][2];
```

in the computer's
memory somewhere
3 rows x 2 columns

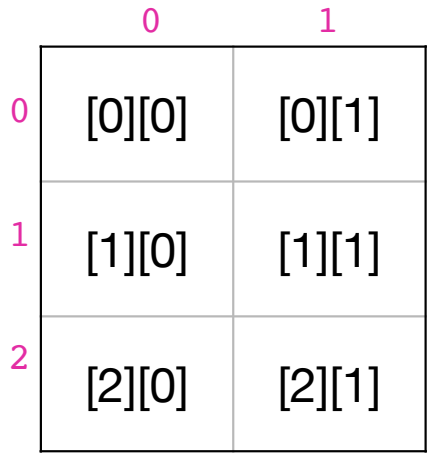


CAN DO THIS ALL TOGETHER

```
int[][] myArray = new int [3][2];
```

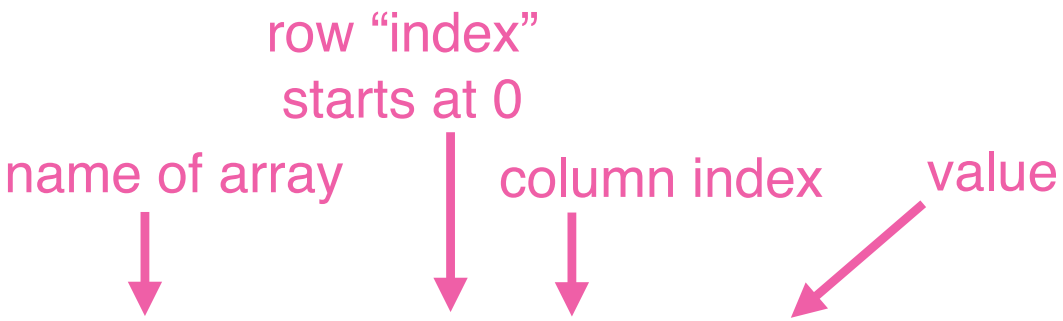
2D ARRAY INDICES

`myArray[row][column]`



questions?

STORING VALUES IN AN ARRAY



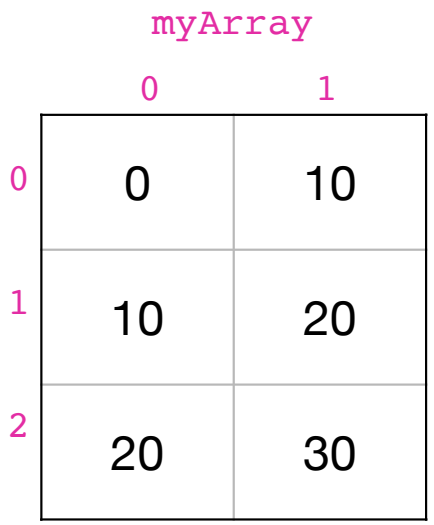

```
myArray[0][0] = 0;
myArray[0][1] = 10;
myArray[1][0] = 10;
myArray[1][1] = 20;
myArray[2][0] = 20;
myArray[2][1] = 30;
```

this stores actual values in the array

PUTTING IT ALL TOGETHER

```
int[][] myArray;
myArray = new int [3][2];
myArray[0][0] = 0;
myArray[0][1] = 10;
myArray[1][0] = 10;
myArray[1][1] = 20;
myArray[2][0] = 20;
myArray[2][1] = 30;
```

in the computer's memory somewhere



questions?

2D ARRAYS ❤ NESTED FOR LOOPS

```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

for (int i=0; i<rows; i++) {

    for (int j=0; j<columns; j++) {
        myArray[i][j] = i*10 + j*10;
    }

}
```

this loop and variable i is for the rows

this loop and variable j is for the columns

ADD SOME PRINT STATEMENTS

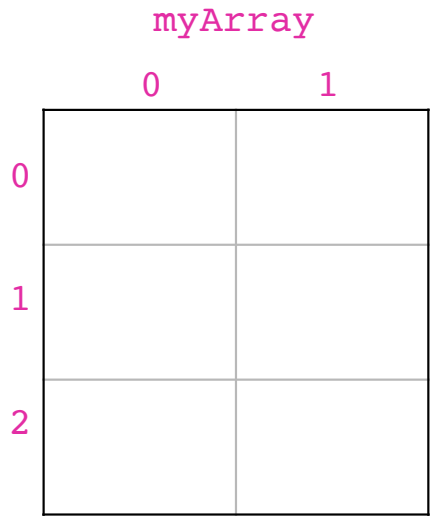
```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

for (int i=0; i<rows; i++) {
    for (int j=0; j<columns; j++) {
        myArray[i][j] = i*10 + j*10;
        System.out.print(myArray[i][j] + "\t");
    }
    System.out.println();
}
```

LETS STEP THROUGH THE LOOP

```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

for (int i=0; i<rows; i++) {
    for (int j=0; j<columns; j++) {
        myArray[i][j] = i*10 + j*10;
        System.out.print(myArray[i][j] + "\t");
    }
    System.out.println();
}
```

LETS STEP THROUGH THE LOOP

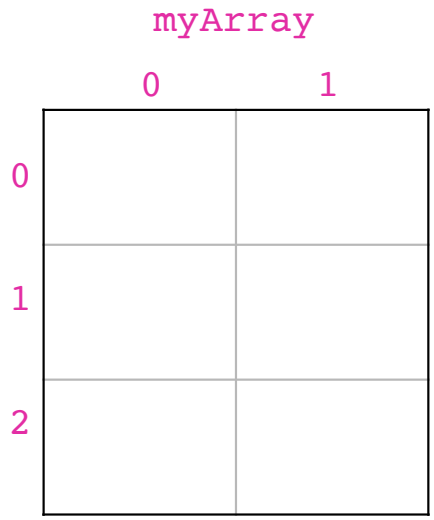
```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

for (int i=0; i<rows; i++) {
    for (int j=0; j<columns; j++) {
        myArray[i][j] = i*10 + j*10;
        System.out.print(myArray[i][j] + "\t");
    }
    System.out.println();
}
```



LETS STEP THROUGH THE LOOP

```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

for (int i=0; i<rows; i++) {
    for (int j=0; j<columns; j++) {
        myArray[i][j] = i*10 + j*10;
        System.out.print(myArray[i][j] + "\t");
    }
    System.out.println();
}
```

i = 0

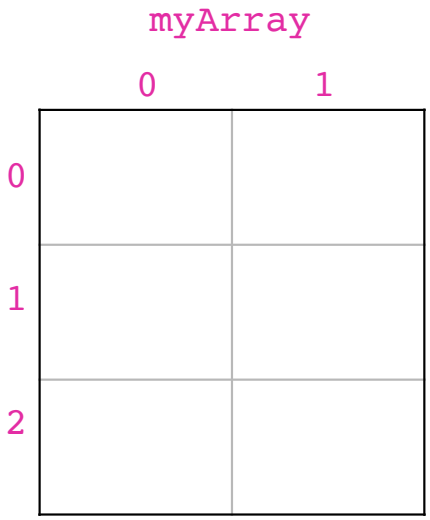


LETS STEP THROUGH THE LOOP

```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

for (int i=0; i<rows; i++) {
    for (int j=0; j<columns; j++) {
        myArray[i][j] = i*10 + j*10;
        System.out.print(myArray[i][j] + "\t");
    }
    System.out.println();
}
```

i = 0

i < 3



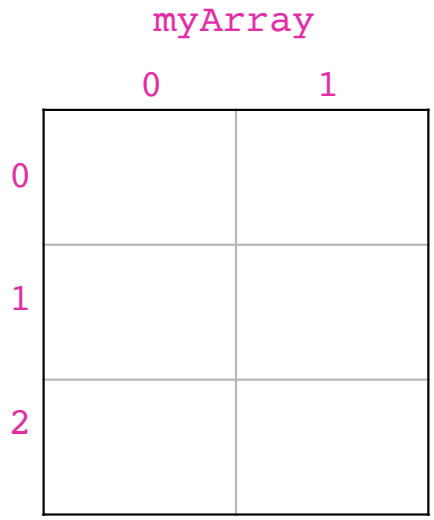
LETS STEP THROUGH THE LOOP

```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

for (int i=0; i<rows; i++) {
    for (int j=0; j<columns; j++) {
        myArray[i][j] = i*10 + j*10;
        System.out.print(myArray[i][j] + "\t");
    }
    System.out.println();
}
```

i = 0

i < 3

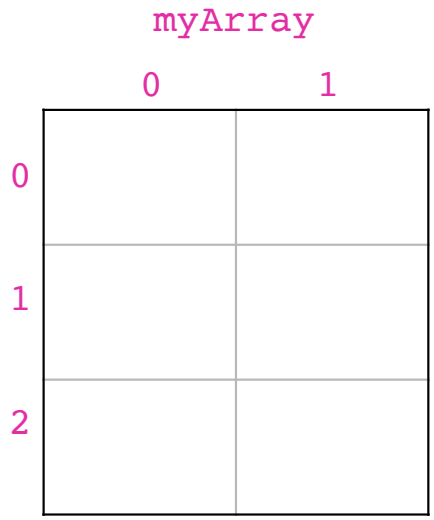
j = 0



LETS STEP THROUGH THE LOOP

```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

for (int i=0; i<rows; i++) {
    for (int j=0; j<columns; j++) {
        myArray[0][0] = 0*10 + 0*10;
        System.out.print(myArray[i][j] + "\t");
    }
    System.out.println();
}
```

```
i = 0

i < 3

j = 0

j < 2
```



LETS STEP THROUGH THE LOOP

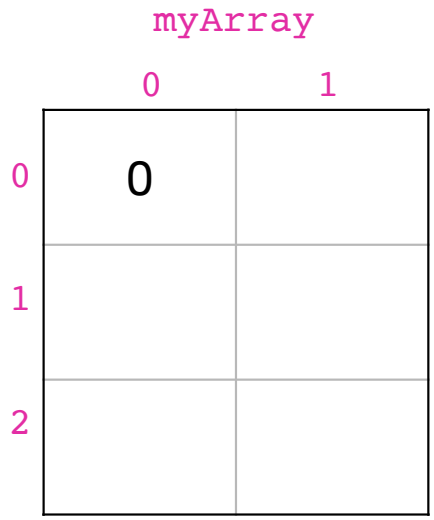
```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

for (int i=0; i<rows; i++) {
    for (int j=0; j<columns; j++) {
        myArray[0][0] = 0*10 + 0*10;
        System.out.print(myArray[i][j] + "\t");
    }
    System.out.println();
}
```

i = 0

i < 3

j = 0

j < 2



LETS STEP THROUGH THE LOOP

```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

for (int i=0; i<rows; i++) {
    for (int j=0; j<columns; j++) {
        myArray[i][j] = i*10 + j*10;
        System.out.print(myArray[0][0] + "\t");
    }
    System.out.println();
}
```

```
0    _
```

i = 0

i < 3

j = 0

j < 2

myArray

	0	1
0	0	
1		
2		

LETS STEP THROUGH THE LOOP

```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

for (int i=0; i<rows; i++) {
    for (int j=0; j<columns; j++) {
        myArray[i][j] = i*10 + j*10;
        System.out.print(myArray[i][j] + "\t");
    }
    System.out.println();
}
```

```
0    _
```

```
i = 0

i < 3

j = 0 + 1
```

myArray

	0	1
0	0	
1		
2		

LETS STEP THROUGH THE LOOP

```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

for (int i=0; i<rows; i++) {
    for (int j=0; j<columns; j++) {
        myArray[i][j] = i*10 + j*10;
        System.out.print(myArray[i][j] + "\t");
    }
    System.out.println();
}
```

```
0   _
```

i = 0

i < 3

j = 1

j < 2

myArray

	0	1
0	0	
1		
2		

LETS STEP THROUGH THE LOOP

```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

for (int i=0; i<rows; i++) {
    for (int j=0; j<columns; j++) {
        myArray[0][1] = 0*10 + 1*10;
        System.out.print(myArray[i][j] + "\t");
    }
    System.out.println();
}
```

```
0    _
```

i = 0

i < 3

j = 1

j < 2

myArray

	0	1
0	0	10
1		
2		

LETS STEP THROUGH THE LOOP

```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

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    for (int j=0; j<columns; j++) {
        myArray[i][j] = i*10 + j*10;
        System.out.print(myArray[0][1] + "\t");
    }
    System.out.println();
}
```

```
0    10
```

```
i = 0

i < 3

j = 1

j < 2
```

myArray

	0	1
0	0	10
1		
2		

LETS STEP THROUGH THE LOOP

```
int rows = 3;
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    for (int j=0; j<columns; j++) {
        myArray[i][j] = i*10 + j*10;
        System.out.print(myArray[i][j] + "\t");
    }
    System.out.println();
}
```

```
0    10
```

```
i = 0

i < 3

j = 1 + 1
```

myArray

	0	1
0	0	10
1		
2		

LETS STEP THROUGH THE LOOP

```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

for (int i=0; i<rows; i++) {
    for (int j=0; j<columns; j++) {
        myArray[i][j] = i*10 + j*10;
        System.out.print(myArray[i][j] + "\t");
    }
    System.out.println();
}
```

```
0    10
```

```
i = 0
i < 3
j = 2
j < 2
```

myArray

	0	1
0	0	10
1		
2		

LETS STEP THROUGH THE LOOP

```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

for (int i=0; i<rows; i++) {
    for (int j=0; j<columns; j++) {
        myArray[0][1] = 0*10 + 1*10;
        System.out.print(myArray[i][j] + "\t");
    }
    System.out.println();
}
```

```
0    10
_
```

i = 0

i < 3

myArray

	0	1
0	0	10
1		
2		

LETS STEP THROUGH THE LOOP

```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

for (int i=0; i<rows; i++) {
    for (int j=0; j<columns; j++) {
        myArray[i][j] = i*10 + j*10;
        System.out.print(myArray[i][j] + "\t");
    }
    System.out.println();
}
```

```
0    10
_
```

```
i = 0 + 1
```

myArray

	0	1
0	0	10
1		
2		

LETS STEP THROUGH THE LOOP

```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

for (int i=0; i<rows; i++) {
    for (int j=0; j<columns; j++) {
        myArray[i][j] = i*10 + j*10;
        System.out.print(myArray[i][j] + "\t");
    }
    System.out.println();
}
```

```
0    10
_
```

i = 1

i < 3

myArray

	0	1
0	0	10
1		
2		

LETS STEP THROUGH THE LOOP

```
int rows = 3;
int columns = 2;
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    for (int j=0; j<columns; j++) {
        myArray[i][j] = i*10 + j*10;
        System.out.print(myArray[i][j] + "\t");
    }
    System.out.println();
}
```

```
0    10
_
```

```
i = 1

i < 3

j = 0
```

myArray

	0	1
0	0	10
1		
2		

LETS STEP THROUGH THE LOOP

```
int rows = 3;
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        myArray[i][j] = i*10 + j*10;
        System.out.print(myArray[i][j] + "\t");
    }
    System.out.println();
}
```

```
0    10
_
```

```
i = 1

i < 3

j = 0

j < 2
```

myArray

	0	1
0	0	10
1		
2		

LETS STEP THROUGH THE LOOP

```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

for (int i=0; i<rows; i++) {
    for (int j=0; j<columns; j++) {
        myArray[1][0] = 1*10 + 0*10;
        System.out.print(myArray[i][j] + "\t");
    }
    System.out.println();
}
```

```
0    10
_
```

i = 1

i < 3

j = 0

j < 2

myArray

	0	1
0	0	10
1	10	
2		

LETS STEP THROUGH THE LOOP

```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

for (int i=0; i<rows; i++) {
    for (int j=0; j<columns; j++) {
        myArray[i][j] = i*10 + j*10;
        System.out.print(myArray[1][0] + "\t");
    }
    System.out.println();
}
```

```
0    10
10   _
```

```
i = 1

i < 3

j = 0

j < 2
```

myArray

	0	1
0	0	10
1	10	
2		

LETS STEP THROUGH THE LOOP

```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

for (int i=0; i<rows; i++) {
    for (int j=0; j<columns; j++) {
        myArray[i][j] = i*10 + j*10;
        System.out.print(myArray[1][0] + "\t");
    }
    System.out.println();
}
```

```
0    10
10   _
```

```
i = 1

i < 3

j = 0 + 1
```

myArray

	0	1
0	0	10
1	10	
2		

LETS STEP THROUGH THE LOOP

```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

for (int i=0; i<rows; i++) {
    for (int j=0; j<columns; j++) {
        myArray[i][j] = i*10 + j*10;
        System.out.print(myArray[i][j] + "\t");
    }
    System.out.println();
}
```

```
0    10
10   _
```

```
i = 1

i < 3

j = 1

j < 2
```

myArray

	0	1
0	0	10
1	10	
2		

LETS STEP THROUGH THE LOOP

```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

for (int i=0; i<rows; i++) {
    for (int j=0; j<columns; j++) {
        myArray[1][1] = 1*10 + 1*10;
        System.out.print(myArray[i][j] + "\t");
    }
    System.out.println();
}
```

```
0    10
10   _
```

```
i = 1

i < 3

j = 1

j < 2
```

myArray

	0	1
0	0	10
1	10	20
2		

LETS STEP THROUGH THE LOOP

```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

for (int i=0; i<rows; i++) {
    for (int j=0; j<columns; j++) {
        myArray[i][j] = i*10 + j*10;
        System.out.print(myArray[1][1] + "\t");
    }
    System.out.println();
}
```

```
0    10
10   20
```

i = 1

i < 3

j = 1

j < 2

myArray

	0	1
0	0	10
1	10	20
2		

LETS STEP THROUGH THE LOOP

```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

for (int i=0; i<rows; i++) {
    for (int j=0; j<columns; j++) {
        myArray[i][j] = i*10 + j*10;
        System.out.print(myArray[i][j] + "\t");
    }
    System.out.println();
}
```

```
0    10
10   20
```

i = 1

i < 3

j = 1 + 1

myArray

	0	1
0	0	10
1	10	20
2		

LETS STEP THROUGH THE LOOP

```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

for (int i=0; i<rows; i++) {
    for (int j=0; j<columns; j++) {
        myArray[i][j] = i*10 + j*10;
        System.out.print(myArray[i][j] + "\t");
    }
    System.out.println();
}
```

```
0    10
10   20
```

i = 1

i < 3

j = 2

j < 2

myArray

	0	1
0	0	10
1	10	20
2		

LETS STEP THROUGH THE LOOP

```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

for (int i=0; i<rows; i++) {
    for (int j=0; j<columns; j++) {
        myArray[i][j] = i*10 + j*10;
        System.out.print(myArray[i][j] + "\t");
    }
    System.out.println();
}
```

```
0    10
10   20
_
```

i = 1

i < 3

myArray

	0	1
0	0	10
1	10	20
2		

LETS STEP THROUGH THE LOOP

```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

for (int i=0; i<rows; i++) {
    for (int j=0; j<columns; j++) {
        myArray[i][j] = i*10 + j*10;
        System.out.print(myArray[i][j] + "\t");
    }
    System.out.println();
}
```

```
0    10
10   20
_
```

i = 1+1

myArray

	0	1
0	0	10
1	10	20
2		

LETS STEP THROUGH THE LOOP

```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

for (int i=0; i<rows; i++) {
    for (int j=0; j<columns; j++) {
        myArray[i][j] = i*10 + j*10;
        System.out.print(myArray[i][j] + "\t");
    }
    System.out.println();
}
```

```
0    10
10   20
_
```

```
i = 2

i < 3
```

myArray

	0	1
0	0	10
1	10	20
2		

questions?

LENTH OF 2D ARRAYS

WHAT IS THE LENGTH OF myArray?

```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

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

```
{{0,  10},
 {10, 20},
 {20, 30}}
```

```
3
number of rows
```

WHY?

```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

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

```
{{0,  10},
 {10, 20},
 {20, 30}}
```

2D ARRAY = A LIST OF LISTS

```
{{0,  10},
 {10, 20},
 {20, 30}}
```

=

```
{{0,  10}, {10, 20}, {20, 30}}
```

WHAT IS THE LENGTH OF myArray[0]?

```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

System.out.println(myArray[0].length);
```

```
{{0,  10},
 {10, 20},
 {20, 30}}
```

```
2
number of columns
```

GOOD PRACTICE WITH 2D ARRAYS: USE VARIABLES IN FOR LOOPS

```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

for (int i=0; i<rows; i++) {
    for (int j=0; j<columns; j++) {
        myArray[i][j] = i*10 + j*10;
        System.out.print(myArray[i][j] + "\t");
    }
    System.out.println();
}
```

MORE CONFUSING

```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

for (int i=0; i<myArray.length; i++) {
    for (int j=0; j<myArray[i].length; j++) {
        myArray[i][j] = i*10 + j*10;
        System.out.print(myArray[i][j] + "\t");
    }
    System.out.println();
}
```

LESS CONFUSING

```
int rows = 3;
int columns = 2;
int [][] myArray = new int [rows][columns];

for (int i=0; i<rows; i++) {
    for (int j=0; j<columns; j++) {
        myArray[i][j] = i*10 + j*10;
        System.out.print(myArray[i][j] + "\t");
    }
    System.out.println();
}
```

questions?

LETS WRITE A METHOD THAT GENERATES AND PRINTS A 2D ARRAY

WITH INPUT VARIABLES FOR ROWS AND COLUMNS

A METHOD

```
static void generateAndPrint(int rows, int columns) {
    int [][] myArray = new int [rows][columns];

    for (int i=0; i<rows; i++) {
        for (int j=0; j<columns; j++) {
            myArray[i][j] = i*10 + j*10;
            System.out.print(myArray[i][j] + "\t");
        }
        System.out.println();
    }
}
```

IN MAIN

```
public static void main(String[] args) {
    int rows = 3;
    int columns = 2;

    generateAndPrint(rows, columns);
}
```

IN MAIN

```
public static void main(String[] args) {
    int x = 3;
    int y = 2;

    generateAndPrint(x, y);
}
```

IN MAIN

```
public static void main(String[] args) {
    generateAndPrint(3, 2);
}
```

PROBLEM?

```
public static void main(String[] args) {
    generateAndPrint(3, 2);
    myArray[0][0] = 100;
}
```

myArray variable is out of scope in main()

Thank you!

CS 152
Professor: Leah Buechley
TAs: Melody Horn, Noah Garcia, Andrew Geyko, Juan Ormaza
Time: MWF 10:00-10:50am
https://handandmachine.cs.unm.edu/classes/CS152_Fall2021/