

Picture Lab Activity 4

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Two-dimensional arrays in Java

Task	Java Syntax	Examples
Declare a 2D array	<code>type[][] name</code>	<code>int[][] matrix</code> <code>Pixel[][] pixels</code>
Create a 2D array	<code>new type[numRows][numCols]</code>	<code>new int[5][8]</code> <code>new Pixel[numRows][numCols]</code>
Access an element	<code>name[row][col]</code>	<code>int value = matrix[3][2];</code> <code>Pixel pixel = pixels[r][c];</code>
Set the value of an element	<code>name[row][col] = value</code>	<code>matrix[3][2] = 8;</code> <code>pixels[r][c] = aPixel;</code>
Get the number of rows	<code>name.length</code>	<code>matrix.length</code> <code>pixels.length</code>
Get the number of columns	<code>name[0].length</code>	<code>matrix[0].length</code> <code>pixels[0].length</code>

Video on 2D Arrays

To loop through the values in a 2D array you must have two indexes. One index is used to change the row index and one is used to change the column index. You can use nested loops, which is one for loop inside of another, to loop through all the values in a 2D array.

Here is a method in the `IntArrayWorker` class that totals all the values in a 2D array of integers in a private instance variable (field in the class) named `matrix`. Notice the nested for loop and how it uses `matrix.length` to get the number of rows and `matrix[0].length` to get the number of columns. Since `matrix[0]` returns the inner array in a 2D array, you can use `matrix[0].length` to get the number of columns.

```

public int getTotal()
{
    int total = 0;
    for (int row = 0; row < matrix.length; row++)
    {
        for (int col = 0; col < matrix[0].length; col++)
        {
            total = total + matrix[row][col];
        }
    }
    return total;
}

```

Because Java two-dimensional arrays are actually arrays of arrays, you can also get the total using nested "for-each" loops as shown in `getTotalNested` below. The outer loop will loop through the outer

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array (each of the rows) and the inner loop will loop through the inner array (columns in that row). You can use a nested for-each loop whenever you want to loop through all items in a 2D array and you don't need to know the row index or column index.

```
public int getTotalNested()
{
    int total = 0;
    for (int[] rowArray : matrix)
    {
        for (int item : rowArray)
        {
            total = total + item;
        }
    }
    return total;
}
```

Exercises

1. Write a `getCount(int i)` method in the `IntArrayWorker` class that returns the count of the number of times the integer value `i` is found in the matrix. There is already a method to test this in `IntArrayWorkerTester`. Just uncomment the method `testGetCount()` (around line 25) and the call to it in the main method of `IntArrayWorkerTester`.
2. Write a `getLargest` method in the `IntArrayWorker` class that returns the largest value in the matrix. There is already a method to test this in `IntArrayWorkerTester`. Just uncomment the method `testGetLargest()` (around line 55) and the call to it in the main method of `IntArrayWorkerTester`.
3. Write a `getColTotal(int col)` method in the `IntArrayWorker` class that returns the total of all integers in a specified column. There is already a method to test this in `IntArrayWorkerTester` (around line 80). Just uncomment the method `testGetColTotal()` and the call to it in the main method of `IntArrayWorkerTester`.

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