

The Matrix

1	2	3	4	5	6	7	8	8	1	1	2	3	4	5	6	7	8	8	1
A	b	a	d	e	a	a	a	a	a	A	b	a	d	e	a	a	a	a	a
1	4	6	2	a	a	3	2	5	1	1	4	6	2	a	a	3	2	5	1
1	2	3	4	5	6	7	8	8	1	1	2	3	4	5	6	7	8	8	1
A	b	a	d	e	a	a	a	a	a	A	b	a	d	e	a	a	a	a	a
1	4	6	2	a	a	3	2	5	1	1	4	6	2	a	a	3	2	5	1
1	2	3	4	5	6	7	8	8	1	1	2	3	4	5	6	7	8	8	1
A	b	a	d	e	a	a	a	a	a	A	b	a	d	e	a	a	a	a	a
1	4	6	2	a	a	3	2	5	1	1	4	6	2	a	a	3	2	5	1

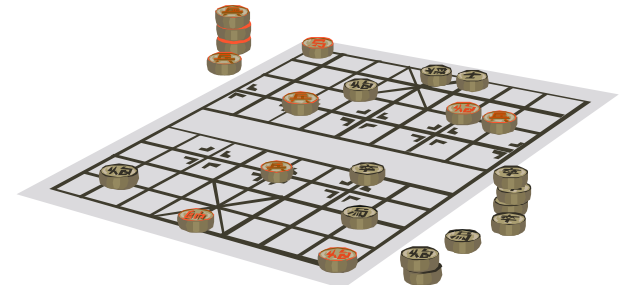
Two-D arrays

Matrices

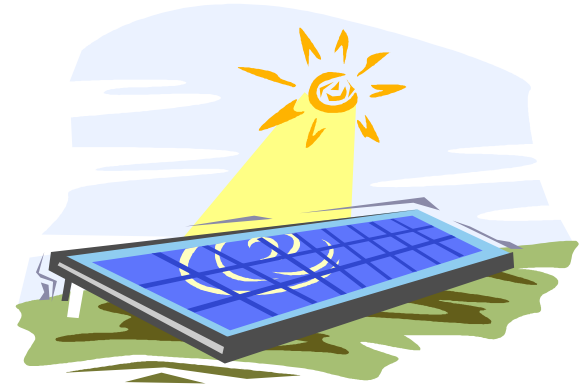
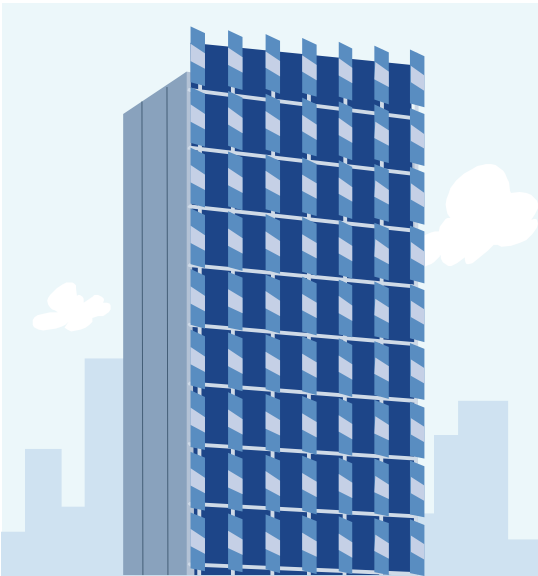
A two-dimensional array is a one-dimensional array of one-dimensional arrays.

A spreadsheet is a matrix.

A matrix has rows and columns.



Two-D arrays Matrices



A solar panel is a large array of solar cells.

What is an array?

An array is a group of items all of the same type which are accessed through a single identifier.

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

	0	1	2	3	4	5	6	7	8	9
nums	0	0	0	0	0	0	0	0	0	0

Matrices

0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

A matrix is filled with 0 values when instantiated. The exact value in the matrix depends on the specified type.

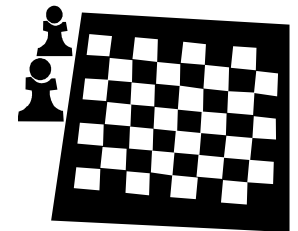
Matrices

0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

Each row is a one-dimensional array.

Matrices

	0	1	2	3	4
0	0	0	0	0	0
1	0	0	0	0	0
2	0	0	0	0	0
3	0	0	0	0	0
4	0	0	0	0	0

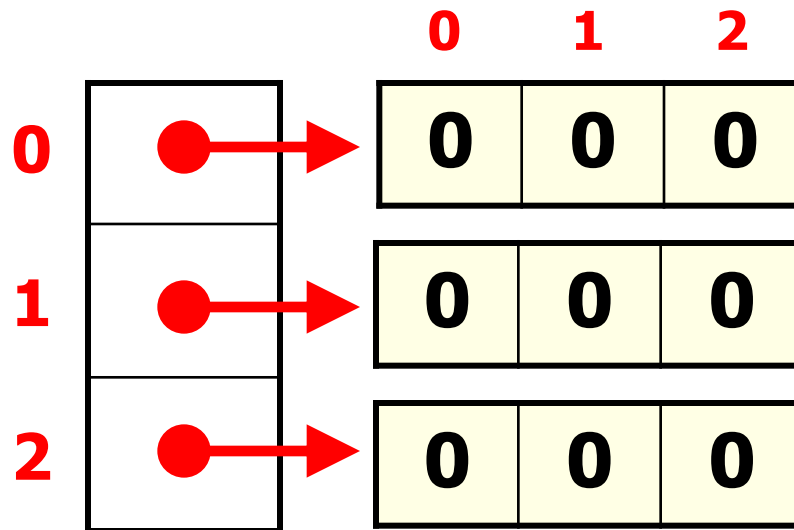


```
int[][] mat = new int[5][5];
```

What is a matrix?

A matrix is an array of arrays.

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



open
matrixone.java

Matrix

Variables

Matrix Variables

```
int[][] mat = {{6, 5, 7, 9, 2},  
               {5, 3, 4, 6},  
               {7, 0, 8}};
```

```
final int SIZE = 40;  
int[][] intMat = new int[SIZE][SIZE];  
//intMat is filled with zeros - 0s
```

Matrix Variables

String[][] words = new String[4][4];
//words is filled with 16 nulls

double[][] dMat = new double[3][3];
//dMat is filled with 9 0.0s

int[][] mat = new int[5][5];
//mat is filled with 25 0s

Printing Matrix

Values

Printing Spots

```
int[][] mat = {{5,7,9,2,1,9},  
               {5,3,4},  
               {3,7,0,8,9}};
```

```
out.println(mat[2][1]);  
out.println(mat[1][2]);  
out.println(mat[0][3]);  
out.println(mat[2][4]);
```

OUTPUT

7
4
2
9

Printing Spots

```
int[][] mat = {{5,7,9,2,1,9},  
               {5,3,4},  
               {3,7,0,8,9}};
```

```
out.println(mat[7/4][0]);  
out.println(mat[1*2][2]);  
out.println(mat.length);  
out.println(mat[0].length);
```

OUTPUT

5
0
3
6

open
matrixtwo.java

Setting Matrix

Values

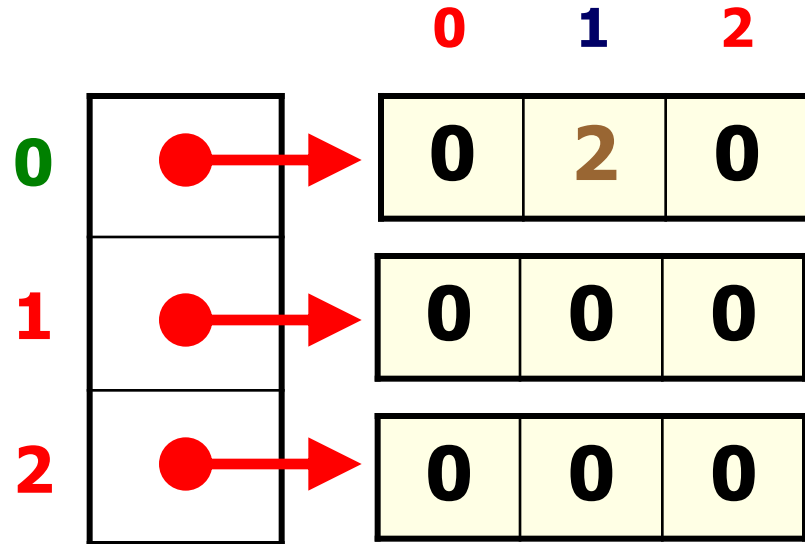
What is a matrix?

A matrix is an array of arrays.

```
int[][] mat = new int[3][3];  
mat[0][1]=2;
```

Which
array?

Which
spot?



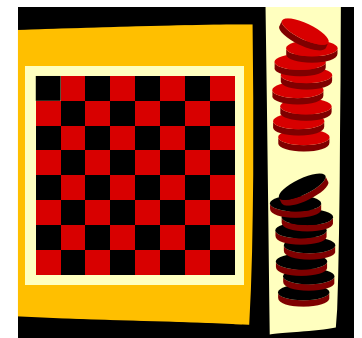
Assigning Matrix Values

	0	1	2	3	4
0	0	0	0	5	0
1	0	0	0	0	0
2	0	0	7	0	0
3	0	0	0	0	0
4	0	3	0	0	0

`mat[2][2]=7;`

`mat[0][3]=5;`

`mat[4][1]=3`



Assigning Matrix Values

```
for( int r = 0; r < mat.length; r++)  
{  
    for( int c = 0; c < mat[r].length; c++)  
    {  
        mat[r][c] = r*c;  
    }  
}
```

if mat was 3x3

0	0	0
0	1	2
0	2	4

open
matrixsetone.java
matrixsettwo.java

Nested Loop

Review

Nested Loop Review

```
int outer=1;  
    //start    //stop    //increment  
for(outer=1;  outer<=2;    outer++)  
{  
    //start    //stop    //increment  
    for(int inner=1; inner<=2; inner++)  
        out.println(outer + " " + inner);  
    out.println();  
}
```

OUTPUT

1 1

1 2

2 1

2 2

**open
nestedfor.java**

Processing

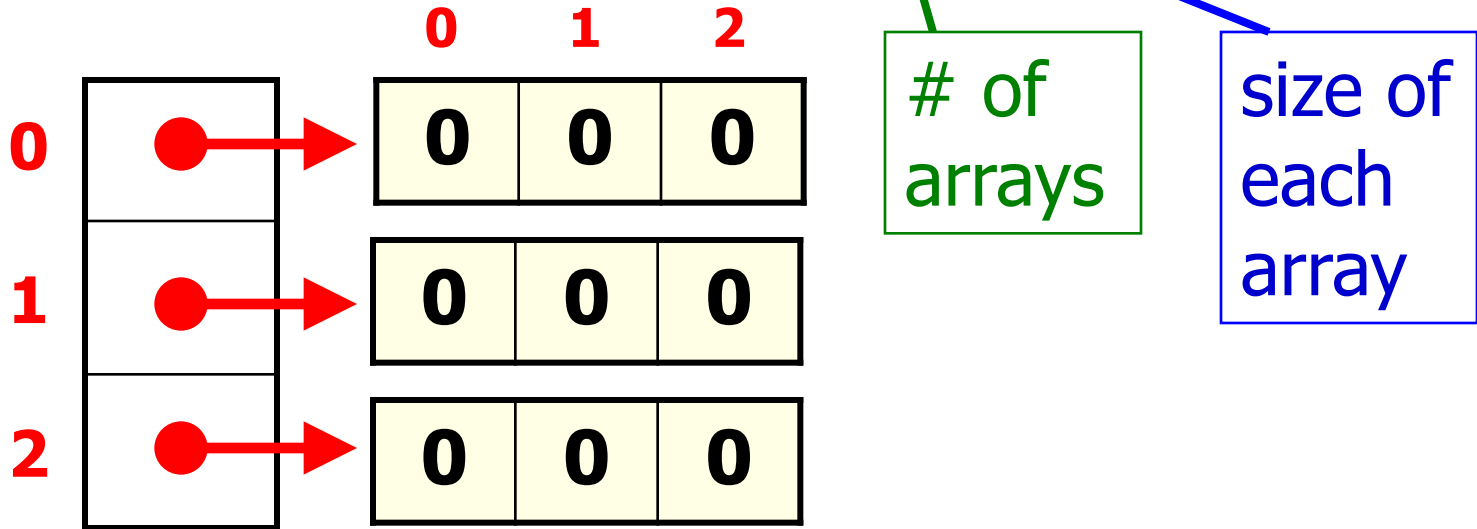
Matrices

With Loops

What is a matrix?

A matrix is an array of arrays.

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



Printing an Array

```
int[][] mat = {{5,7},{5,3,4,6},{0,8,9}};  
out.println(Arrays.toString(mat[0]));  
out.println(Arrays.toString(mat[1]));
```

OUTPUT

[5, 7]

[5, 3, 4, 6]

Printing an Array

```
int[] nums = {1,2,3,4,5,6,7};  
for(int r=0; r<nums.length; r++)  
{  
    out.println(nums[r]);  
}
```

length returns the # of
elements/items/spots in the
array!!!

OUTPUT

1
2
3
4
5
6
7

Printing a Matrix

```
int[][] mat = {{5,7},{5,3,4,6},{0,8,9}};  
for(int r=0; r<mat.length; r++)  
{  
    for(int c=0; c<mat[r].length; c++)  
    {  
        out.print(mat[r][c]);  
    }  
    out.println();  
}
```

OUTPUT

5 3 4 6

5 3 4 6

0 8 9

Printing a Matrix

```
int[][] mat = {{5,7},{5,3,4,6},{0,8,9}};
```

```
for( int[] row : mat )  
{  
    for( int num : row )  
    {  
        System.out.print( num + " ");  
    }  
    System.out.println();  
}
```

OUTPUT

5 7

5 3 4 6

0 8 9

open
matrixoutone.java
matrixouttwo.java

open

matrixoutthree.java

matrixoutfour.java

Searching for Values

Searching a Matrix

```
int[][] mat = {{5,7},{5,3,4,6},{0,8,9}};  
int count = 0;  
for( int r = 0; r < mat.length; r++ )  
{  
    for( int c = 0; c < mat[r].length; c++ )  
    {  
        if( mat[r][c] == 5 )  
            count++;  
    }  
}  
System.out.println("5 count = " + count);
```

OUTPUT

5 count = 2

Searching a Matrix

```
int[][] mat = {{5,7},{5,3,4,6},{0,8,9}};  
int count = 0;  
for( int[] row : mat )  
{  
    for( int num : row )  
    {  
        if( num == 5 )  
            count++;  
    }  
}  
System.out.println("5 count = " + count);
```

OUTPUT

5 count = 2

open
matrixsearch.java

Matrices As

Instance Vars

Matrix Instance Vars

```
public class MatrixFun
{
    private int[][] mat;    //instance variable

    public MatrixFun(int numRows, int numCols)
    {
        mat=new int[numRows][numCols];
    }

    //other methods not shown
}
```

open

matrixinstancevars.java

Matrix Extras

matrixinout.java

A complete matrix program.

matrixtotal.java

A matrix program that totals a matrix.

matrixfilereaderfor.java

A matrix program that reads a matrix from a file.

Helpful Hint

2D Matrices like RC.

Rows first - - Columns second



**Start work
on the labs**