Matrix

Agenda

- Nested loop
- Array of arrays
- Matrix representation
- Looping through a matrix

Nested Loop

Our Task: we want to know if there are duplicated numbers in an array of numbers.

Example:

```
var arr1 = [1,3,5,6,3,2]; // true - 3 is duplicated
var arr2 = [2,6,8,4,3,7]; // false
```

How will we solve this problem?

For each value in the array we want to find out if there are other identical values.

So for each value: we want to iterate over the array => **loop**

We want to iterate over all the values in the array => **loop**

Nested Loop

Let's see some code

We want to iterate over all the values in the array => loop

```
for (var i=0; i<arr.length; i++){
    // i is the current index for which we run the second loop
  // For each value we want to iterate over the array => loop
  for (var j=0;j<arr.length;j++){
      if (i !== j && arr[i] === arr[j]){
        return true;
      }
  }
}
```

Nested Loop

A Closer Look

```
for (var i=0; i<arr.length; i++){
        for (var j=0;j<arr.length;j++){
        if (i !== j && arr[i] === arr[j]){
           return true;
        }
   }
}
```

We define 2 different indexes I & j

We do an action with these 2 values

Let's run a live simulation!

Questions

```
console.log("Questions?");
```

Nested Loop

Practice

Your Task:

We want to know if an array contains 2 following numbers.

following = 4 comes immediately after 3 => following

3,5 => not following

Example:

[1,4,7,3]; // true 3,4

[1,3,5,8]; //false

Array of Arrays

Let's define an array:

```
var arr = [];
```

We know we can put any type of variables in an array:

```
arr[0] = 1; //Number
arr[1] = "hello"; //String
arr[2] = true; //Boolean
arr[3] = null; //Null
arr[4] = undefined;//Undefined
```

Even Objects:

```
arr[5] = {name: "Sam"};
```

But what about arrays?

```
arr[6] = [1,2,3,4];
```

Array of Arrays

So if all the values we assign to the array are arrays we get an array of arrays:

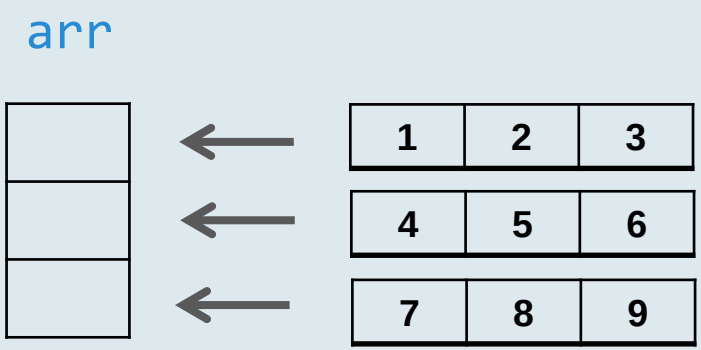
```
var arr = [];

arr[0] = [1,2,3];
arr[1] = [4,5,6];
arr[2] = [7,8,9];
```

Matrix

We have an array with 3 cells:

In each cell we have another array with 3 cells.



What will we get?

```
arr[0];
arr[1];
arr[2];
```

Get Value - Philosophy

How do we retrieve individual values?

We can think of the 2d array like a matrix:

a table with rows

and columns

Columns

Rows

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

To get a value we specify first the row then the column.

Like this (row, column).

(0,1) – will be the value in

row 0

column 1

Questions

```
console.log("Questions?");
```

Matrix

Practice Time

What will be in?

(0,2)?

(0,0)?

(1,0)?

(2,0)?

(1,1)?

(1,2)?

(2,2)?

(2,1)?

Columns

Rows

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

Matrix

Let's see it in the code

Initializing the 2D array:

```
var arr = [[1,2,3], [4,5,6], [7,8,9]];
```

We can even organize it to look like the matrix:

```
var arr = [
     [1,2,3],
     [4,5,6],
     [7,8,9]
];
```

Columns

Rows

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

Retrieving values:

```
arr[0][2]; //?
arr[1][0]; //?
```

Practice

Initialize the following 2D arrays

```
var arr = [
   [1,1,1],
   [2,2,2],
   [3,3,3]
];
```

1	1	1
2	2	2
3	3	3

```
var arr = [
      [1,2],
      [5,6],
      [3,4]
];
```

1	2
5	6
3	4

```
var arr = [
   [1,2,3],
   [4,5],
   [6,7,8]
];
```

1	2	3
4	5	
6	7	8

Matrix

Let's Break it Down

We had `arr[0][2];`

`arr[0][2] =`

`([[1,2,3],[4,5,6],[7,8,9]])[0][2] =`

`([1,2,3])[2] =`

`3`

`arr[1][0] =`

`([[1,2,3],[4,5,6],[7,8,9]])[1][0] =`

`([4,5,6])[0] =`

`4`

Rows

Columns

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

Questions

```
console.log("Questions?");
```

Nested Loop

Our Task: we want to print all the values of the 2D array.

How will we solve this problem?

For each row in the array we want to print all it's values

So for each row => loop

We want to iterate over all the values in the row => loop

Again it's a nested loop!

Nested Loop

Let's see Some Code

We want to iterate over all the rows in the array => loop

```
for (var i=0; i<arr.length; i++){
    // i is the index for the current row
  //For each row(=array) we want to iterate over the array => loop
  for (var j=0;j<arr.length;j++){
      console.log(arr[i][j]);
  }
}
```

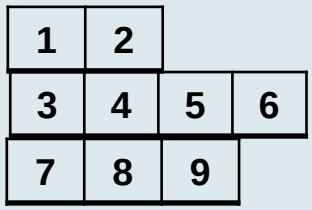
Let's run a live simulation!

Nested Loop

What If …

our matrix will not have equal width and height

In that case we need to add a small adjustment:




```
for (var i=0; i<arr.length; i++){
    for (var j=0; j < arr[i].length; j++){
      console.log(arr[i][j]);
  }
}
```

Nested Loop

Iterating over the columns

So far we've learned to iterate over the rows.

What if we want to iterate over the columns and print all the values?

1,4,7,2,5,8,3,6,9

```
Note: we assume a matrix of nxn (width=height)
for (var i=0; i<arr.length; i++){
    for (var j=0;j<arr.length;j++){
      console.log(arr[j][i]);
  }
}
```

Columns

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

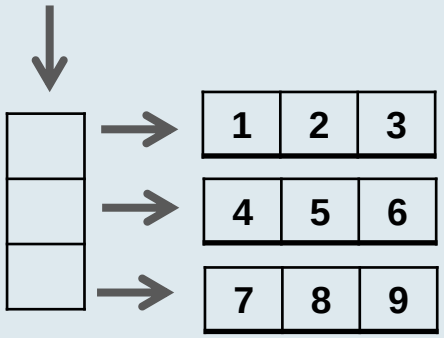
Questions

```
console.log("Questions?");
```

Cheat Sheet

Initializing a 2D array:

```
var arr = [
          [1,1,1],
          [2,2,2],
          [3,3,3]
];
```



2D array:

Get value: `arr[row][col];`

```
arr[i][j] = arr[row][col];
arr[0][1] = 2
```

Columns

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

Nested loop for 2D array:

```
for (var i=0; i<arr.length; i++){
  for (var j=0;j<arr[i].length;j++){
    console.log(arr[i][j]);
  }
}
```