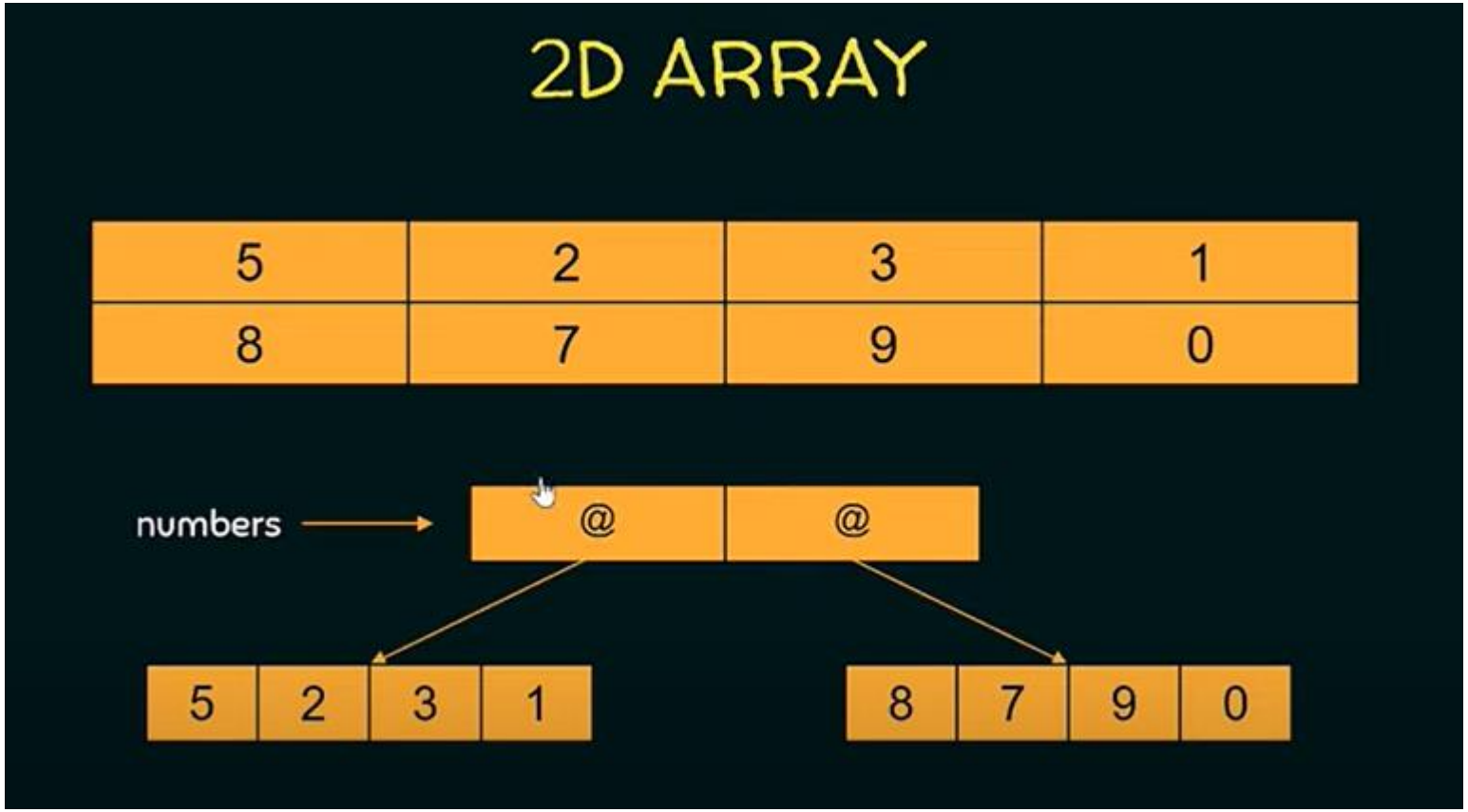
Two-Dimensional Array



A two-dimensional array is a one-dimensional array in which each element is another one-dimensional array.

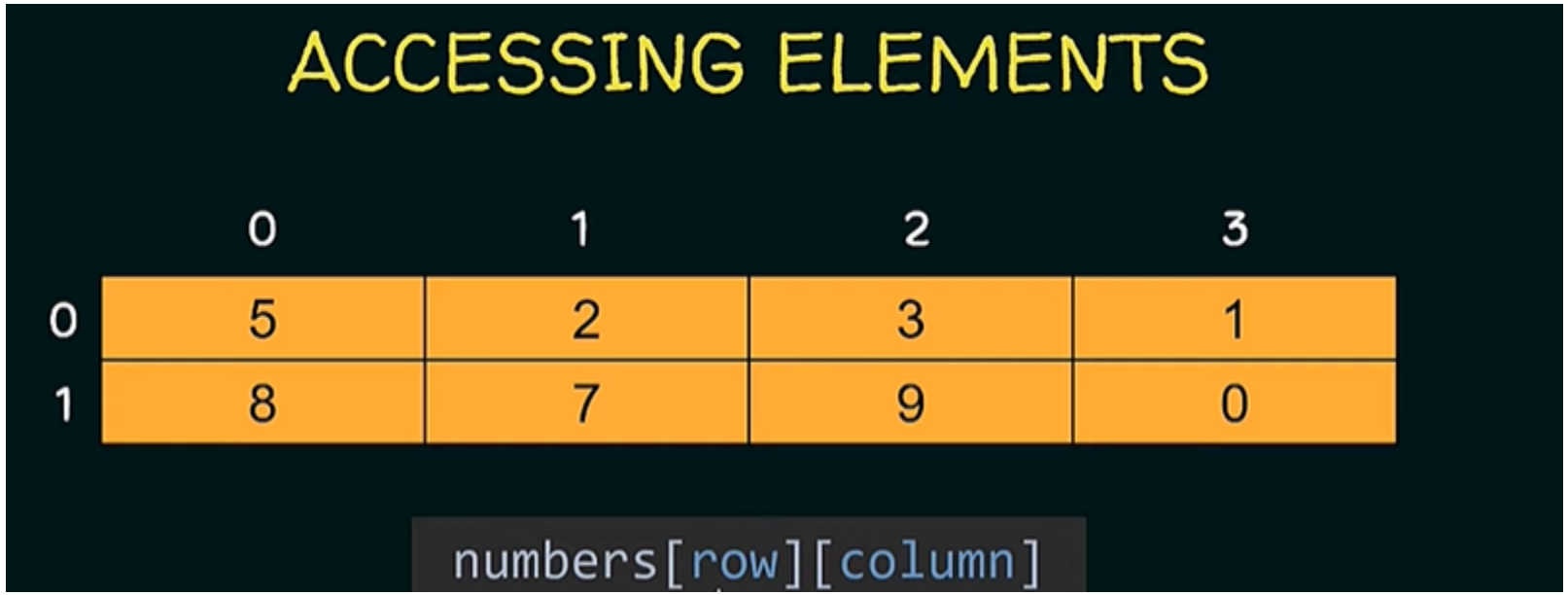
CREATING 2D ARRAYS

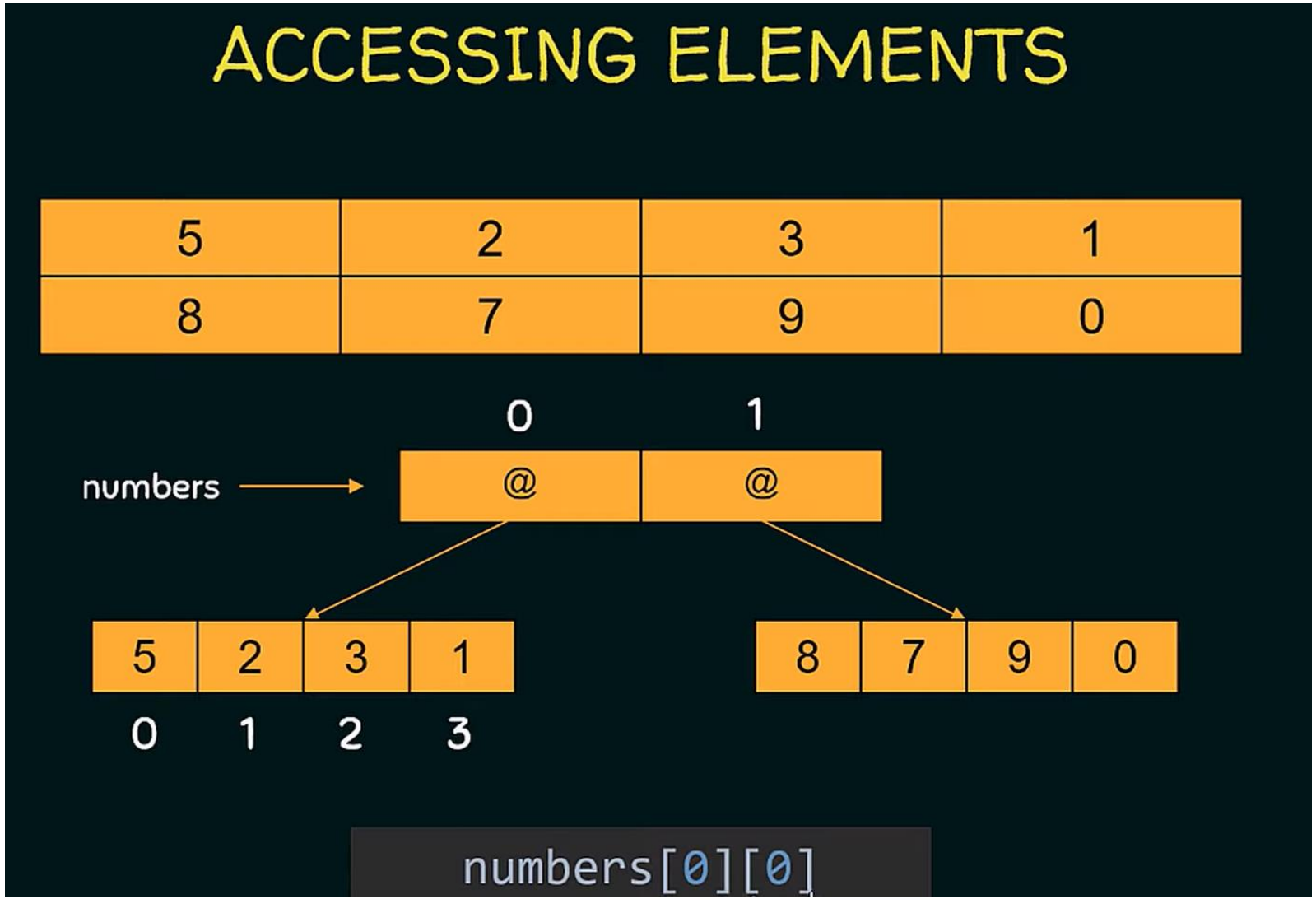
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0

```
int[][] numbers; // null

numbers = new int[5][3];

int[][] numbers = new int[5][3];
```


ACCESSING ELEMENTS
0
1
2
3
0
5
2
3
1
1
8
7
9
0
numbers[row][column]


ACCESSING ELEMENTS
5
2
3
1
8
7
9
0
0
1
numbers
@
@
5
2
3
1
8
7
9
0
0
1
2
3
numbers[0][0]

ACCESSING ELEMENTS

```
int[][] integers = new int[2][2]; // [[0, 0], [0, 0]]

integers[0][0] = 3; // [[3, 0], [0, 0]]
integers[0][1] = 5; // [[3, 5], [0, 0]]

integers[1][0] = 10; // [[3, 5], [10, 0]]
integers[1][1] = 2; // [[3, 5], [10, 2]]
```

INITIALIZING 2D ARRAYS

```
int[][] integers = { {3, 5}, {10, 2} };
```

PRINTING ROW BY ROW

```
int[][] integers = { {3, 5, 7}, {10, 2, 9} };

// print first row
System.out.print( integers[0][0] + " ");
System.out.print( integers[0][1] + " " );
System.out.print( integers[0][2] + " " );

// print second row
System.out.print( integers[1][0] + " " );
System.out.print( integers[1][1] + " " );
System.out.print( integers[1][2] + " " );
```

PRINTING ROW BY ROW

```
int[][] integers = { {3, 5, 7}, {10, 2, 9} };

for(int i = 0; i < 2; i++)
    for(int j = 0; j < 3; j++)
        System.out.print(integers[i][j] + " ");
```

```
3 5 7 10 2 9
```

PRINTING ROW BY ROW

```
int[][] integers = { {3, 5, 7}, {10, 2, 9} };

for(int i = 0; i < 2; i++) {
    for(int j = 0; j < 3; j++)
        System.out.print(integers[i][j] + " ");

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

```
3 5 7
10 2 9
```

PRINTING COLUMN BY COLUMN

```
int[][] integers = {
                {3, 5, 7},
                {10, 2, 9}
        };

// print first column
System.out.print( integers[0][0] + " ");
System.out.print( integers[1][0] + " " );

// print second column
System.out.print( integers[0][1] + " " );
System.out.print( integers[1][1] + " " );

// print third column
System.out.print( integers[0][2] + " " );
System.out.print( integers[1][2] + " " );
```

PRINTING COLUMN BY COLUMN

```
int[][] integers = {
                {3, 5, 7},
                {10, 2, 9}
        };

for(int i = 0; i < 3; i++) {
    for(int j = 0; j < 2; j++)
        System.out.print(integers[j][i] + " ");

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

```
3 10
5 2
7 9
```

TO STRING

```java
int[][] integers = { {3, 5, 7}, {10, 2, 9} };

System.out.println(Arrays.toString(integers));
// [ [I@7b23ec81, [I@6acbcfc0 ]

System.out.println(Arrays.deepToString(integers));
// [[3, 5, 7], [10, 2, 9]]
```

EXAMPLE

```
public static void main(String[] args) {
    int[][] integers = getArray();
    printArray(integers);
}
```

RETURNING A 2D ARRAY

```
public static int[][] getArray() {
    return new int[][] { {1, 2, 3}, {4, 5, 6}, {7, 8, 9} };
}
```

PASSING A 2D ARRAY

```
public static void printArray(int[][] integers) {
    for(int i = 0; i < 3; i++) {
        for(int j = 0; j < 3; j++)
            System.out.print(integers[i][j]);

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

```
123
456
789
```

PASSING A 2D ARRAY

```
public static void printArray(int[][] integers) {
    for(int i = 0; i < integers.length; i++) {
        for(int j = 0; j < integers[i].length; j++)
            System.out.print(integers[i][j]);

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

RAGGED ARRAYS

A 2D array with rows of different length

```
public static void main(String[] args) {
    int[][] integers = {
            {1, 2, 3},
            {5, 6},
            {7, 8, 9, 4, 10}
    };

    printArray(integers);
}
```

RAGGED ARRAYS

```
public static void printArray(int[][] integers) {
    for(int i = 0; i < integers.length; i++) {
        for(int j = 0; j < integers[i].length; j++)
            System.out.print(integers[i][j] + " ");

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

```
1 2 3
5 6
7 8 9 4 10
```

EXERCISE

Write a program that prints the sum of each row in a 2D array.

Resolve the exercise and print the sum of each column.

EXAMPLE

```
public static void main(String[] args) {
    int[][] integers = {
            {1, 2, 3, 4},
            {5, 6, 7, 8},
            {9, 10, 11, 12}
    };
}
```

```
Sum of Row 1: 10
Sum of Row 2: 26
Sum of Row 3: 42
```

```
Sum of Column 1: 15
Sum of Column 2: 18
Sum of Column 3: 21
Sum of Column 4: 24
```

EXERCISE

Write a program that prints the maximum of each row in a 2D array.

EXAMPLE

```
public static void main(String[] args) {
    int[][] integers = {
            {1, 10, 3, 8},
            {9, 12, 6, 7},
            {5, 2, 11, 4}
    };
}
```

```
Max of Row 1: 10
Max of Row 2: 12
Max of Row 3: 11
```