2023-02-03

8.1
Two-Dimensional Arrays

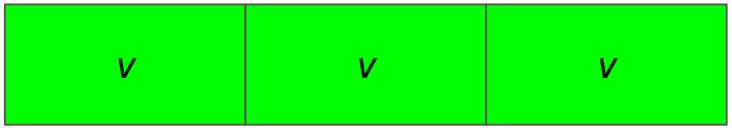
Arrays

- Arrays are collections of values of the same type

```
type[] name;
```

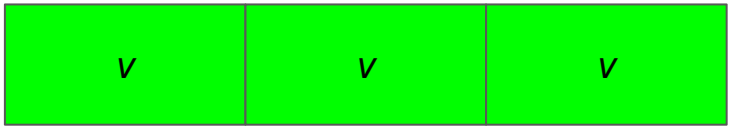
- Examples

```
boolean[] answers;
String[] questions;
int[] scores;
Student[] students;
```



Array of Arrays - Declaration

- **Arrays are a type** - Which means you can easily create an **Array that contains Arrays** - often called Two-Dimensional Arrays




```
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- Examples

```
boolean[][] theaterSeats;
String[][] seatingChart;
int[][] bingoCard;
Apt[][] building;
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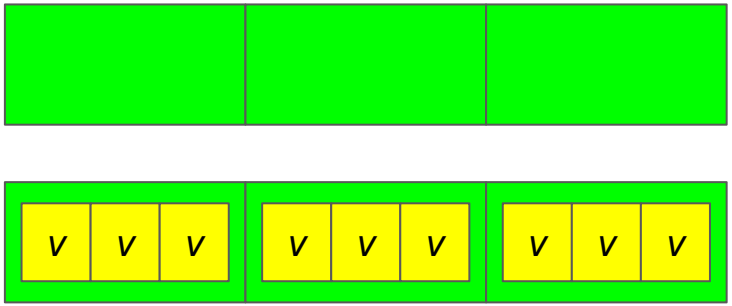

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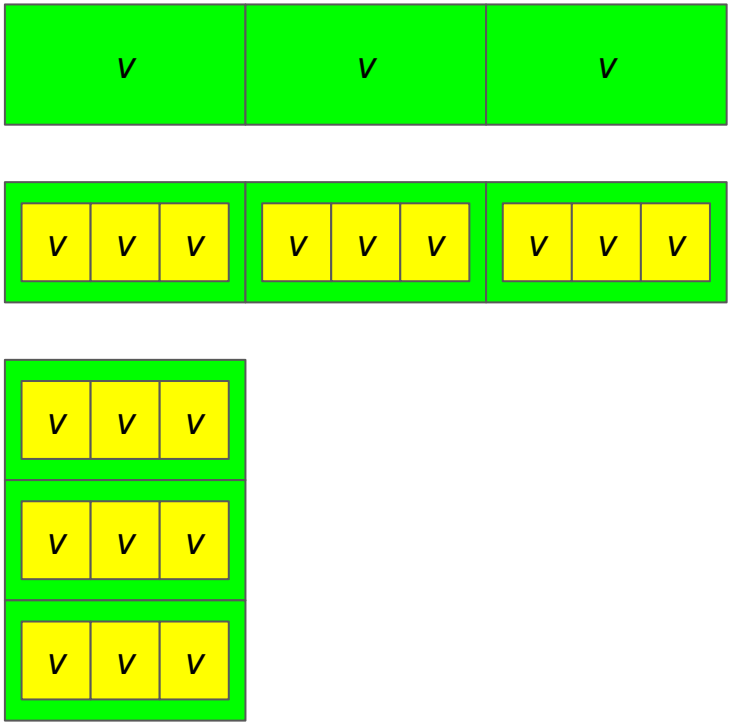

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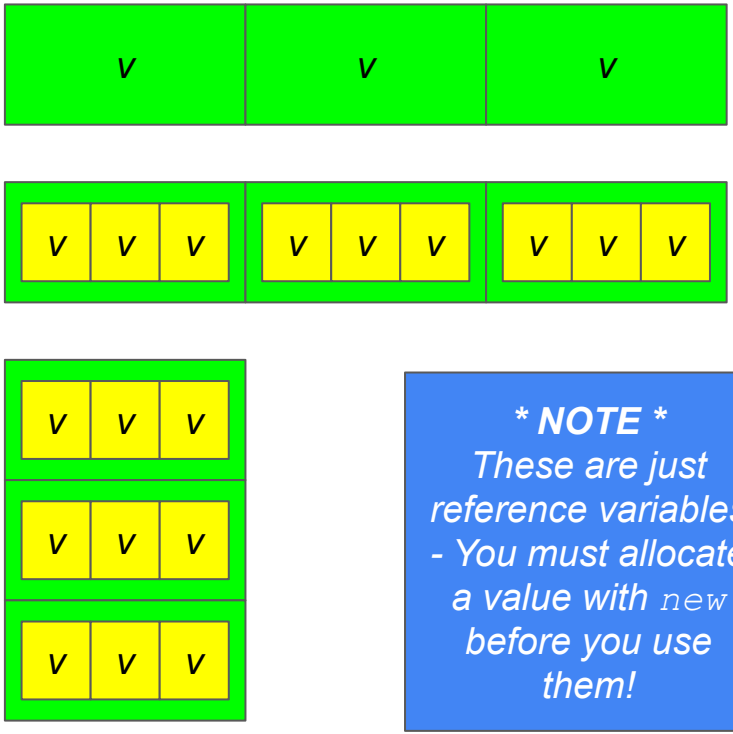

**** NOTE ****
These are just reference variables - You must allocate a value with `new` before you use them!

Array of Arrays - Definition

```
boolean[][] theaterSeats = new boolean[numRows][numSeatsPerRow];
String[][] seatingChart = new String[numRows][numSeatsPerRow];
int[][] bingoCard = new int[5][5];
Apt[][] building = new Apt[numFloors][numAptsPerFloor];
```

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boolean[][] theaterSeats = new boolean[numRows][numSeatsPerRow];
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Apt[][] building = new Apt[numFloors][numAptsPerFloor];
```

**** NOTE 1 ****
Two-Dimensional Arrays can have non-equal dimensions!

```
boolean[][] theaterSeats = new boolean[75][25];
String[][] seatingChart = new String[5][10];
int[][] multiplicationTable = new int[100][500];
Apt[][] building = new Apt[5][10];
```

Array of Arrays - Definition

```
boolean[][] theaterSeats = new boolean[numRows][numSeatsPerRow];
String[][] seatingChart = new String[numRows][numSeatsPerRow];
int[][] bingoCard = new int[5][5];
Apt[][] building = new Apt[numFloors][numAptsPerFloor];
```

**** NOTE 2 ****
Just like Arrays - Two-Dimensional Arrays initialize their values to "reasonable" defaults

- **0 for numeric types**
- **null for Object types**
- **false for boolean types**

Array of Arrays - Definition

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

                          Alternatively...

int[][] bingoCard = new int[5][]; // omit internal array size
bingoCard[0] = new int[5];
bingoCard[1] = new int[5];
bingoCard[2] = new int[5];
bingoCard[3] = new int[5];
bingoCard[4] = new int[5];
```

Array of Arrays - Definition

```
boolean[][] theaterSeats = new boolean[numRows][numSeatsPerRow];

                          Alternatively...

boolean[][] theaterSeats = new boolean[numRows][];
for (int rowIdx = 0 ; rowIdx < numRows ; rowIdx++ {
  theaterSeats[rowIdx] = new boolean[numSeatsPerRow];
}
```

Arrays of Arrays - Example

```
boolean[][] theaterSeats = new boolean[rows][seats];
```

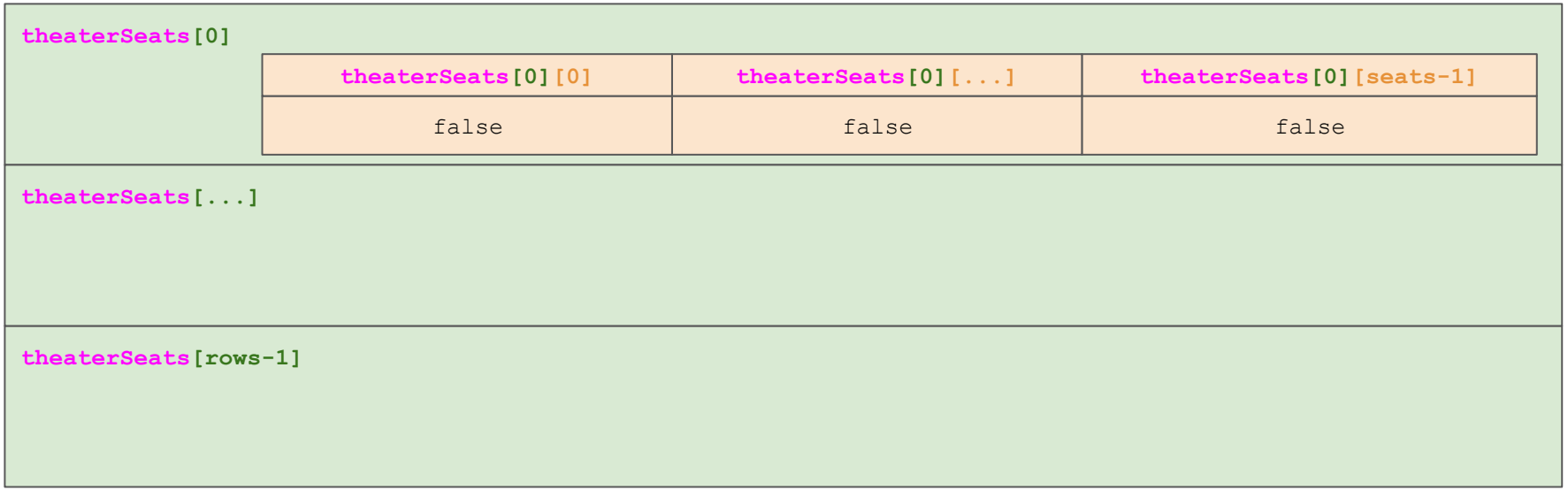
Arrays of Arrays - Example

```
boolean[][] theaterSeats = new boolean[rows][seats];
```

`theaterSeats[0]`
`theaterSeats[...]`
`theaterSeats[rows-1]`

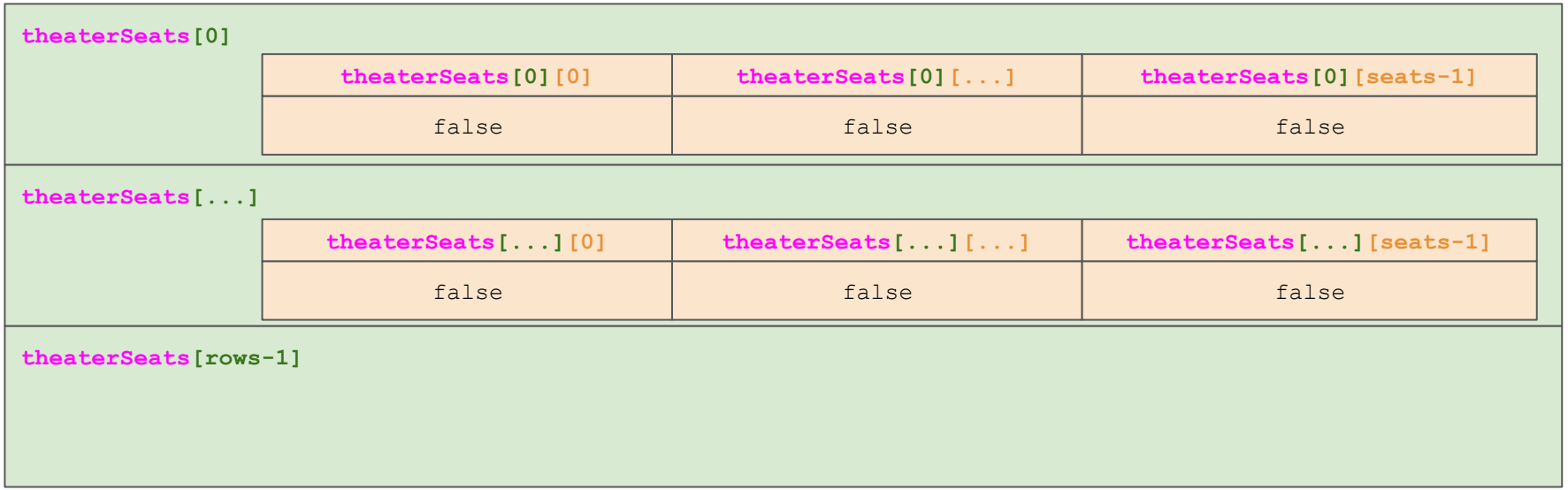
Arrays of Arrays - Example

```
boolean[][] theaterSeats = new boolean[row][seats];
```



Arrays of Arrays - Example

```
boolean[][] theaterSeats = new boolean[row][seats];
```



Arrays of Arrays - Example

```
boolean[][] theaterSeats = new boolean[row][seats];
```

theaterSeats[0]

theaterSeats[0][0]	theaterSeats[0][...]	theaterSeats[0][seats-1]
false	false	false

theaterSeats[...]

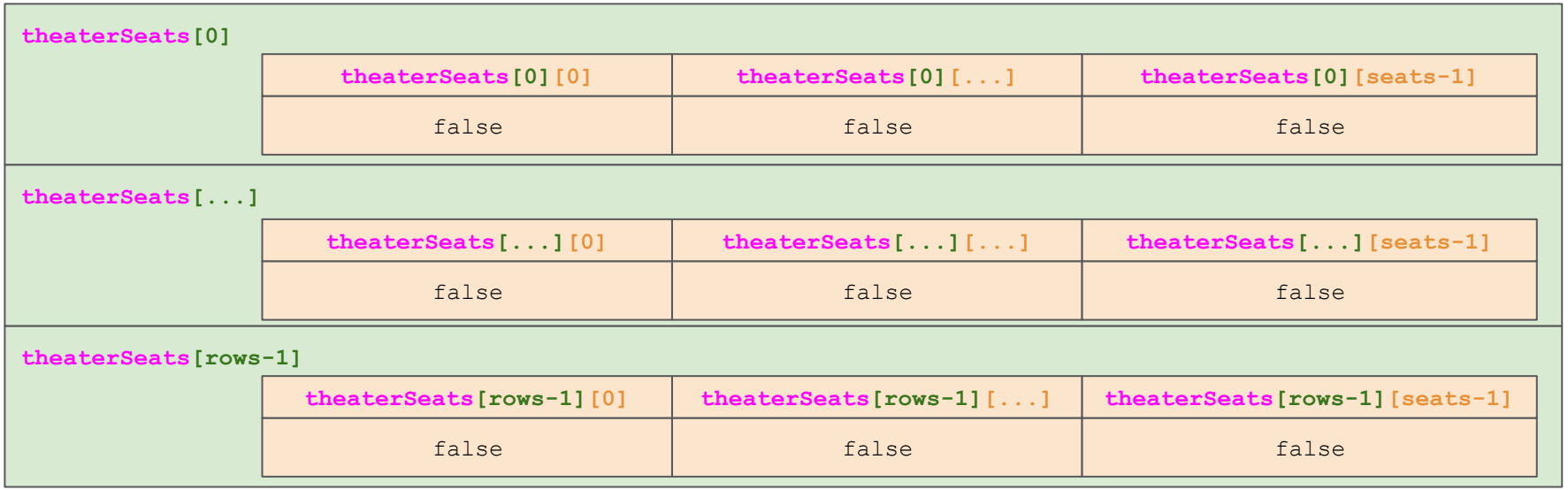
theaterSeats[...][0]	theaterSeats[...][...]	theaterSeats[...][seats-1]
false	false	false

theaterSeats[rows-1]

theaterSeats[rows-1][0]	theaterSeats[rows-1][...]	theaterSeats[rows-1][seats-1]
false	false	false

Arrays of Arrays - Example

```
boolean[][] theaterSeats = new boolean[row][seats];
```




```
Write: theaterSeats[0][0] = true;
Read : System.out.println(theaterSeats[rows-1][seats-1]);
```

Arrays of Arrays - Initializer Lists

- You can initialize the values of a Two-Dimensional Array when you create it (and the sizes will be automatically calculated)

```
int[][] ticketInfo = { {25,20,25}, {25,20,25} };
ticketInfo.length     => 2
ticketInfo[0].length) => 3
ticketInfo[1].length) => 3
```

```
boolean[][] jaggedTable = { {false, true, true}, {false}, {true} };
jaggedTable.length     => 3
jaggedTable[0].length) => 3
jaggedTable[1].length) => 1
jaggedTable[2].length) => 1
```

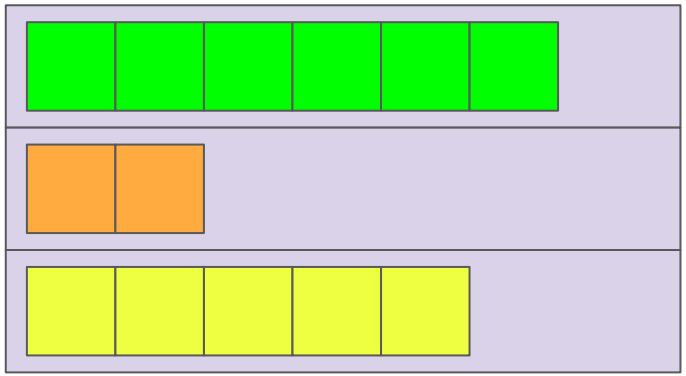
Arrays of Arrays - Jagged Arrays

- On the exam all inner arrays will have the same length - **However** it is possible in Java to have inner arrays of different lengths. These are called Jagged (or Ragged) Arrays

```
int jaggedTable[][] = new int[3][]; // omit the inner array size

jaggedTable[0] = new int[6];
jaggedTable[1] = new int[2];
jaggedTable[2] = new int[5];

jaggedTable.length      => 3
jaggedTable[0].length   => 5
jaggedTable[1].length   => 10
jaggedTable[2].length   => 20
```



Practice on your own

- CSAwesome 8.1 - Two-Dimensional Arrays
- Replit - ASCII Sketch