Mohammad Ghafari

What could go wrong here?

```
int table[][] = new int[2][3];
// some code
int sum = 0;
for (int i = 0; i < 2; i++)
   for (int j = 0; j < 3; j++)
   {
      int value = table[i][j];
      sum += value;
   }
```

6

Motivation

Write a program that computes the average of three numbers.

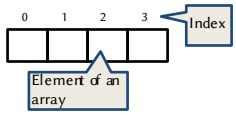
```
import java.util.Scanner;
// ...
Scanner in = new Scanner(System.in);

int num1 = in.nextInt(); // handle InputMismatchException
int num2 = in.nextInt();
int num3 = in.nextInt();

int total = num1+ num2+ num3;
double average = total/3;
```

7

Array Definition

- A data structure for storing a fixed number of elements.
- Elements are of the same type and share the same name.
- Each element is accessed using its relative position in the array.

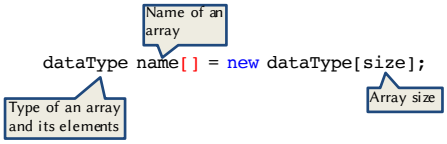
Array of four elements:



8

Set up an array

You have to tell Java what kind of data is going into your array, and how many elements the array has.

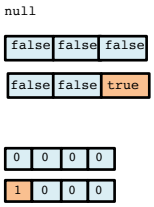



```
dataType name[];
name = new dataType[size]
```

9

Arrays of Primitives

```
boolean status[];
status = new boolean[3];
status[2] = true;

int nums[] = new int[4];
nums[0] = 1;
```



10

Common Mistakes

```
boolean status[] = new boolean[3];
status[3] = true;
```

Array Index Out of Bounds Exception

11

Common Mistakes

```
int nums[] = new int[4];
nums[2] = true;
```

Type mismatch error

12

Common Mistakes

```
Number nums[] = new Float[2];
nums[0] = new Integer(1);
```


Array Store Exception

13

Array Initialization

```
int nums[] = new int[4];
nums[0] = 4;
nums[1] = 1;
nums[2] = 3;
nums[3] = 2;
```

14

Array Initialization

```
int nums[] = new int[4];
nums[0] = 4;
nums[1] = 1;
nums[2] = 3;
nums[3] = 2;
```

```
int nums[] = {4, 1, 3, 2};
```

15

Common Mistakes

```
int nums[];
nums = {4, 1, 3, 2};
```


Array constants can only be used in initializers

16

Common Mistakes

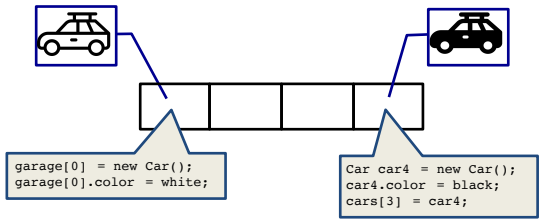
```
int nums[];
nums = {4, 1, 3, 2};
```
Array constants can only be used in initializers

```
void f(float[] input) { ... }
void f(double[] input) { ... }
void g() {
    f({1, 2, 3, 4});
}
```
Which function to call?

17

Arrays of Objects

```
Car garage[ ] = new Car[4];
```



18

Multi-dimensional Arrays

Multidimensional arrays are **arrays of arrays** with each element of the array holding the reference of other array.

```
dataType name []..[] = new dataType[x]..[z];
```
Number of dimensions

Size of each dimension

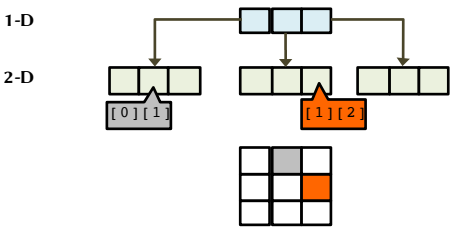
Examples:
- Board games, Spreadsheets, …

19

Multi-dimensional Arrays (2D)

```
int matrix[][] = new int[3][3];
```
2-D column position

2-D row position



20

Array Traversal

```
String row[] = new String[2];
```

```
for (int i = 0; i < row.length; i++)
{
    // assign or read "row[i]"…
}
```

```
for (String s : row)
{
    // read "s" …
}
```

21

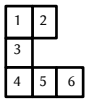
Array Traversal (2D)

```
int table[][] = new int[2][3];
…   // some code
int sum = 0;
for (int i = 0; i < table.length; i++)
   for (int j = 0; j < table[i].length; j++)
   {
      int value = table[i][j];
      sum += value;
   }
```

22

Ragged Arrays

```
int part[][] = {{1,2}, {3}, (4,5,6}};
```

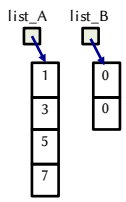



```
int part[][] = new int[3][];
part[0] = new int[2];
part[1] = new int[1];
part[2] = new int[3];
```

24

Array Copy

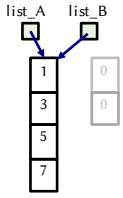
```
int[] list_A = {1, 3, 5, 7};
int[] list_B = new int[2];

// list_B = list_A;

// System.out.println(list_B[3]);

// list_B[1] = -1;

// System.out.println(list_A[1]);
```



25

Array Copy

```
int[] list_A = {1, 3, 5, 7};
int[] list_B = new int[2];

list_B = list_A;

System.out.println(list_B[3]); // 7

list_B[1] = -1;

System.out.println(list_A[1]); // -1
```



26

Array Comparison

```
int[] list_A = {1, 3, 5, 7};
int[] list_B = {1, 3, 5, 7};
```

```
if(list_A == list_B){…}
or
if(list_A.equals(list_B)){…}
```

Are they referring to the same array?

To determine whether two arrays contain the same elements, compare them element by element.

27

Passing and returning arrays

```
int numOfInputs = scanner.nextInt();
int[] input = getInput(numOfInputs);
int sum = sum(input);
double average = sum/numOfInputs;
```

Returns an array

```
public int[] getInput(int num) {
    int[] input = new int[num];
    for(int i=0; i< num; i++){
        input[i] = scanner.nextInt();
    }
    return input;
}
```

Receives an array

```
public int sum(int[] nums){
    int result = 0;
    for(int i : nums){
        result += i;
    }
    return result;
}
```

28

java.util.Arrays

- fill
- sort
- binarySearch
- copyOf
- equals
- deepEquals

29

What you should know

- What an array is
- Array declaration, instantiation, and initialization
- Arrays of primitives and arrays of objects
- Multi-dimensional arrays
- Traversing arrays
- Passing arrays to methods and returning arrays from methods

30

Exercise 1

Given a text corpus, compute bi-grams and record their frequencies.

For example: "this is some text"

this is
is some
some text

31

Exercise 2

A 3x3 Sudoku puzzle: The user should place the numbers 1 to 9 such that each row, column, and diagonal adds up to the same number.

8	1	6
3	5	7
4	9	2

N.B. each number should be used exactly once.

32