

# Arrays

# Example

- Write a program to keep track of all students' scores on exam 1.
- Need a *list* of everyone's score
- Declare 14 double variables?
- What about next semester?

# Arrays

- Declare a list of variables – all with the *same* type
- Size is determined at time of declaration

```
double[] scores = new double[14];
```

# Example

scores:

90.5	73	87
------	----	----

# Example

scores:



```
//declare the array  
double[] scores = new double[3];  
//put 90.5 in the first box
```

# Example

scores:

90.5		
------	--	--

```
//declare the array  
double[] scores = new double[3];  
//put 90.5 in the first box  
scores[0] = 90.5;
```

# Example

scores:

90.5	73	87
------	----	----

```
//declare the array  
double[] scores = new double[3];  
//put 90.5 in the first box  
scores[0] = 90.5;  
scores[1] = 73;  
scores[2] = 87;
```

# Alternative

```
double[] scores = {90.5, 73, 87};
```

- Initializes elements of the array to values given when array is created



# Subscripts

- Subscript describes which box of the array you are dealing with
- Array of size N has subscripts
  - 0, 1, 2, ... (n-1)
  - array of size 3 – 0, 1, 2
  - subscript added to base address of array
- Subscript can be a variable or expression which produces an integer
  - `scores[i];`
  - `scores[i+5];`
- If subscript specified does not exist – runtime error (`ArrayIndexOutOfBoundsException`)

# Example

scores:

90.5	73	87
------	----	----

```
//assume i = -2;  
sum = scores[1] + scores[2];  
sum = scores[1] + scores[i*8];  
scores[2] = scores[1] + 6;
```

# Accessing Array Elements

- Print all elements of the array *scores*
  - Use only one `System.out.println` statement

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  - Use only one `System.out.println` statement

```
double[] scores = {90.5, 73, 82};
for(int i = 0; i < 3; i++) {
    System.out.println("Score " + (i+1) + ": " + scores[i]);
}
```

# foreach

```
double[] scores = {90.5, 73, 82};  
for(double d : scores) {  
    System.out.println("Score " + d);  
}
```

# Passing Array Elements

- Write a method to add two elements of an array

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- Write a method to add two elements of an array
  - How is the method called?

```
double add(double num1, double num2) {  
    return (num1 + num2);  
}
```

# Passing Array Elements

- Write a method to add two elements of an array
  - How is the method called?

```
add(scores[0], scores[1]);
```

```
...
```

```
double add(double num1, double num2) {  
    return (num1 + num2);  
}
```



# Passing Arrays

- Would like to pass an entire array into a method
  - Sum all elements, prompt user for values

# Example

```
sum(scores);
```

```
static double sum(double[] scores) {  
    double sum = 0;  
    for(double d: scores) {  
        sum+=d;  
    }  
    return sum;  
}
```

# Arrays of objects

```
Flight[] flights = new Flight[10];
```

# Multidimensional Arrays

- `double[][] warmups = new double[14][30];`
- Declares a multidimensional array with 14 rows and 30 columns

	0	1	2	...	29
0					
1					
...					
13					

# Example

	0	1	2		29
0					
1					
				...	
13					

- Set first warmup score for first student to 3

# Example

	0	1	2	...	29
0					
1					
...				...	
13					

- Set first warmup score for first student to 3

```
warmups[0][0] = 3;
```

# Example

	0	1	2		29
0					
1					
				...	
13					

- Print all scores for all students

# Example

- Print all scores for all students

```
static void printscores(double[][] scores) {  
    for(int row = 0; row < scores.length; row++) {  
        for(int col = 0; col < scores[row].length; col++) {  
            System.out.println("Item " + scores[row][col]);  
        }  
    }  
}
```



# Exercises

1. Modify your Student class to keep an array of courses. Provide a method that takes as input a course name and returns true if the Student is taking the course represented by the name and false otherwise.

# ArrayList

- Like an array, but it can dynamically change size
- Stores object references
  - cannot store primitive types without a wrapper
- By default, not declared to store a particular type
  - `ArrayList al = new ArrayList();`
- Because it is a *generic type*, we can explicitly specify the type
  - `ArrayList<String> stringal = new ArrayList<String>();`

# Exercises

1. Modify your Student class to use an ArrayList for the courses rather than an array.