ARRAY SIZES

zyBook 7.2, zyBook 7.3, zyBook 7.4, zyBook 7.5

@ Dr. Jessica Young Schmidt and NCSU Computer Science Faculty

ARRAY SIZES

- "A perfect size array is an array where the number of elements is exactly equal to the memory allocated."
- "An oversize array is an array where the number of elements used is less than or equal to the memory allocated. Since the number of elements used in an oversize array is usually less than the array's length, a separate integer variable is used to keep track of how many array elements are currently used."

PERFECT SIZE ARRAYS

The number of elements used is equal to the length of the array.

```
import java.util.Arrays;
import java.util.Scanner;

public class GradebookPerfectSize {
    public static void main(String[] args) {
        Scanner in = new Scanner(System.in);
        System.out.print("How many students? ");
        while (!in.hasNextInt()) {
            in.next();
            System.out.print("How many students? (as int) ");
        }
        int numStudents = in.nextInt();

        int[] grades = new int[numStudents];
        getGrades(grades, in);
        System.out.println(Arrays.toString(grades));

        double average = calculateAverage(grades);
        System.out.println("Average Project 1 Grade = " + average);

        int count = above(grades, average);
        System.out.println(count + " students were above average.");
    }

    // Other methods
}
```

```
$java -cp bin GradebookPerfectSize
How many students? 3
Student 1's Grade: 100
Student 2's Grade: 90
Student 3's Grade: 93
[100, 90, 93]
Average Project 1 Grade = 94.33333333333333
1 students were above average.
```

```java
import java.util.Arrays;
import java.util.Scanner;

public class GradebookPerfectSize {
    public static void main(String[] args) {
        Scanner in = new Scanner(System.in);
        System.out.print("How many students? ");
        while (!in.hasNextInt()) {
            in.next();
            System.out.print("How many students? (as int) ");
        }
        int numStudents = in.nextInt();

        int[] grades = new int[numStudents];
        getGrades(grades, in);
        System.out.println(Arrays.toString(grades));

        double average = calculateAverage(grades);
        System.out.println("Average Project 1 Grade = " + average);

        int count = above(grades, average);
        System.out.println(count + " students were above average.");
    }

    // Other methods

    public static void getGrades(int[] grades, Scanner in) {
        for (int i = 0; i < grades.length; i++) {
            System.out.print("Student " + (i + 1) + "'s Grade: ");
            while (!in.hasNextInt()) {
                in.next();
                System.out.print("Student " + (i + 1) + "'s Grade: ");
            }
            grades[i] = in.nextInt();
        }
    }
}
```

```
$java -cp bin GradebookPerfectSize
How many students? 3
Student 1's Grade: 100
Student 2's Grade: 90
Student 3's Grade: 93
[100, 90, 93]
Average Project 1 Grade = 94.33333333333333
1 students were above average.
```

```java
import java.util.Arrays;
import java.util.Scanner;

public class GradebookPerfectSize {
    public static void main(String[] args) {
        Scanner in = new Scanner(System.in);
        System.out.print("How many students? ");
        while (!in.hasNextInt()) {
            in.next();
            System.out.print("How many students? (as int) ");
        }
        int numStudents = in.nextInt();

        int[] grades = new int[numStudents];
        getGrades(grades, in);
        System.out.println(Arrays.toString(grades));

        double average = calculateAverage(grades);
        System.out.println("Average Project 1 Grade = " + average);

        int count = above(grades, average);
        System.out.println(count + " students were above average.");
    }

    // Other methods

    public static double calculateAverage(int[] grades) {
        double average = 0;
        for (int i = 0; i < grades.length; i++) {
            average += grades[i];
        }
        return average / grades.length;
    }
}
```

```
$java -cp bin GradebookPerfectSize
How many students? 3
Student 1's Grade: 100
Student 2's Grade: 90
Student 3's Grade: 93
[100, 90, 93]
Average Project 1 Grade = 94.33333333333333
1 students were above average.
```

```java
import java.util.Arrays;
import java.util.Scanner;

public class GradebookPerfectSize {
    public static void main(String[] args) {
        Scanner in = new Scanner(System.in);
        System.out.print("How many students? ");
        while (!in.hasNextInt()) {
            in.next();
            System.out.print("How many students? (as int) ");
        }
        int numStudents = in.nextInt();

        int[] grades = new int[numStudents];
        getGrades(grades, in);
        System.out.println(Arrays.toString(grades));

        double average = calculateAverage(grades);
        System.out.println("Average Project 1 Grade = " + average);

        int count = above(grades, average);
        System.out.println(count + " students were above average.");
    }

    public static int above(int[] grades, double score) {
        int count = 0;
        for (int i = 0; i < grades.length; i++) {
            if (grades[i] > score) {
                count++;
            }
        }
        return count;
    }

    // Other methods
}
```

```
$java -cp bin GradebookPerfectSize
How many students? 3
Student 1's Grade: 100
Student 2's Grade: 90
Student 3's Grade: 93
[100, 90, 93]
Average Project 1 Grade = 94.33333333333333
1 students were above average.
```

OVERSIZE ARRAYS

The number of elements used is less than the length of the array.

```
import java.util.Arrays;
import java.util.Scanner;

public class GradebookOversize {
    public static final int MAX = 20;
    public static void main(String[] args) {
        Scanner in = new Scanner(System.in);
        System.out.print("How many students? (less than " + MAX + ") ");
        while (!in.hasNextInt()) {
            in.next();
            System.out.print("How many students? (as int) ");
        }
        int numStudents = in.nextInt();

        int[] grades = new int[MAX];
        getGrades(grades, in, numStudents);
        System.out.println(Arrays.toString(grades));

        double average = calculateAverage(grades, numStudents);
        System.out.println("Average Project 1 Grade = " + average);

        int count = above(grades, average, numStudents);
        System.out.println(count + " students were above average.");
    }

    // Other methods
}
```

```
$java -cp bin GradebookOversize
How many students? (less than 20) 3
Student 1's Grade: 100
Student 2's Grade: 90
Student 3's Grade: 93
[100, 90, 93, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
Average Project 1 Grade = 94.33333333333333
1 students were above average.
```

```java
import java.util.Arrays;
import java.util.Scanner;

public class GradebookOversize {
    public static final int MAX = 20;
    public static void main(String[] args) {
        Scanner in = new Scanner(System.in);
        System.out.print("How many students? (less than " + MAX + ") ");
        while (!in.hasNextInt()) {
            in.next();
            System.out.print("How many students? (as int) ");
        }
        int numStudents = in.nextInt();

        int[] grades = new int[MAX];
        getGrades(grades, in, numStudents);
        System.out.println(Arrays.toString(grades));

        double average = calculateAverage(grades, numStudents);
        System.out.println("Average Project 1 Grade = " + average);

        int count = above(grades, average, numStudents);
        System.out.println(count + " students were above average.");
    }

    // Other methods

    public static void getGrades(int[] grades, Scanner in, int numStudents) {
        for (int i = 0; i < numStudents; i++) {
            System.out.print("Student " + (i + 1) + "'s Grade: ");
            while (!in.hasNextInt()) {
                in.next();
                System.out.print("Student " + (i + 1) + "'s Grade: ");
            }
            grades[i] = in.nextInt();
        }
    }
}
```

```
$java -cp bin GradebookOversize
How many students? (less than 20) 3
Student 1's Grade: 100
Student 2's Grade: 90
Student 3's Grade: 93
[100, 90, 93, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
Average Project 1 Grade = 94.33333333333333
1 students were above average.
```

```java
import java.util.Arrays;
import java.util.Scanner;

public class GradebookOversize {
    public static final int MAX = 20;
    public static void main(String[] args) {
        Scanner in = new Scanner(System.in);
        System.out.print("How many students? (less than " + MAX + ") ");
        while (!in.hasNextInt()) {
            in.next();
            System.out.print("How many students? (as int) ");
        }
        int numStudents = in.nextInt();

        int[] grades = new int[MAX];
        getGrades(grades, in, numStudents);
        System.out.println(Arrays.toString(grades));

        double average = calculateAverage(grades, numStudents);
        System.out.println("Average Project 1 Grade = " + average);

        int count = above(grades, average, numStudents);
        System.out.println(count + " students were above average.");
    }

    // Other methods

    public static double calculateAverage(int[] grades, int numStudents) {
        double average = 0;
        for (int i = 0; i < numStudents; i++) {
            average += grades[i];
        }
        return average / numStudents;
    }
}
```

```
$java -cp bin GradebookOversize
How many students? (less than 20) 3
Student 1's Grade: 100
Student 2's Grade: 90
Student 3's Grade: 93
[100, 90, 93, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
Average Project 1 Grade = 94.33333333333333
1 students were above average.
```

```java
import java.util.Arrays;
import java.util.Scanner;

public class GradebookOversize {
    public static final int MAX = 20;
    public static void main(String[] args) {
        Scanner in = new Scanner(System.in);
        System.out.print("How many students? (less than " + MAX + ") ");
        while (!in.hasNextInt()) {
            in.next();
            System.out.print("How many students? (as int) ");
        }
        int numStudents = in.nextInt();

        int[] grades = new int[MAX];
        getGrades(grades, in, numStudents);
        System.out.println(Arrays.toString(grades));

        double average = calculateAverage(grades, numStudents);
        System.out.println("Average Project 1 Grade = " + average);

        int count = above(grades, average, numStudents);
        System.out.println(count + " students were above average.");
    }

    // Other methods

    public static int above(int[] grades, double score, int numStudents) {
        int count = 0;
        for (int i = 0; i < numStudents; i++) {
            if (grades[i] > score) {
                count++;
            }
        }
        return count;
    }
}
```

```
$java -cp bin GradebookOversize
How many students? (less than 20) 3
Student 1's Grade: 100
Student 2's Grade: 90
Student 3's Grade: 93
[100, 90, 93, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
Average Project 1 Grade = 94.33333333333333
1 students were above average.
```