

# Array Sizes

zyBook Chap 8.7, 8.8

# Recap – Motivating Example

Write a program that

- prompts user for number of students
- prompts user for Exam 1 grades for each student
- prints average grade for Exam 1
- prints number of students with Exam 1 grade higher than average

```
How many students? 5
Student 1's Exam 1 Grade: 96
Student 2's Exam 1 Grade: 92.5
Student 3's Exam 1 Grade: 80.5
Student 4's Exam 1 Grade: 99
Student 5's Exam 1 Grade: 87
Average Exam 1 Grade: 91.0
3 students were above average.
```

```

import java.util.Scanner;

public class Gradebook {
    public static void main (String[] args) {
        Scanner input = new Scanner(System.in);
        System.out.print("How many students? ");

        while (!input.hasNextInt()){ // Verify user input
            input.next(); // Discard the invalid input
            System.out.print("How many students? (positive int) ");
        }
        int numStudents = input.nextInt();

        // Construct an array to store students' grades
        double[] exam1 = new double[numStudents];
        getGrades(exam1, input);

        double average = calcAvg(exam1);
        System.out.println("Average Exam 1 Grade = " + average);

        int numAbove = countAbove(exam1, average);
        System.out.println(numAbove + " students were above average.");
    }

    public static void getGrades (double[] exam1, Scanner input) {
        // Prompt user for Exam 1 grades for each student
        for (int i = 0; i < exam1.length; i++) {
            System.out.print("Student " + (i + 1) + "'s Exam 1 Grade: ");
            while (!input.hasNextDouble()) { // Verify user input
                input.next(); // Discard the invalid input
                System.out.print("Student " + (i + 1) + "'s Exam 1 Grade: ");
            }
            exam1[i] = input.nextDouble();
        }
    }
    // Other methods...
}

```

# Perfect Size Array Example

```

How many students? 5
Student 1's Exam 1 Grade: 96
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        getGrades(exam1, input);

        double average = calcAvg(exam1);
        System.out.println("Average Exam 1 Grade = " + average);

        int numAbove = countAbove(exam1, average);
        System.out.println(numAbove + " students were above average.");
    }

    public static double calcAvg (double[] exam1) {
        double average = 0;
        for (int i = 0; i < exam1.length; i++) {
            average += exam1[i];
        }
        return average /= exam1.length;
    }

    // Other methods...
}

```

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Student 1's Exam 1 Grade: 96
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        getGrades(exam1, input);

        double average = calcAvg(exam1);
        System.out.println("Average Exam 1 Grade = " + average);

        int numAbove = countAbove(exam1, average);
        System.out.println(numAbove + " students were above average.");
    }

    public static int countAbove (double[] exam1, double average) {
        int numAbove = 0;
        for (int i = 0; i < exam1.length; i++) {
            if (exam1[i] > average) {
                numAbove++;
            }
        }
        return numAbove;
    }
    // Other methods...
}

```

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# Array Sizes

- Perfect size array
  - An array where the number of elements is **exactly equal to** the memory allocated.
- Oversize array
  - 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.

# Oversize Array Example

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

public class GradebookOversize {

    public static final int MAX = 20;

    public static void main (String[] args) {
        Scanner input = new Scanner(System.in);
        System.out.print("How many students? (less than " + MAX + ") ");

        while (!input.hasNextInt()){ // Verify user input
            input.next(); // Discard the invalid input
            System.out.print("How many students? (positive int) ");
        }
        int numStudents = input.nextInt();

        // Construct an array to store students' grades
        double[] exam1 = new double[MAX];
        // LIVE CODING – ADD CODE HERE ...
    }

    // Other methods...
}
```

```

import java.util.Scanner;

public class GradebookOversize {
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    public static void main (String[] args) {
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            System.out.print("How many students? (positive int) ");
        }
        int numStudents = input.nextInt();

        // Construct an array to store students' grades
        double[] exam1 = new double[MAX];
        getGrades(exam1, input, numStudents);

        double average = calcAvg(exam1, numStudents);
        System.out.println("Average Exam 1 Grade = " + average);

        int numAbove = countAbove(exam1, average, numStudents);
        System.out.println(numAbove + " students were above average.");
    }

    public static void getGrades (double[] exam1, Scanner input, int numStudents) {
        // Prompt user for Exam 1 grades for each student
        for (int i = 0; i < numStudents; i++) {
            System.out.print("Student " + (i + 1) + "'s Exam 1 Grade: ");
            while (!input.hasNextDouble()) { // Verify user input
                input.next(); // Discard the invalid input
                System.out.print("Student " + (i + 1) + "'s Exam 1 Grade: ");
            }
            exam1[i] = input.nextDouble();
        }
    }
    // Other methods...
}

```

# Oversize Array Example

```

$ java GradebookOversize
How many students? (less than 20) 5
Student 1's Exam 1 Grade: 96
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    }

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        double average = 0;
        for (int i = 0; i < numStudents; i++) {
            average += exam1[i];
        }
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    public static int countAbove (double[] exam1, double average, int numStudents) {
        int numAbove = 0;
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