

Programming Fundamentals II

Lab 8: Multidimensional Arrays

Learning Objectives:

- Program common operations for two-dimensional arrays.
- Utilize multidimensional arrays.

Requisite knowledge:

- Chapter 8 Elementary Programming from “Introduction to Java Programming Brief Version” Reference (See ims.uofk.edu).
- Lecture 8 (See ims.uofk.edu).

Lab 8 Assignment: Check Lab 7_8 Assignment file.

Case Study: Calculating Total Scores

(*Multi-Dimensional Array*) Write a program that prints the scores for students in a class. Suppose the scores are stored in a three-dimensional array named `scores`. The first index in `scores` refers to a student, the second refers to an exam, and the third refers to the part of the exam. Suppose there are 7 students, 5 exams, and each exam has two parts--the multiple-choice part and the programming part. So, `scores[i][j][0]` represents the score on the multiple-choice part for the `i`'s student on the `j`'s exam. Your program displays the total score for each student.

Student 1 Marks details:

Exam 1 (Subject 1) Mark Details:

part 1 (multiple-choice) Marks: 7.5

part 2 (programming) Marks: 20.5

Exam 2 (Subject 2) Mark Details:

part 1 (multiple-choice) Marks: 9.0

part 2 (programming) Marks: 22.5

Exam 3 (Subject 3) Mark Details:

part 1 (multiple-choice) Marks: 15.0

part 2 (programming) Marks: 33.5

Exam 4 (Subject 4) Mark Details:

part 1 (multiple-choice) Marks: 13.0

part 2 (programming) Marks: 21.5

Exam 5 (Subject 5) Mark Details:

part 1 (multiple-choice) Marks: 15.0

part 2 (programming) Marks: 2.5

Student 2 Marks details:

Exam 1 (Subject 1) Mark Details:

part 1 (multiple-choice) Marks: 4.5

part 2 (programming) Marks: 21.5

Exam 2 (Subject 2) Mark Details:

part 1 (multiple-choice) Marks: 9.0

part 2 (programming) Marks: 22.5

```
double[][][] scores =  
{ {7.5, 20.5}, {9.0, 22.5}, {15, 33.5}, {13, 21.5}, {15, 2.5} },  
{ {4.5, 21.5}, {9.0, 22.5}, {15, 34.5}, {12, 20.5}, {14, 9.5} },  
{ {6.5, 30.5}, {9.4, 10.5}, {11, 33.5}, {11, 23.5}, {10, 2.5} },  
{ {6.5, 23.5}, {9.4, 32.5}, {13, 34.5}, {11, 20.5}, {16, 7.5} },  
{ {8.5, 26.5}, {9.4, 52.5}, {13, 36.5}, {13, 24.5}, {16, 2.5} },  
{ {9.5, 20.5}, {9.4, 42.5}, {13, 31.5}, {12, 20.5}, {16, 6.5} },  
{ {1.5, 29.5}, {6.4, 22.5}, {14, 30.5}, {10, 30.5}, {16, 6.0} } };
```

□ Output from the `TotalScore` program:

```
Student 0's score is 160.0  
Student 1's score is 163.0  
Student 2's score is 148.4  
Student 3's score is 174.4  
Student 4's score is 202.4  
Student 5's score is 181.4  
Student 6's score is 166.9
```

```

package totalscore;

public class TotalScore {

//Main method
    public static void main(String args[]) {
        double[][][] scores = {
            { {7.5, 20.5}, {9.0, 22.5}, {15, 33.5}, {13, 21.5}, {15, 2.5} },
            { {4.5, 21.5}, {9.0, 22.5}, {15, 34.5}, {12, 20.5}, {14, 9.5} },
            { {6.5, 30.5}, {9.4, 10.5}, {11, 33.5}, {11, 23.5}, {10, 2.5} },
            { {6.5, 23.5}, {9.4, 32.5}, {13, 34.5}, {11, 20.5}, {16, 7.5} },
            { {8.5, 26.5}, {9.4, 52.5}, {13, 36.5}, {13, 24.5}, {16, 2.5} },
            { {9.5, 20.5}, {9.4, 42.5}, {13, 31.5}, {12, 20.5}, {16, 6.5} },
            { {1.5, 29.5}, {6.4, 22.5}, {14, 30.5}, {10, 30.5}, {16, 6.0} } };

// Calculate and display total score for each student

        for(int i = 0; i < scores.length; i++){ // i=0
            double totalScore = 0 ; // =160
            for( int j =0 ; j < scores[i].length;j++){
                // totalScore = totalScore + scores[i][j][0]+ scores[i][j][1];

                for (int k =0; k < scores[i][j].length; k++) { //k=1
                    totalScore = totalScore + scores[i][j][k]; //7.5 + 20.5
                }
            }

            System.out.println("Student "+ i + " total score is "+ totalScore );
        }
    }
}

```

Case Study: Daily Temperature and Humidity

```
import java.util.Scanner;

public class Weather {
    public static void main(String[] args) {
        final int NUMBER_OF_DAYS = 10;
        final int NUMBER_OF_HOURS = 24;
        double[][][] data = new double[NUMBER_OF_DAYS][NUMBER_OF_HOURS][2];

        Scanner input = new Scanner(System.in);
        // Read input using input redirection from a file
        for (int k = 0; k < NUMBER_OF_DAYS * NUMBER_OF_HOURS; k++) {
            int day = input.nextInt();
            int hour = input.nextInt();
            double temperature = input.nextDouble();
            double humidity = input.nextDouble();
            data[day - 1][hour - 1][0] = temperature;
            data[day - 1][hour - 1][1] = humidity;
        }

        // Find the average daily temperature and humidity
        for (int i = 0; i < NUMBER_OF_DAYS; i++) {
            double dailyTemperatureTotal = 0, dailyHumidityTotal = 0;
            for (int j = 0; j < NUMBER_OF_HOURS; j++) {
                dailyTemperatureTotal += data[i][j][0];
                dailyHumidityTotal += data[i][j][1];
            }

            // Display result
            System.out.println("Day " + i + "'s average temperature is "
                               + dailyTemperatureTotal / NUMBER_OF_HOURS);
            System.out.println("Day " + i + "'s average humidity is "
                               + dailyHumidityTotal / NUMBER_OF_HOURS);
        }
    }
}
```

```
Day 0's average temperature is 77.7708
Day 0's average humidity is 0.929583
Day 1's average temperature is 77.3125
Day 1's average humidity is 0.929583
...
Day 9's average temperature is 79.3542
Day 9's average humidity is 0.9125
```

End Of Lab!