

Object-Oriented Programming – Exercises Week 4

This week, we are going to create a course registry for university. The course registry system can add students, courses, mark course completions to a specific student and perform calculations. In addition, the system can save the registry changes to a file and load the details from a file.

This system will again be operated via a command line.

The learning goal for this exercise

1. Creating a larger program with multiple classes
2. Use of data types (HashMap or ArrayList and our own created Object types)
3. Writing to a file and reading from a file
4. Serializing data

Submission

You need a similar project structure than in week 1 and week 2 (see how this is going? :-P)

This week's assignments involve a **Calculator** class, which can calculate completed courses located under the **Student** class. As usual, you need **App.java** to handle the menu structure. In addition, the implementation of **Calculator.java**, **University.java**, and **Student.java** classes must be included in the assignment. Optionally, you might need to add **Grade.java** class as well, depending on your implementation.

The program's purpose is to input student's course completions (course name and course grade) into the system. This can be achieved by using, for example, HashMap, but also ArrayList, together with **Grade.java**, works well and is easily expandable. You can utilize the latter if HashMap does not feel familiar.

The program can withhold information of 0 to N number of students, and students can have 0 to N amount of course completions.

There is a separate functionality to save input and read input to or from files. In practice, the **University.java** class is responsible for writing students' data structure to the file. The object withholds all the information, so the data is automatically written to the file. Hence, the **Student.java** class must be serialized as well as the **Grade** class if that is included in the implementation.

The **Calculator** can calculate both the average and median of the courses. In addition to this, the program can print out all the course completions that students have (see example output below).

Calculator class must have the following functionality:

- `getAverageGrade(Student s)` – returns the average of course completions as double. In case there are no completions, return 0.
- `getMedianGrade(Student s)` – return the median of the course grades as double.
 - This can be best achieved by first sorting the data structure in order of magnitude and then returning the middle item.
 - You should perform the sorting for copy of the data structure to avoid possible changes on the original data structure.
 - If there is even number of course completions, class returns the average of the two middle items in the sorted list. In case there is no course completions, returns 0.

Student class must have the following functionality:

- `addGrade(String course, int grade)` – saves the course completion to the list.
- `getGrades()` – Returns the course completions

1 point implementation

Feature 1: The user can save new students and list them on the screen

Feature 2: The user can input course completions to the chosen students

Feature 3: The program saves student data to a file and reads the data from a file

2 point implementation

Feature 4: The program can calculate the average of course completions for the chosen student

Feature 5: The program can calculate the median of course completions and print out “Wrong input value” when necessary.

Example console output and input for the program

1) Add student, 2) List students, 3) Add course completion for student, 4) List course completions of student, 5) Calculate the average of course completions, 6) Calculate median of course completions, 7) Save students to file, 8) Load students from file, 0) End the program

1

What is the name of the student?

Simon Studier

What is the student number of the student?

055667

1) Add student, 2) List students, 3) Add course completion for student, 4) List course completions of student, 5) Calculate the average of course completions, 6) Calculate median of course completions, 7) Save students to file, 8) Load students from file, 0) End the program

1

What is the name of the student?

Carla Coder

What is the student number of the student?

330223

1) Add student, 2) List students, 3) Add course completion for student, 4) List course completions of student, 5) Calculate the average of course completions, 6) Calculate median of course completions, 7) Save students to file, 8) Load students from file, 0) End the program

2

0: 055667: Simon Studier

1: 330223: Carla Coder

1) Add student, 2) List students, 3) Add course completion for student, 4) List course completions of student, 5) Calculate the average of course completions, 6) Calculate median of course completions, 7) Save students to file, 8) Load students from file, 0) End the program

3

0: 055667: Simon Studier

1: 330223: Carla Coder

Which student?

1

What is the name of the course?

Object-oriented programming

What is the grade of the course?

5

1) Add student, 2) List students, 3) Add course completion for student, 4) List course completions of student, 5) Calculate the average of course completions, 6) Calculate median of course completions, 7) Save students to file, 8) Load students from file, 0) End the program

3

0: 055667: Simon Studier

1: 330223: Carla Coder

Which student?

0

What is the name of the course?

Test Course

What is the grade of the course?

2

1) Add student, 2) List students, 3) Add course completion for student, 4) List course completions of student, 5) Calculate the average of course completions, 6) Calculate median of course completions, 7) Save students to file, 8) Load students from file, 0) End the program

5

0: 055667: Simon Studier

1: 330223: Carla Coder

Which student?

0

Average is 2.0

1) Add student, 2) List students, 3) Add course completion for student, 4) List course completions of student, 5) Calculate the average of course completions, 6) Calculate median of course completions, 7) Save students to file, 8) Load students from file, 0) End the program

3

0: 055667: Simon Studier

1: 330223: Carla Coder

Which student?

1

What is the name of the course?

Spanish 101

What is the grade of the course?

3

1) Add student, 2) List students, 3) Add course completion for student, 4) List course completions of student, 5) Calculate the average of course completions, 6) Calculate median of course completions, 7) Save students to file, 8) Load students from file, 0) End the program

4

0: 055667: Simon Studier

1: 330223: Carla Coder

Which student?

1

Object-oriented programming: 5

Spanish 101: 3

1) Add student, 2) List students, 3) Add course completion for student, 4) List course completions of student, 5) Calculate the average of course completions, 6) Calculate median of course completions, 7) Save students to file, 8) Load students from file, 0) End the program

5

0: 055667: Simon Studier

1: 330223: Carla Coder

Which student?

1

Average is 4.0

1) Add student, 2) List students, 3) Add course completion for student, 4) List course completions of student, 5) Calculate the average of course completions, 6) Calculate median of course completions, 7) Save students to file, 8) Load students from file, 0) End the program

3

0: 055667: Simon Studier

1: 330223: Carla Coder

Which student?

0

What is the name of the course?

Course of Failures

What is the grade of the course?

0

1) Add student, 2) List students, 3) Add course completion for student, 4) List course completions of student, 5) Calculate the average of course completions, 6) Calculate median of course completions, 7) Save students to file, 8) Load students from file, 0) End the program

4

0: 055667: Simon Studier

1: 330223: Carla Coder

Which student?

0

Test Course: 2

Course of Failures: 0

1) Add student, 2) List students, 3) Add course completion for student, 4) List course completions of student, 5) Calculate the average of course completions, 6) Calculate median of course completions, 7) Save students to file, 8) Load students from file, 0) End the program

5

0: 055667: Simon Studier

1: 330223: Carla Coder

Which student?

0

Average is 1.0

1) Add student, 2) List students, 3) Add course completion for student, 4) List course completions of student, 5) Calculate the average of course completions, 6) Calculate median of course completions, 7) Save students to file, 8) Load students from file, 0) End the program

6

0: 055667: Simon Studier

1: 330223: Carla Coder

Which student?

1

Median is 4.0

1) Add student, 2) List students, 3) Add course completion for student, 4) List course completions of student, 5) Calculate the average of course completions, 6) Calculate median of course completions, 7) Save students to file, 8) Load students from file, 0) End the program

7

Students saved to file.

1) Add student, 2) List students, 3) Add course completion for student, 4) List course completions of student, 5) Calculate the average of course completions, 6) Calculate median of course completions, 7) Save students to file, 8) Load students from file, 0) End the program

1

What is the name of the student?

Randal Removal

What is the student number of the student?

666

1) Add student, 2) List students, 3) Add course completion for student, 4) List course completions of student, 5) Calculate the average of course completions, 6) Calculate median of course completions, 7) Save students to file, 8) Load students from file, 0) End the program

2

0: 055667: Simon Studier

1: 330223: Carla Coder

2: 666: Randal Removal

1) Add student, 2) List students, 3) Add course completion for student, 4) List course completions of student, 5) Calculate the average of course completions, 6) Calculate median of course completions, 7) Save students to file, 8) Load students from file, 0) End the program

8

Students loaded from file.

1) Add student, 2) List students, 3) Add course completion for student, 4) List course completions of student, 5) Calculate the average of course completions, 6) Calculate median of course completions, 7) Save students to file, 8) Load students from file, 0) End the program

2

0: 055667: Simon Studier

1: 330223: Carla Coder

1) Add student, 2) List students, 3) Add course completion for student, 4) List course completions of student, 5) Calculate the average of course completions, 6) Calculate median of course completions, 7) Save students to file, 8) Load students from file, 0) End the program

0

Thank you for using the program.