112 物件導向程式設計 - Java 第二次作業

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1. 請試寫一個程式，使用者只要輸入三角型的 2 邊長及夾角，就能算出第 3 邊的邊長。(提示：餘弦定理：a2=b2+c2-2bc*cosA)

程式說明：

執行後，程式會輸出提示字串，依照提示逐一輸入第一個邊長、第二個邊長、兩邊長中間夾角的角度（degree）。

如果在輸入時輸入非數字型態的值、小於等於 0 的值，會丟出錯誤訊息，提示使用者這是非法輸入，並讓使用者重新輸入。

程式演示：

1. 正常輸入並執行：

```
Please enter the lengths of the first sides of the triangle:
4
Please enter the lengths of the second sides of the triangle:
3
Please enter the size of the included angle (degrees):
50
The length of the first side is: 4.0
The length of the second side is: 3.0
The size of the included angle(radians) is: 0.8726646259971648
The length of the third side is: 3.0940422375143903
PS C:\Users\user\OneDrive\桌面\course\OOP\homework2>
```

2. 錯誤訊息：

```
Please enter the lengths of the first sides of the triangle:
.
java.util.InputMismatchException
Please make sure the format is right!
```

```
Please enter the lengths of the first sides of the triangle:
+6
Please enter the lengths of the second sides of the triangle:
-6
Exception message: The side length cannot be negative or zero!
```

```
Please enter the lengths of the first sides of the triangle:
0
Exception message: The side length cannot be negative or zero!
Please enter the lengths of the first sides of the triangle:
+3
Please enter the lengths of the second sides of the triangle:
4
Please enter the size of the included angle (degrees):
90
```

```
Please enter the lengths of the first sides of the triangle:
+3
Please enter the lengths of the second sides of the triangle:
4
Please enter the size of the included angle (degrees):
90
The length of the first side is: 3.0
The length of the second side is: 4.0
The size of the included angle(radians) is: 1.5707963267948966
The length of the third side is: 5.0
PS C:\Users\user\OneDrive\桌面\course\OOP\homework2>
```

```
Please enter the lengths of the first sides of the triangle:
.
java.util.InputMismatchException
Please make sure the format is right!

Please enter the lengths of the first sides of the triangle:
+6
Please enter the lengths of the second sides of the triangle:
-6
Exception message: The side length cannot be negative or zero!
Please enter the lengths of the first sides of the triangle:
0
Exception message: The side length cannot be negative or zero!
Please enter the lengths of the first sides of the triangle:
+3
Please enter the lengths of the second sides of the triangle:
4
Please enter the size of the included angle (degrees):
90
The length of the first side is: 3.0
The length of the second side is: 4.0
The size of the included angle(radians) is: 1.5707963267948966
The length of the third side is: 5.0
PS C:\Users\user\OneDrive\桌面\course\OOP\homework2>
```

2. 請撰寫一個程式，擁有一個代表學生的類別以及一個代表老師的類別，其中學生與老師分別要有以下成員變數：

成員變數	學生	老師
姓名	V	V
出生年 (民國)	V	V
學號	V	X
年級	V	X
教授科目 (國文、英文或數學)	X	V

程式截圖驗證：

學生與老師的類別中有題目所要求的成員變數。

```
83  /*****************************************************************************************
84  /*  Student class is used to store the information of students.
85  /*  The class contains four attributes: name、birthYear、studentID、grade
86  /*
87  /*  The class contains two constructors.
88  /*
89  /*  The class contains three methods:
90  /*  1. getName(): return the name of the student.    -> so that we can sort by name
91  /*  2. getBirthYear(): return the birth year of the student.    -> so that we can sort by age
92  /*  3. toString(): override the toString method to print the information of the student.
93  /*****************************************************************************************/
```

```
94  class Student {
95      private String name; // name of the student
96      private int birthYear; // birth year of the student
97      private int studentID; // ID of the student
98      private int grade; // grade of the student
```

```
126 /*****************************************************************************************
127 /*  Teacher class is used to store the information of teachers.
128 /*  The class contains three attributes:name、birthYear、subject
129 /*
130 /*  The class contains two constructors:
131 /*
132 /*  The class contains three methods:
133 /*  1. getName(): return the name of the teacher.    -> so that we can sort by name
134 /*  2. getBirthYear(): return the birth year of the teacher.    -> so that we can sort by age
135 /*  3. toString(): override the toString method to print the information of the teacher.
136 /*****************************************************************************************/
```

```
137 class Teacher {
138     private String name; // name of the teacher
139     private int birthYear; // birth year of the teacher
140     private String subject; // subject of the teacher
```

3. 延續上題，請為各類別重新定義 toString() 方法，以便能夠利用 System.out.println() 顯示學生或老師的個人資訊。

程式截圖驗證：

第 121 行，與第 161 行分別重新定義了 Student 與 Teacher 的 toString()。

```
120     // override toString method to print the information of the student
121     @Override public String toString() {
122         return "name: " + name + ", birthYear: " + birthYear + ", studentID: " + studentID + ", grade: " + grade;
123     }
```

```
160     // override toString method to print the information of the teacher
161     @Override public String toString() {
162         return "name: " + name + ", birthYear: " + birthYear + ", subject: " + subject;
163     }
```

程式執行結果：

輸出所有學生與老師的資訊。

```java
        // test the Student class toString() method
        System.out.println("\033[1;31m\nStudent info: \033[0m");
        for (Student student : students) {
            System.out.println(student);
        }
```

```
Student info:
name: John Smith, birthYear: 2003, studentID: 2023001, grade: 1
name: Emily Johnson, birthYear: 2002, studentID: 2022002, grade: 2
name: Michael Williams, birthYear: 2003, studentID: 2023003, grade: 1
name: Sarah Brown, birthYear: 2002, studentID: 2022004, grade: 2
name: Jessica Davis, birthYear: 2003, studentID: 2023005, grade: 1
name: David Miller, birthYear: 2002, studentID: 2022006, grade: 2
name: Ashley Wilson, birthYear: 2003, studentID: 2023007, grade: 1
name: Matthew Taylor, birthYear: 2002, studentID: 2022008, grade: 2
name: Olivia Martinez, birthYear: 2003, studentID: 2023009, grade: 1
name: Ethan Anderson, birthYear: 2002, studentID: 2022010, grade: 2
```

```java
        // test the Teacher class toString() method
        System.out.println("\033[1;31m\nTeacher info: \033[0m");
        for (Teacher teacher : teachers) {
            System.out.println(teacher);
        }
```

```
Teacher info:
name: Johnson, birthYear: 1985, subject: Math
name: Williams, birthYear: 1978, subject: English
name: Brown, birthYear: 1990, subject: Chinese
name: Davis, birthYear: 1983, subject: Math
name: Miller, birthYear: 1975, subject: Chinese
name: Wilson, birthYear: 1992, subject: English
name: Taylor, birthYear: 1988, subject: Math
name: Martinez, birthYear: 1979, subject: Chinese
name: Anderson, birthYear: 1995, subject: Math
name: Thomas, birthYear: 1980, subject: English
```

4. 延續上題，請撰寫一個類別，提供有一個 showInfoByName()方法,可以傳入學生以及老師的串列，並依據姓名排序後，顯示每一個學生以及老師的資訊。

```java
/*********************************************************************************
/*  InfoSorter : used to sort the students and teachers by name and age.
/*  The class contains four methods:
/*  1. showInfoByName(Student[] student): Sort students by name and print the result.
/*  2. showInfoByName(Teacher[] teacher): Sort teachers by name and print the result.
/*  3. showInfoByAge(Student[] student): Sort students by age and print the result.
/*  4. showInfoByAge(Teacher[] teacher): Sort teachers by age and print the result.
/*********************************************************************************/
```

```java
class InfoSorter {
    public static void showInfoByName(Student[] student) {
        // Bubble sort to sort students by name
        for (int i = 0; i < student.length - 1; i++) {
            for (int j = 0; j < student.length - i - 1; j++) {
                // Swap
                if (student[j].getName().compareTo(student[j + 1].getName()) > 0) {
                    Student temp = student[j];
                    student[j] = student[j + 1];
                    student[j + 1] = temp;
                }
            }
        }
        for(Student s : student) {
            System.out.println(s);
        }
    }
```

```java
    public static void showInfoByName(Teacher[] teacher) {
        // Bubble sort to sort teachers by name
        for (int i = 0; i < teacher.length - 1; i++) {
            for (int j = 0; j < teacher.length - i - 1; j++) {
                // Swap
                if (teacher[j].getName().compareTo(teacher[j + 1].getName()) > 0) {
                    Teacher temp = teacher[j];
                    teacher[j] = teacher[j + 1];
                    teacher[j + 1] = temp;
                }
            }
        }
        for(Teacher t : teacher) {
            System.out.println(t);
        }
    }
```

程式執行結果：

輸出所有學生與老師的資訊。

```
Sort students by name:
name: Ashley Wilson, birthYear: 2003, studentID: 2023007, grade: 1
name: David Miller, birthYear: 2002, studentID: 2022006, grade: 2
name: Emily Johnson, birthYear: 2002, studentID: 2022002, grade: 2
name: Ethan Anderson, birthYear: 2002, studentID: 2022010, grade: 2
name: Jessica Davis, birthYear: 2003, studentID: 2023005, grade: 1
name: John Smith, birthYear: 2003, studentID: 2023001, grade: 1
name: Matthew Taylor, birthYear: 2002, studentID: 2022008, grade: 2
name: Michael Williams, birthYear: 2003, studentID: 2023003, grade: 1
name: Olivia Martinez, birthYear: 2003, studentID: 2023009, grade: 1
name: Sarah Brown, birthYear: 2002, studentID: 2022004, grade: 2
```

```
Sort teachers by name:
name: Anderson, birthYear: 1995, subject: Math
name: Brown, birthYear: 1990, subject: Chinese
name: Davis, birthYear: 1983, subject: Math
name: Johnson, birthYear: 1985, subject: Math
name: Martinez, birthYear: 1979, subject: Chinese
name: Miller, birthYear: 1975, subject: Chinese
name: Taylor, birthYear: 1988, subject: Math
name: Thomas, birthYear: 1980, subject: English
name: Williams, birthYear: 1978, subject: English
name: Wilson, birthYear: 1992, subject: English
```

5. 延續上題，新增一個 showInfoByAge() 方法，顯示同樣的結果，但是根據年齡排序。

```java
    public static void showInfoByAge(Student[] student) {
        // Bubble sort to sort students by age
        for (int i = 0; i < student.length - 1; i++) {
            for (int j = 0; j < student.length - i - 1; j++) {
                // Swap
                if (student[j].getBirthYear() > student[j + 1].getBirthYear()) {
                    Student temp = student[j];
                    student[j] = student[j + 1];
                    student[j + 1] = temp;
                }
            }
        }
        for(Student s : student) {
            System.out.println(s);
        }
    }
```

```java
    public static void showInfoByAge(Teacher[] teacher) {
        // Bubble sort to sort teachers by age
        for (int i = 0; i < teacher.length - 1; i++) {
            for (int j = 0; j < teacher.length - i - 1; j++) {
                // Swap
                if (teacher[j].getBirthYear() > teacher[j + 1].getBirthYear()) {
                    Teacher temp = teacher[j];
                    teacher[j] = teacher[j + 1];
                    teacher[j + 1] = temp;
                }
            }
        }
        for(Teacher t : teacher) {
            System.out.println(t);
        }
    }
```

程式執行結果：

輸出所有學生與老師的資訊。

```
Sort students by age:
name: David Miller, birthYear: 2002, studentID: 2022006, grade: 2
name: Emily Johnson, birthYear: 2002, studentID: 2022002, grade: 2
name: Ethan Anderson, birthYear: 2002, studentID: 2022010, grade: 2
name: Matthew Taylor, birthYear: 2002, studentID: 2022008, grade: 2
name: Sarah Brown, birthYear: 2002, studentID: 2022004, grade: 2
name: Ashley Wilson, birthYear: 2003, studentID: 2023007, grade: 1
name: Jessica Davis, birthYear: 2003, studentID: 2023005, grade: 1
name: John Smith, birthYear: 2003, studentID: 2023001, grade: 1
name: Michael Williams, birthYear: 2003, studentID: 2023003, grade: 1
name: Olivia Martinez, birthYear: 2003, studentID: 2023009, grade: 1
```

```
Sort teachers by age:
name: Miller, birthYear: 1975, subject: Chinese
name: Williams, birthYear: 1978, subject: English
name: Martinez, birthYear: 1979, subject: Chinese
name: Thomas, birthYear: 1980, subject: English
name: Davis, birthYear: 1983, subject: Math
name: Johnson, birthYear: 1985, subject: Math
name: Taylor, birthYear: 1988, subject: Math
name: Brown, birthYear: 1990, subject: Chinese
name: Wilson, birthYear: 1992, subject: English
name: Anderson, birthYear: 1995, subject: Math
PS C:\Users\user\OneDrive\桌面\course\OOP\homework2>
```