CS215: Introduction to Program Design, Abstraction and Problem Solving
(Spring, 2024)
Lab Assignment 10
(20 points)
Today's Date: Monday, April 1
Demonstration Due Date: the end of Lab11 class
Submission Due Date: Friday, April 12

The purpose of this lab assignment:

- to better understand the concept of class, object, encapsulation, OOP
- To continue practicing how to define your own class
- To understand "Has-A" relationship among classes
- To help you make BIG progress in your Project 2 (to complete Part 2).

Problem Statement

As Part 2 of Project 2, define the following class **`MathReport`** that provides the vector of **`MathOperations`** objects to store the list of questions solved; the number of questions with correct answers; the number of questions with wrong answers; and the list of **`MathOperations`** objects, named **`errorList`**, to store the questions with wrong answers (for more practice in the future).

```
class MathReport
{
  public:
    // default constructor
    MathReport();

    // add a Question object into the vector of mathQuestions
    // and the response to check with the correct answer:
    //   if response is correct, increase numCorrectAnswers
    //   otherwise, increase numWrongAnswers
    void insert(MathOperations newQuestions, int response);

    // return the value of numCorrectAnswers
    int getNumOfCorrectAnswers() const;

    // return the value of numWrongAnswers
    int getNumOfWrongAnswers() const;

    // generate a brief report
    // if showAnswer is true, display questions solved with correct answers
    //                  otherwise, display questions without answers
    void generateReport(bool showAnswer) const;

    // display the questions in errorList for practice again and collect the user answer
    // and check if the answer is correct so that it can be removed from the errorList
    // return false if all questions have been corrected and removed from the errorList
```

```
    // otherwise return true: errorList is not empty yet, need more practice
    bool needMorePractice();

  private:
    int numCorrectAnswers;   // number of correctly answered questions
    int numWrongAnswers;     // number of wrong answers
    vector<MathOperations> mathQuestions; //sequence of questions
    list<MathOperations> errorList; //sequence of questions with wrong
                                    //answers, need to practice again

};
```

You can either download or copy the content of the header file, which contains the declaration of the class **`MathReport`**, from the following link:
https://www.cs.uky.edu/~yipike/CS215/MathReport.h

Note that for this Lab assignment, you only need to provide the implementation of the member functions for the class **`MathReport`**, in a .cpp file, which completes the definition of class **`MathReport`**. After you create a new project from Visual Studio IDE, right click on **Source Files** and select **Add → New Item...,** and choose "C++ File (.cpp)" for the implementation file of the class **`MathReport`**, or click on **Header Files** and select **Add → New Item...,** and choose "Header File (.h)" for the declaration of the class **`MathReport`** (You can copy the content from the link above). You also need to add **`MathOperations.h`** and **`MathOperations.cpp`**, copy these two files, which you finished in Lab9, into the same folder of the solution for Lab10.

Then use the following link to download the source file named Lab10.cpp, which provides the main function, to test your complete definition of the class, named **`MathReport`**:
https://www.cs.uky.edu/~yipike/CS215/Lab10.cpp

From Visual Studio IDE, right click on **Source Files** and select **Add → New Item...,** and choose "C++ File (.cpp)" for the main source file (You can copy the content from the file named **Lab10.cpp** of the above link.
In summary, the solution for Lab10 contains two .h header files and two .cpp implementation files and one .cpp file for main function: **`MathOperations.h, MathReport.h, MathOperations.cpp, MathReport.cpp`** and **`Lab10.cpp!`**

In this Lab assignment, you only need to work on one source file, named MathReport.cpp. After you finish writing your code, compile the program and test running your program while checking the following sample output, to better understand the purpose of this program.

The following shows **FOUR** sample outputs: (Note that your output should **exactly** match the sample outputs, and also think about how to design your own testing cases)

(Note that the user input is shown in blue and ↵ represents the return key.)

Sample output 1:

```
        Month-at-a-Glance (MAAG) of April
        Math Is Fun! Try to solve Multiplication problems...
    37
 *   9
 -----
Please type your answer:
333↲
Congratulations! 333 is the right answer.


    38
 *   9
 -----
Please type your answer:
342↲
Congratulations! 342 is the right answer.


    39
 *   9
 -----
Please type your answer:
351↲
Congratulations! 351 is the right answer.


    40
 *   9
 -----
Please type your answer:
360↲
Congratulations! 360 is the right answer.



You have solved the following 4 math problems:

Question 1 :
    37
 *   9
 -----
   333

Question 2 :
    38
```

```
 *   9
 -----
   342

Question 3 :
    39
 *   9
 -----
   351

Question 4 :
    40
 *   9
 -----
   360
-----------------------------------
Your answered 4 questions correctly.
Your made 0 mistakes.
Great job!
Thank you for using Math Tutor.
```

Sample output 2:

```
        Month-at-a-Glance (MAAG) of April
        Math Is Fun! Try to solve Multiplication problems...
    37
 *   9
 -----
Please type your answer:
370↲
Sorry, the answer is wrong. You may practice again.


    38
 *   9
 -----
Please type your answer:
380↲
Sorry, the answer is wrong. You may practice again.


    39
 *   9
 -----
Please type your answer:
390↲
Sorry, the answer is wrong. You may practice again.
```

```
    40
 *   9
 -----
Please type your answer:
400↲
Sorry, the answer is wrong. You may practice again.


You have solved the following 4 math problems:

Question 1 :
    37
 *   9
 -----


Question 2 :
    38
 *   9
 -----


Question 3 :
    39
 *   9
 -----


Question 4 :
    40
 *   9
 -----

-----------------------------------
Your answered 0 questions correctly.
Your made 4 mistakes.
You will do better next time...
    37
 *   9
 -----
Please type your answer:
333↲
Congratulations! 333 is the right answer.
    38
```

```
 *   9
 -----
Please type your answer:
352↲
Sorry, answer is wrong. You may practice again.
    39
 *   9
 -----
Please type your answer:
361↲
Sorry, answer is wrong. You may practice again.
    40
 *   9
 -----
Please type your answer:
400↲
Sorry, answer is wrong. You may practice again.
You still need more practice!
    38
 *   9
 -----
Please type your answer:
342↲
Congratulations! 342 is the right answer.
    39
 *   9
 -----
Please type your answer:
361↲
Sorry, answer is wrong. You may practice again.
    40
 *   9
 -----
Please type your answer:
360↲
Congratulations! 360 is the right answer.
You still need more practice!
    39
 *   9
 -----
Please type your answer:
362↲
Sorry, answer is wrong. You may practice again.
You still need more practice!
Sorry! You have reached the maximum of 3 times of practice!
```

```
You have solved the following 4 math problems:

Question 1 :
    37
 *   9
 -----
   333

Question 2 :
    38
 *   9
 -----
   342

Question 3 :
    39
 *   9
 -----
   351

Question 4 :
    40
 *   9
 -----
   360
-----------------------------------
Your answered 3 questions correctly.
Your made 1 mistakes.
Great job!
Thank you for using Math Tutor.
```

Sample output 3:

```
        Month-at-a-Glance (MAAG) of April
        Math Is Fun! Try to solve Multiplication problems...
    37
 *   9
 -----
Please type your answer:
370↲
Sorry, the answer is wrong. You may practice again.

    38
 *   9
 -----
Please type your answer:
380↲
```

```
Sorry, the answer is wrong. You may practice again.

    39
 *   9
 -----
Please type your answer:
390↲
Sorry, the answer is wrong. You may practice again.

    40
 *   9
 -----
Please type your answer:
360↲
Congratulations! 360 is the right answer.


You have solved the following 4 math problems:

Question 1 :
    37
 *   9
 -----


Question 2 :
    38
 *   9
 -----


Question 3 :
    39
 *   9
 -----


Question 4 :
    40
 *   9
 -----

-----------------------------------
Your answered 1 questions correctly.
Your made 3 mistakes.
You will do better next time...
    37
```

```
 *   9
 -----
Please type your answer:
370↲
Sorry, answer is wrong. You may practice again.
    38
 *   9
 -----
Please type your answer:
342↲
Congratulations! 342 is the right answer.
    39
 *   9
 -----
Please type your answer:
390↲
Sorry, answer is wrong. You may practice again.
You still need more practice!
    37
 *   9
 -----
Please type your answer:
333↲
Congratulations! 333 is the right answer.
    39
 *   9
 -----
Please type your answer:
351↲
Congratulations! 351 is the right answer.
Excellent! Your answers are all correct! No more practice is
needed:)

You have solved the following 4 math problems:

Question 1 :
    37
 *   9
 -----
   333

Question 2 :
    38
 *   9
 -----
   342
```

```
Question 3 :
    39
 *   9
 -----
   351

Question 4 :
    40
 *   9
 -----
   360
-----------------------------------
Your answered 4 questions correctly.
Your made 0 mistakes.
Great job!
Thank you for using Math Tutor.
```

Sample output 4:

```
        Month-at-a-Glance (MAAG) of April
        Math Is Fun! Try to solve Multiplication problems...
    37
 *   9
 -----
Please type your answer:
333↲
Congratulations! 333 is the right answer.


    38
 *   9
 -----
Please type your answer:
380↲
Sorry, the answer is wrong. You may practice again.


    39
 *   9
 -----
Please type your answer:
390↲
Sorry, the answer is wrong. You may practice again.


    40
 *   9
```

```
 -----
Please type your answer:
360↲
Congratulations! 360 is the right answer.



You have solved the following 4 math problems:

Question 1 :
    37
 *   9
 -----


Question 2 :
    38
 *   9
 -----


Question 3 :
    39
 *   9
 -----


Question 4 :
    40
 *   9
 -----

---------------------------------
Your answered 2 questions correctly.
Your made 2 mistakes.
You will do better next time...
    38
 *   9
 -----
Please type your answer:
380↲
Sorry, answer is wrong. You may practice again.
    39
 *   9
 -----
Please type your answer:
351↲
```

```
Congratulations! 351 is the right answer.
You still need more practice!
    38
 *   9
 -----
Please type your answer:
380↲
Sorry, answer is wrong. You may practice again.
You still need more practice!
    38
 *   9
 -----
Please type your answer:
382↲
Sorry, answer is wrong. You may practice again.
You still need more practice!
Sorry! You have reached the maximum of 3 times of practice!

You have solved the following 4 math problems:

Question 1 :
    37
 *   9
 -----
   333

Question 2 :
    38
 *   9
 -----
   342

Question 3 :
    39
 *   9
 -----
   351

Question 4 :
    40
 *   9
 -----
   360
-----------------------------------
Your answered 3 questions correctly.
Your made 1 mistakes.
Great job!
```

`Thank you for using Math Tutor.`

Demonstration and Submission

Each Lab assignment needs to demonstrate to your TA to be graded. You can demonstrate Lab10 during Lab10 class (with possible bonus 3 points) or no later than the end of Lab11 class (this is **the demonstration deadline** for Lab10).
If you finish Lab10 assignment during Lab10 class, you may demonstrate your program to your TA and answer your TA's questions, you can get up to 3 extra points for this lab assignment. (Note you can also demonstrate your program to your TA during Lab11 class. However, any demonstration later than the end of the Lab10 class cannot get bonus 3 points.) If you need extra time, you can continue working on Lab10 assignment after the Lab class and try to finish it before the next Lab class. Then demonstrate your Lab10 during Lab11 class. If you do not demonstrate your code, even if you submit it in Canvas, you will receive a grade of 0!! The TA may ask you to make some corrections. If so, make the corrections and demonstrate again…repeat until you have 100%!
2. After the successful demonstration, submit the code in Canvas. Open the link to Course Canvas page (**https://www.uky.edu/canvas**), and log in to your account using your LinkBlue ID and password. Please submit the source files, named MathReport.cpp through link "Lab 10".
Even if you successfully demonstrated it to the TA, if you do not submit in Canvas by **the submission deadline**, *you will receive a grade of 0!*

Grading (20 points + Bonus 3 points)

1. Attend the lab session or have a documented excused absence. (5 points)
2. Demonstrate your program to your TA and submit it in Canvas. (15 points)
   - Include comments as specified in the lecture notes. (3 points)
   - Class definition is correct. (9 points)
     - ✓ each member function is correct.
     - ✓ the format in the generateReport() member function follows the requirement and should match the sample output accordingly.
   - Separate source files and header files. (3 points)

Demonstrate your program to your TA and answer TA's questions during Lab class when the same Lab assignment is given. (Bonus 3 points)

For Mac Users (under Microsoft Visual Studio Code):

1. Make sure that all FIVE files (**`MathOperations.h`**, **`MathReport.h`**, **`MathOperations.cpp`**, **`MathReport.cpp`** and **`Lab10.cpp`**) are stored in the **SAME** folder.
2. Open a new terminal, and go to the same folder as where you saved the five files above, then type the following command to compile the program:
   `g++ Lab10.cpp MathOperations.cpp MathReport.cpp -o Lab10`
3. If you have compile-time errors, try to fix the errors and compile the program again, until it passes the compilation.
4. Test running your program from the terminal by typing:
   `./Lab10`
5. Check if the execution of your program matches the sample outputs.