CMPSC 221 **Name: _____**

OO Programming with Web-Based Applications
Spring 2020
Due Date: April 14th, 2020 (6:15 p.m.)

Instructions: Please create a Java application to solve the following problem. Submit electronic (Canvas Dropbox) copies of your program source code and **two or more** sample runs to me by the deadline. For the electronic submission of your program, you may: 1) compress (i.e., zip) your entire project folder (NetBeans, Eclipse, etc.) and upload that to Canvas OR 2) place your Java source code file(s) in a folder, compress the folder, and upload that to Canvas.) Documentation requirements follow the problem specification. **Important Note:** Please be sure to upload your Project 5 files to Canvas by the deadline. If you miss the deadline, you WILL automatically receive a grade of 0 (zero).

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1. Problem Specification: Your task is to create a GUI-based Java application that will help an elementary school student learn the mathematical operations of addition, subtraction, and multiplication. The program begins by generating a random integer in the range 1 through 3, inclusive, to randomly select one of the three operations. Next, it generates two random integers in the range 1 through 10, inclusive, for the operands. Finally, it displays a math problem of the chosen type. After displaying the problem, the program prompts the student to enter his or her answer. If the student answers incorrectly, the program displays the message "I'm sorry, but no. Please try again". If the student answers correctly, the program displays the message "Very good!", along with the number of attempts to solve the problem. Regardless of whether the student's response was correct or incorrect, the program provides him or her with the opportunity to solve additional problems by clicking on a "New Problem" button. As usual, your program output should resemble the sample runs at the end of this document.

   Implementation Requirements and Guidelines:

   - A `JLabel` **must** be used to display the math problem (example below).

     ```
     How much is 5 times 9?
     ```

   - A second `JLabel` **must** be used to display the prompt to the student to enter his or her answer.
   - A `JTextField` **must** be used to input the answer.
     (Note: In the sample run, the program checks the student's answer after s/he enters it in the `JTextField` then presses <enter>. If you prefer that the program check the student's answer after s/he clicks on a button, feel free to add a second button to the interface.)
   - A `JLabel` **must** be used to display the status of the student's answer (correct/incorrect). (You may simply reuse the second `JLabel` if you like.)
   - A `JButton` **must** be provided to allow the student to try a new problem. When the `JButton` is clicked:
     - A new problem **must** be generated.
     - The prompt `"Please enter your answer."` **must** be displayed.
     - The `JTextField` used for input **must** be cleared.
   - Your program **must** use methods to carry out the primary tasks of the program. Some possible methods include:
     - `public void generateProblem();` // Generates a math problem
     - `public void checkAnswer(int userAnswer);` // Checks student's answer

     etc.

- I prefer that you use two or more classes to implement this program as demonstrated in *FirstWindowDemo* posted on Canvas. *FirstWindowDemo* consists of a driver class (*FirstWindowDemo*), a listener class (*EndingListener*), and a class that creates the GUI (*FirstWindow*). However, you will not be penalized if you implement your program using only one class.

References:
Savitch: Chapter 17 (Swing I); GUI demo programs on Canvas

Documentation Requirements:

1) Each program source code file (i.e., Java class) must have a header at the beginning of the class containing the following:

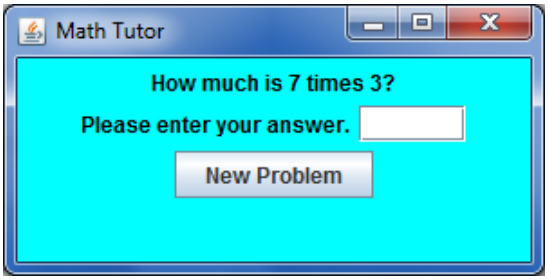
   - Name of author, PSU e-mail address of author, name of course, assignment number and due date, name of file, purpose of class, compiler/IDE, operating system, and any external references used (e.g., Website)
   - Example:

```
/*
Author:          Wanda Kunkle
E-mail:          wmk12@psu.edu
Course:          CMPSC 221
Assignment:      Programming Assignment 5
Due date:        4/14/2020
File:            MathTutor_1_0.java
Purpose:         Java GUI application that helps an elementary school
                 student learn addition, subtraction, and multiplication
Compiler/IDE:    Java 11.0.5/Apache NetBeans IDE 11.2
Operating
system:          MS Windows 8.1
Reference(s):    Java 10 API - Oracle Documentation
                 (http://docs.oracle.com/javase/10/docs/api/);
                 (Include ALL additional references (Web page, etc.) here.)
*/
```

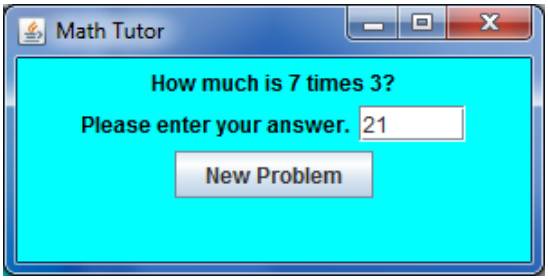
2) The purpose of each method in the source code file(s) must be documented as shown in the example below. I prefer that you use the **javadoc** comment style.

```
/** This method generates a math problem.
*/
public void generateProblem()
{
   // Method definition (i.e., body)
}
```

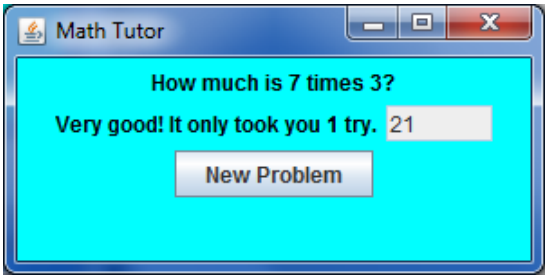
Sample run #1 *(Student answers correctly after one try.)*:



← Program displays problem



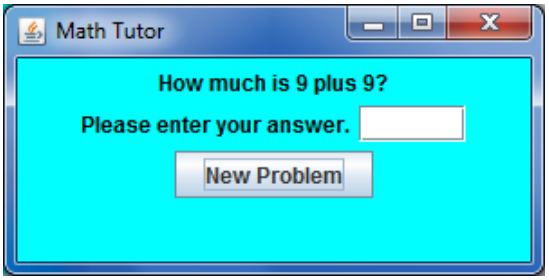
← Student enters answer



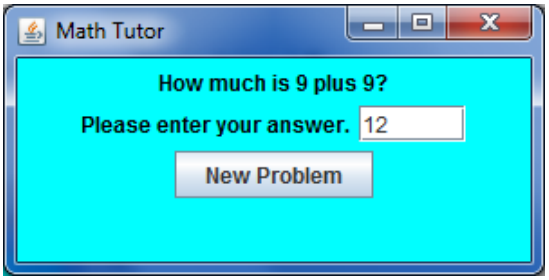
← Student hits <enter> to check answer

Student clicks “New Problem”, then … (see next run)

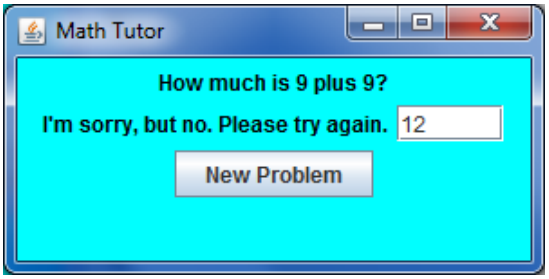
Sample run #2 *(Student answers correctly after multiple tries.)*:



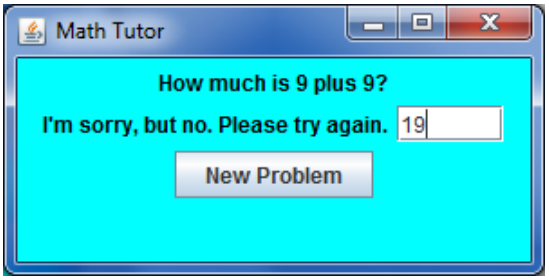
← Program displays problem



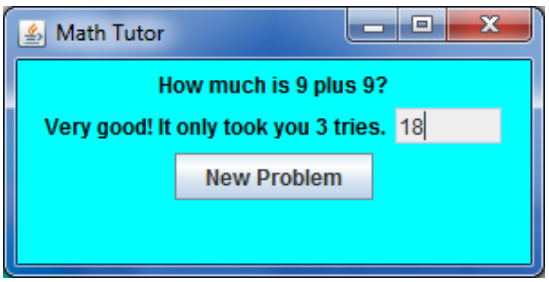
← Student enters answer



← Student hits <enter> to check answer



← Student enters new answer, then hits <enter> again to check new answer



← Student enters new answer, then hits <enter> again to check new answer