CST 8221 – JAP, Assignment #1, Part 2

Due Date: prior or on 6 March 2020

Earnings: 7% of your total course mark (plus up to 3.0% Bonus)

Purpose: Developing GUI based Calculator Application

The purpose of this simple yet comprehensive assignment is to give you the enjoyment of exercising your programming skills and the delight of applying your knowledge of how to build a relatively simple GUI Calculator Application. The assignment is based on the material covered in lectures, lab exercises, and hybrid activities. You will also find Chapters 26 and 35 of your textbook to be very helpful.

Requirements Specification:

In this part of Assignment #1 you are to complete the implementation of the Calculator Application. Your Calculator Application must exhibit the behavior described below.

Tasks:

In this part of Assignment#1 you must add a ***CalculatorModel*** class to the *calculator* package, and complete the implementation of the event handling in the ***Controller*** class or classes.

Class *CalculatorModel*

The class ***CalculatorModel*** class is responsible for performing the calculations. The CalculatorModel class code must provide at least the following:

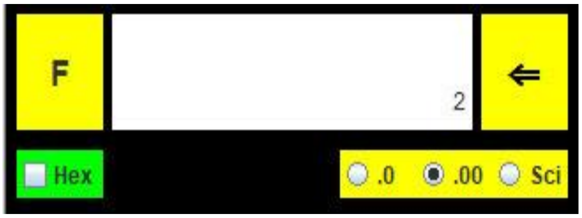
- set methods for setting the operands (both operands must be of String type).
- set methods to set the arithmetic operation (+,-,*,/).
- set methods to set the the operational mode - Integer(Hexdecimal) or Float.
- set method to set the floating-point precision.
- get method to return the result from the operation in formatted form based on the current precision. The result should be implemented as a v*irtual field*. Virtual fields are also called *computational fields* or *calculated field*.
- set and get method for the *error state* field of the class. If the result of the calculations cannot be determined (illegal operands, operators or mode; result is ***NaN***, ***Infinity***, or out of range) the error state must be set to *true*.
- *a* private *calculate()* method that calculates the result based on the current operands, arithmentic operation and operational mode (Integer (**H**exadecimal) or **F**loat). In order to get full credit you should use java.math ***BigInteger*** and ***BigDecimal*** classes to perform the calculations (see Marking Sheet).

Controller class(es)

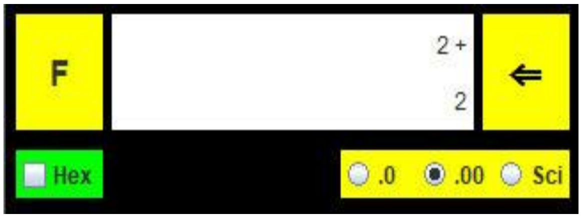
In this part of the assignment you must complete the implementation of the event handling. All components used in the Calculator GUI generate an action event. You can use only a single instance of the ***Controller*** class (see Assignment 1 Part 1) to handle all action events in a single event handler (recommended), or you can use more than one instance to handle different action events in different event handlers.

If for some reason you need to handle events different from ***ActionEvent***, you can use the same ***Controller*** class and add implementation of an appropriate listener interface, or you can implement another private inner classes in the same way as the Controller class. You must name it appropriately: The name of the class must contain the word Controller.

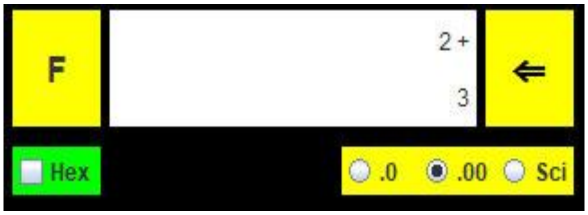
The implementation of the event handler(s) must provide behavior identical to the behavior described in the ***Important test checkpoints*** section. No calculations must be performed in the *Controller* class(es). All calculations must be carried out by the *CalculatorModel* class.
In the description of the checkpoints the notation [ ] means that a specific button must be clicked. For example, [Hex] means that the Hex checkbox must be clicked.
The sequence 2+3= means that the following buttons have been clicked in the specified order: button 2, button +, button 3, button =. When 2 is clicked the calculator display2 must show 2; then when + is clicked display2 must still display 2 but *display1* must show 2 +; then when 3 is clicked *display2* must show 3; and finally when = is clicked *display2* must show the result which in this case is 5.00 in Float (**F**) mode and 5 in Integer (**H**) mode and *display1* must be cleared.



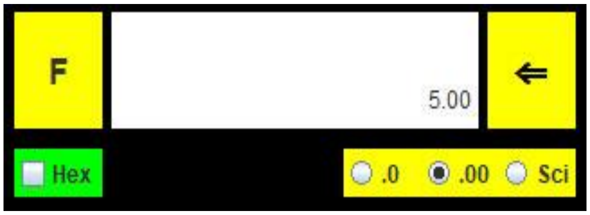
2 clicked



+ clicked

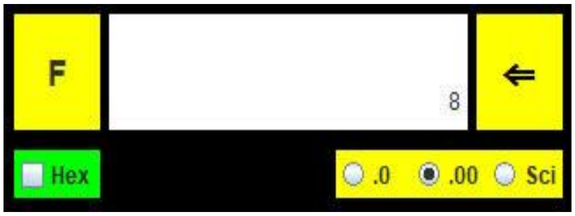


3 clicked

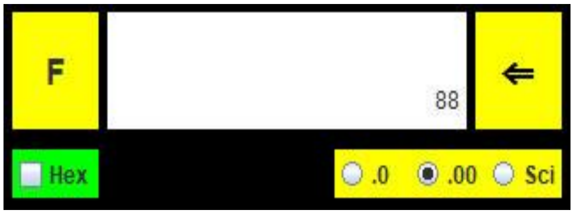


= clicked

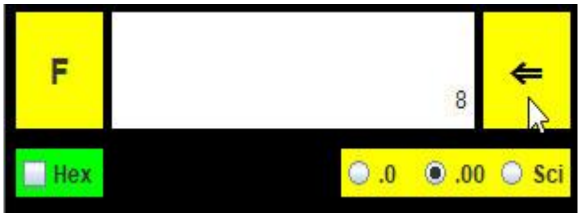
After = has been clicked if a number is clicked, display2 must display the number. Also, after = has been clicked the backspace button ⇐ is not operational. The backspace button is operational only when numbers (operands) are entered.



8 clicked



8 clicked again



backspace ⇐ has been clicked

Important test checkpoints:

1) When the user clicks on the **[Hex]** checkbox the **. button** must be disabled and all hexadecimal buttons (A-F) must be enabled. The *mode/error display* label must display a black letter **H** on a green background. The calculator must operate in integer (hexadecimal) mode. Then if one of the floating-point precision radio buttons is clicked the **. button** must be enabled and hexadecimal buttons (A-F) must be disabled. The label must display a black letter **F** on a yellow background. The calculator must operate in Float mode.

2) 22 + 22 = must display 44 in *Integer* (**H**) mode and 44.00 in *Float* (**F**) mode. Do not forget that at launch the Calculator is in **F** mode and the precision is **.00.** If 2 is clicked after =, display2 must display 2.

3) 2 * 2 = 4.00 (display2) [+] (*display1*: 4.00+, *display2*: 4.00) [5] (*display2*:5) [=] must display 9.00 (*display2*) in **F** mode or 9 in **H** mode.

4) 2+= must display 4 or 4.00 (*display2*) [=] displays 6 or 6.00 [=] displays 8 (**H**) or 8.0 (**F**)

5) 2*= displays 4 or 4.00 [=] displays 8 or 8.00 [=] displays 10 (**H**) or 16.00 (**F**)

6) 2*/ (*display1*: 2 /) [=] must display 1or 1.00 (*display2*) [=] displays 0 (**H**) or 0.50 (**F**)

7) 2/*= (*display1*: 2*) must display 4 or 4.00 (*display2*)

8) 12 [⇐]+2 = must display 3 or 3.00

9) 2 [±] must display -2 (*display2*). If followed by [±], must display 2 (*display2*)

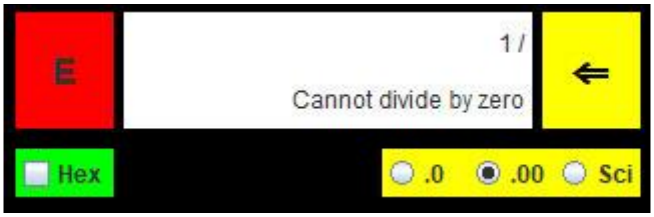
10) -123[⇐][⇐] must display -1

11) -123[⇐][⇐][⇐] must display 0 *(display2*) in **H** mode ([Hex] checked)

12) -123.0 [⇐][⇐]] must display -123

13) -123.0 [⇐][⇐][⇐][⇐][⇐]must display 0.0 (*display2*)

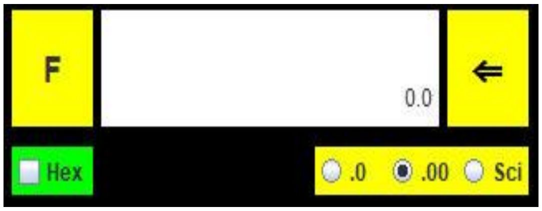
14) 1 / 0 = must display the following:



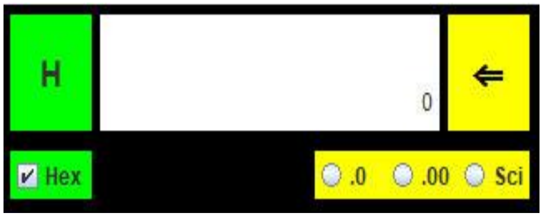
1 /

Cannot divide by zero

Additionally, after an error, the calculator GUI must not be responsive to any button (buttons must not be disabled) except **C**, **Hex**, and the **precisions radio buttons.** The calculator display and the mode/error display must not change until **C** is pressed. Pressing **C** (clear) must display 0 or 0.0 depending on the current mode of operation, and change mode-error display correspondingly to **H** or **F** with the appropriate background color and alignment.

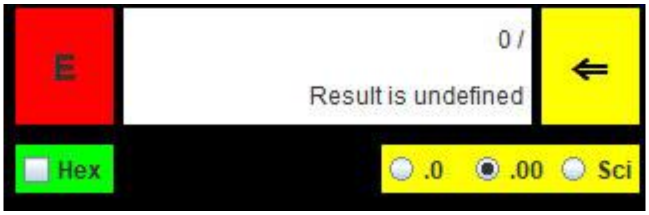


C clicked in mode F



C clicked in mode H

15) 0 / 0 = must display the following:

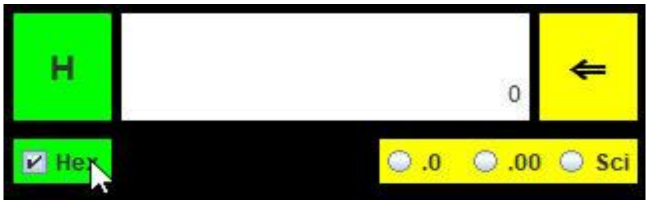


0 /
Result is undefined

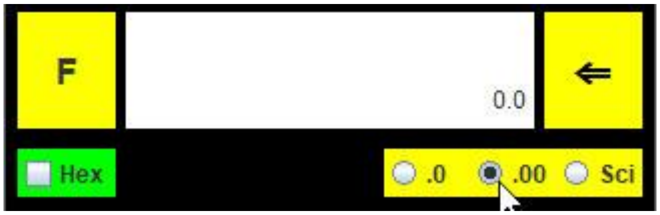
The calculator must behave in the same way as explained in 14.

16) -4 / 2 = must display -2 or -2.00

17) 2.5 [Hex] or 2.5 [+ - / *] [Hex] must clear the calculator display



18) [Hex]2[radio button] or [Hex] 2 [+ - / *] [radio button] must clear the calculator display



19) [Hex] FF+FF= must display 1FE

20) [Hex] EE*EE= must display DD44

21) [.0] 1 / 3= must display 0.3 in **F** mode; [Hex]1 / 3 must display 0

22) [.00] 1 / 3 = must display 0.33

23) [Sci] 1 / 3 = must display 3.333333E-01

24) [Sci] 1 / 3 = + 2 = must display 2.333333E+00 in **F** mode;
[Hex] 1 / 3 = + 2 = must display 2

25) At any time during operation [C] must clear the calculator display (see 17 and 18)

You should try other calculations and combinations and make sure that they work properly.
The calculator must not accept improperly formatted real numbers like 0..0, . , ..5, or …
The calculator must not display numbers that are longer than the current width of the display.
The calculator must not display incorrect results.
The calculator must not print on the console, and must not crash or generate exceptions on input or calculations.

Bonus Tasks

Bonus 1 (0.5%)

Incorporate a progress bar in the Calculator splash screen. The progress bar should initially read "Please wait…Loading Calculator", and then show growing color bar. See HybridAct#6 for details of how to work with progress bars. Create an internal delay in your splash screen class.

Bonus 2 (0.5%)

According to the assignment specifications in order to change the operational mode of the calculator from Float (which is the default mode) to integer (Hex) the user must click on the **[Hex] checkbox** once. Then if the user wants to return back to the floating-point mode, the user must click on one of the precision radio buttons. The design specification does not indicate what should happen if the user clicks on the checkbox twice or multiple times. The purpose of this bonus task is to rectify this situation.

Modify your event handling code so that the calculator works as specified before but additionally if the user clicks on the checkbox (the calculator goes into integer(Hex) mode) and immediately clicks the checkbox again, the checkbox becomes unchecked, the mode returns back to floating-point, and the precision radio **.00 button** becomes selected. If the checkbox is clicked for the third time the calculator returns to integer (Hex) mode.
Note: Currently only four components are available to the Controller inner class - *JTextField display1 and display2*, *JLabel error* and *JButton dotButton*. You may need to add some more.

Bonus 3 (2.0%)

Make the calculator accept keyboard input alongside with the mouse input. The text fields must stay disabled i.e. it must not accept keyboard directly. The get credit for this bonus you must use a KeyEvent and must register a Key Listener. Both the numeric keys and the numeric keypad must work. Also, the Backspace key, the Enter key, the = key, and the /(slash) key must be operational. You have to designate keys for mode, precision, clear, and ± operations. The designated keys must be well documented in your submission (provide a README file). The KeyEvent handler must be a private inner class.

NOTE***: In order to receive credit for the bonus tasks your calculator must comply with the Requirements Specification and it must pass at least 20 of the checkpoints (see the Marking Sheet).***

What to Submit:

Paper submission:

No paper submission is required for this assignment

Code submission:

Compress in one **.zip** file all **.java** files, **.class** files, and **image** file(s), and README file for Bonus 3 if implemented**.** Use the **Assignment 1 Part 2** upload link in the **Assignment** folder and upload the submission ***zip*** file on Brightspace prior to or on the due date. The name of the zip file must have the following structure: Student's family name followed by the last three digits of the student ID number followed by _JAP_A1P2 , and finally, followed by your lab section number (for example s301, s302 and so on). For example, *Ranev007_JAP_A1P2_s301.zip*.

The submission must follow the course submission standards. The ***Assignment Submission Standard*** and the ***Assignment Marking Guide*** are posted on Brightspace in the Course Information folder. Test Plan is not required for this assignment.

Enjoy the assignment. And do not forget that:

"2 + 2 is always 4 except early in the morning." Anonymous Swing Programmer

CST8221 –JAP, 21 January 2020, S^R