EECS 348 Group 10

Web Calculator for University of Kansas Students

User's Manual

Version 1.0

Revision History

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Test Case

1. Purpose

This document provides guidance and instruction on how to utilize the web calculator designed for University of Kansas students. With this document, the functionalities and services of this software are made open and accessible to its users.

2. Introduction

This software provides a web interface in the display of a traditional calculator, consisting of a display screen and series of buttons for numbers, operations, and possible commands. It has the functionalities of an integer calculator. The purposes for each of these features are as follows:

Featured Buttons

The buttons featured on this calculator correspond to the numbers 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, mathematical operations +, -, /, *, ^, %, opening and closing parentheses ( ), and the = command and C command. Below contains a detailed description of each button and its symbol, as well as the corresponding keyboard command to press the button. Each button may also be pressed by using the device cursor to click it.

Symbol	Description	Keyboard Command
0	Corresponds to the number 0.	0
1	Corresponds to the number 1.	1
2	Corresponds to the number 2.	2
3	Corresponds to the number 3.	3
4	Corresponds to the number 4.	4
5	Corresponds to the number 5.	5
6	Corresponds to the number 6.	6
7	Corresponds to the number 7.	7
8	Corresponds to the number 8.	8
9	Corresponds to the number 9.	9
+	Corresponds to the operation of addition. This is used when computing the sum.	+
-	Corresponds to the operation of subtraction and the negation of an integer. This is used when computing the difference or representing a negative number.	-
/	Corresponds to the operation of division. This is used when computing the quotient. Because this is an integer calculator, this operation will return the integer representation of the quotient.	/
*	Corresponds to the operation of multiplication. This is used when computing the product.	*

%	Corresponds to the modulus operation. This is used when computing the modulus.	%
^	Corresponds to the exponentiation operation. This is used when computing the power. Because this is an integer calculator, when taking a negative exponent, the integer representation of this operation will return.	^
(	Corresponds to an opening parenthesis. This is used to specify the ordering of an operation.	(
)	Corresponds to a closing parenthesis. This is used to specify the ordering of an operation.	)
=	Corresponds to the equals operation. This is used to return the output of the inputted expression.	=
C	Corresponds to the Clear command. This will clear the current items shown in the display.	esc

Display
The display, located at the top of the calculator, is provided as a visual for the user both when inputting their input and obtaining its output. When inputting, the display will show the symbols corresponding to the user input as the button for any number or operator is pressed, eventually displaying the full, mathematical expression inputted by the user. Similarly, when the user uses the = button, the corresponding output for the provided user inputted mathematical expression will display. To clear the contents of the display, the C button should be pressed. Note that the delete key on the keyboard may also be utilized with its known functionality and purpose when entering an expression.

The purpose of this software is to provide users with an interactive, visual calculator, providing the solutions and outputs of different types of mathematical operations and expressions, with the enforcement of the standard order of operations defined under PEMDAS.

As the web app is published to DigitalOcean, users are able to go to a URL to use the calculator interface. To do this, a user should enter the IP address, http://137.184.123.158:3000, in a browser on their device. A user may also set up the project for themselves by cloning the repository (GitHub link) and following the README in the repo to build and run the project.

3. Getting started

Once the calculator interface is navigated to, either through building and running the project from the GitHub repository or entering the provided IP address in the browser, a calculator display should appear on the screen of the device. Now, it is ready to be utilized by the user through the following steps:

1. Enter the mathematical expression symbol by symbol to the calculator, either through pressing/clicking the buttons (depending on what device you are using) or using your device's keyboard. Refer to the *Introduction* section for more details on each button and its functionalities.

2. Once the expression is entered, you should see the full input on the display. Next, to evaluate the inputted expression, press the button with the = symbol, either through pressing/clicking the button or using your keyboard.

3. After activating the button with the = symbol, the output of your inputted mathematical expression should appear on the display. You have now successfully used the calculator to evaluate an expression. To clear the contents of the display, navigate to the button with the C symbol. Refer to the *Introduction* section for more details on each button and its functionalities.

4. Advanced features

An advanced feature of this software is extra options available for user interaction with the calculator. With the web interface, users are able to enter input through numbers, operands, and expressions through both the visual buttons provided by the web interface as well as the keyboard on the user's device. Further, keyboard keys may also be used for buttons that correspond to commands on the calculator, such as using the escape key to clear and pressing = to evaluate the inputted expression. Another familiar component of a keyboard that extends into this interface is the delete key. This key may be utilized as it would in any other context for deleting parts of an expression to be inputted. The additional duality that comes with this advanced feature allows the software to be more user-friendly, accessible, and flexible.

5. Troubleshooting

Negation
A number preceded by more than one negation must be inputted using parentheses. Meaning, for example, -- 3 should be inputted as -(-3). Without the use of parentheses, the calculator reads the first negation as missing a number and will output an ERROR message. This means that this error should only occur if there is no other integer in the mathematical expression. Therefore, it is important to utilize parentheses when performing a negation like this.

Multiplication
It is important to know that in order to use the multiplication operation, the corresponding symbol for the operation, *, must be used in the expression. This means using only parentheses to indicate a coefficient is not an indication of the multiplication operation. Meaning, for example, 3(7) will return an ERROR message as the calculator does not detect an operand, and instead, this expression should be entered as 3 * 7. Therefore, it is important to correctly indicate the operation of multiplication using the * symbol as indicated in the *Introduction* section.

Extreme Values
Because of overflow, extreme values in this calculator may not result in the appropriate expected output. This puts a limit on the functionalities this calculator has when dealing with extreme values. Refer to the *FAQ* section for more details.

6. Examples

To use this software to evaluate different types of arithmetic expressions, follow along the sections in this User Manual. Here are some example procedures of using this software to evaluate certain expressions:

Addition:
To calculate the sum between two numbers, enter the first integer, press the + button, and enter the next integer. Keep proceeding by activating the + button and following with the next integer in the expression until all parts of the expression are entered. Once the expression is completed, press the = button.
EXAMPLE: 3 + 9 + 11

1. Press buttons for 3, +, 9, +, and 11 respectively
2. Press button for =
   OUTPUT: 26

Subtraction:

To calculate the difference between two numbers, enter the first integer, press the - button, and enter the next integer. Keep proceeding by activating the - button and following with the next integer in the expression until all parts of the expression are entered. Once the expression is completed, press the = button.
EXAMPLE EXPRESSION: 14 - 2 - 0 - 10

1. Press buttons for 14, -, 2, -, 0, -, and 10 respectively
2. Press button for =
   OUTPUT: 2

Multiplication:
To calculate the product between two numbers, enter the first integer, press the * button, and enter the next integer. Keep proceeding by activating the * button and following with the next integer in the expression until all parts of the expression are entered. Once the expression is completed, press the = button.
EXAMPLE EXPRESSION: 4 * 3 * 11

1. Press buttons for 4, *, 3, *, and 11 respectively
2. Press button for =
   OUTPUT: 132

Division:
To calculate the quotient between two numbers, enter the first integer, press the / button, and enter the next integer. Keep proceeding by activating the / button and following with the next integer in the expression until all parts of the expression are entered. Once the expression is completed, press the = button. Note that because this calculator is an integer calculator, this operation will return the integer representation of the quotient.
EXAMPLE EXPRESSION: 18/6

1. Press buttons for 18, /, and 6 respectively
2. Press button for =
   OUTPUT: 3

Modulus:
To calculate the modulus of a number, enter the first integer, press the % button, and enter the next integer in the modulus statement. Keep proceeding by activating the % button and following with the next integer in the expression until all parts of the expression are entered. Once the expression is completed, press the = button.
EXAMPLE EXPRESSION: 19%7

1. Press buttons for 19, %, and 7 respectively
2. Press button for =
   OUTPUT: 5

Exponentiation:
To calculate the power of a number, enter the first integer, which should be the base, press the ^ button, and enter the next integer, which should be the exponent. Keep proceeding by following the integer base with activating the ^ button and then proceeding with the integer exponent. Once all parts of the expression are entered, press the = button. Note that because this calculator is an integer calculator, this operation will return the integer representation of the exponentiation.
EXAMPLE EXPRESSION: 6^2

1. Press buttons for 6, ^, and 2 respectively
2. Press button for =
   OUTPUT: 36

Order of Operations:
To calculate an expression with a specified order of operations, input the expression using parentheses as the enforcement of PEMDAS will follow through on the calculator. Start each part of the expression to be ordered with an opening parenthesis and be sure to end the part accordingly with a closing parenthesis. Follow this procedure for any other parts in the mathematical expression needing the parentheses to specify the order of operations according to PEMDAS.

EXAMPLE EXPRESSION: (8+2) * (9 - 6) + 4

1. Press buttons for (, 8, +, 2,), *, (, 9, -, 6,), +, and 4 respectively
2. Press button for =
   OUTPUT: 34

Negation:
To calculate the negation of an integer, press the negation button - and proceed with the integer that is to be negated. Note that if this integer is already negative, it should be enclosed in parentheses. Refer to the *Troubleshooting* section for more details.
EXAMPLE EXPRESSION: -(-3)

1. Press buttons for -, (, -, 3, and) respectively
2. Press button for =
   OUTPUT: 3

7. Glossary of terms

Interface: an interface is the point of exchange of information between different components of an application or system. In this context, the interface represents the connection and communication between the web calculator and the calculator C++ program it utilizes.

IP address: an IP address is the unique address in the form of a string of numbers used to identify a device that uses the internet. In this context, the IP address of this web calculator is used to navigate to the application.

Repository: the GitHub repository is a place where all the files and code for an application are stored, providing services for developers through revision history and collaboration. In this context, the GitHub repository for this application is made available for users to build it using the files for this project.

8. FAQ

What device is this software available on?

This software should be compatible with any device where a browser could be navigated to, such as a phone, tablet, and computer. Refer to the *Introduction* section to see more details on how to start the web calculator on your device.

What are the limitations to this calculator?

Because this is an integer calculator, there are some limitations that come with this. As elaborated in the *Troubleshooting* and *Introduction* section, the output of operations division and modulus will be corresponding integer representation of the evaluated expression. This is important to consider for expressions that result in decimal/fractional values, such as remainders in division and using negative exponents.

Another limitation of this calculator is the case of dealing with extreme values. Due to overflow, operations involving extreme values may pose issues to getting the expected output in this calculator. For example, an operation such as 10^10 will output what appears to be a random large number that does not correspond to the expected output. As stated, this is an issue due to overflow, and thus the use of this calculator should be limited to integer values in range.