EfCalc Pro - User's Manual

A Basic Scientific Calculator

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PyCalc Pro - A Python-based Scientific Calculator

1. Introduction

EfCalc Pro is a fully functional scientific calculator designed to handle both basic arithmetic and advanced scientific operations. With a simple, intuitive interface, it allows users to perform calculations efficiently while offering functionality like trigonometry, logarithms, and memory storage. This calculator is suitable for students, engineers, and anyone who needs a reliable tool for performing mathematical computations.

This manual should help users navigate the features of **EfCalc Pro**. With support for both basic and advanced operations, this calculator is equipped to handle everyday calculations and more specialized scientific computations.

2. User Interface

The EfCalc Pro interface is composed of the following sections:

- **Display Panel**: The top area shows your input and results.
- **Keypad**:
    - **Number Pad**: Buttons for digits (0–9) and the decimal point (.)
    - **Arithmetic Operators**: `+`, `-`, `*`, `/`, `=`
    - **Parentheses and Grouping Symbols**: `( )`, `{}`, `[]`
    - **Scientific Functions**: `sin`, `cos`, `tan`, `log`, `sqrt`, `exp`, etc.
    - **Constants**: `π (pi)`, `e`
    - **Memory Functions**: `M`, `M+`, `M-`
    - **Utility Buttons**: `ANS`, `CLR`, `CE`, `EXE`

3. Basic Operations

Performing Basic Arithmetic:

- **Addition (+)**: Adds two or more numbers. Example: `5 + 3 = 8`
- **Subtraction (-)**: Subtracts one number from another. Example: `10 - 2 = 8`
- **Multiplication (*)**: Multiplies numbers. Example: `6 * 7 = 42`
- **Division (/)**: Divides one number by another. Example: `20 / 4 = 5`

Decimal Point (.):

- Use the decimal point button to enter numbers with fractional parts. Example: `3.14`

Equals (=):

- After entering your expression, press the `=` button to calculate the result. Alternatively, you can press `EXE` to evaluate the expression.

4. Scientific Operations

Trigonometric Functions:

- **sin(x)**: Calculates the sine of angle `x` (in radians).
- **cos(x)**: Calculates the cosine of angle `x` (in radians).
- **tan(x)**: Calculates the tangent of angle `x` (in radians).
    - **Note**: For trigonometric operations, make sure to input angles in radians. You can convert degrees to radians by multiplying by π/180.

Logarithmic Functions:

- **log(x)**: Calculates the base-10 logarithm of `x`. Example: `log(100) = 2`

Square Root:

- **sqrt(x)**: Calculates the square root of `x`. Example: `sqrt(16) = 4`

Exponential Functions:

- **exp(x)**: Calculates the value of `e^x`. Example: `exp(1) = 2.71828`

Power/Exponentiation:

- ^: Raises a number to a power. Example: `2 ^ 3 = 8` (Note: this is equivalent to `2 ** 3` in Python).

Absolute Value:

- **abs(x)**: Calculates the absolute value of `x`. Example: `abs(-5) = 5`

Constants:

- **π (pi)**: Inserts the value of π (3.14159) into the display.
- **e**: Inserts the value of Euler's constant `e` (2.71828) into the display.

5. Memory Functions

EfCalc Pro provides memory functionality to store and recall values during calculations.

- **M**: Stores the current displayed value in memory.
- **M+**: Adds the displayed value to the current memory value.
- **M-**: Subtracts the displayed value from the current memory value.

Example of Memory Usage:

1. Type `5` and press `M`. The number 5 is stored in memory.
2. Type `3` and press `M+`. The memory now stores `5 + 3 = 8`.
3. Type `4` and press `M-`. The memory now stores `8 - 4 = 4`.

6. Special Features

ANS Button:

The **`ANS`** button retrieves the last calculated result. This allows you to use the previous answer in a new calculation.

Example:

1. Calculate `5 + 3` (Result = 8).
2. Press `ANS` and then `* 2`. The result will be `8 * 2 = 16`.

Grouping Symbols:

- **Parentheses `()`**: Use for grouping expressions to control the order of operations. Example: `(2 + 3) * 4 = 20`
- **Square Brackets `[]` and Curly Braces `{}`**: These work similarly to parentheses but are used for more complex expressions that involve multiple levels of grouping.

Clear Functions:

- **CLR**: Clears the entire display.
- **CE**: Clears the last character entered.

7. Examples of Usage

1. **Basic Arithmetic**:
    - **Input**: `5 + 3 * 2 =`
    - **Output**: `11` (Multiplication happens before addition).
2. **Using Trigonometric Functions**:
    - **Input**: `sin(30 * pi / 180) =`
    - **Output**: `0.5` (Convert degrees to radians using `π/180`).
3. **Exponential Calculations**:
    - **Input**: `exp(1)`
    - **Output**: `2.71828` (This is `e^1`).
4. **Memory Usage**:
    - **Step 1**: Type `5` and press `M`. Memory now contains `5`.
    - **Step 2**: Type `4` and press `M+`. Memory now contains `9`.
    - **Step 3**: Press `ANS` after calculating a new result to use the stored value.

8. Troubleshooting

- **Error Message**: If an invalid operation is performed (e.g., dividing by zero), "Error" will appear on the display. Press `CLR` to reset the display.
- **Unexpected Results**: Ensure you are inputting values correctly, especially when using radians for trigonometric functions.

- **ANS Not Working**: Make sure you've performed a previous calculation before pressing `ANS`.

Updates

Version 4.3
GUI Framework: PyQt5

About the update and EfCalc

EfCalc is a versatile **scientific calculator** designed to mimic the functionality of popular scientific calculators such as the **Texas Instrument TI-84 Plus Silver Edition**. While it does not include all the features of those devices, it provides a comprehensive set of **scientific functions**, **memory storage**, and an **alphabet mode** for basic calculations. The new updates required a rewite. This version, **4.3**, is the final release, following multiple iterations from version 1.0 to 4.3. This manual explains how to use all the functions and features in **EfCalc**.

Getting Started

1. **Launching EfCalc**:
    - Upon launching the program, you will be presented with the **calculator interface** featuring a numerical display at the top and a **grid of buttons** for performing calculations.
2. **Basic Usage**:
    - Type numbers and mathematical expressions using the buttons on the calculator.
    - The result will be displayed after pressing the **=** or **EXE** buttons.

Main Features Overview

1. **Day/Night Mode**:
    - The **View Menu** allows you to toggle between **Day Mode** and **Night Mode** for better visibility in different lighting conditions.
    - In **Night Mode**, the display and buttons turn darker with **light-green accents** for easier reading in low-light environments.
    - To switch back to **Day Mode**, simply click the **Toggle Day/Night Mode** option again. The button labels and display contents are preserved when switching modes.
2. **Alphabet Mode**:
    - Click the **Alpha** button to enter **Alphabet Mode**, allowing you to input letters instead of numbers.
    - Use the **Shift** button to toggle between **lowercase** and **uppercase** letters while in **Alphabet Mode**.
    - To return to calculator mode, click the **Calc** button, which appears in **Alphabet Mode** where the **Alpha** button was.

Memory Functions

EfCalc supports basic memory functions for storing and recalling values. These functions work as follows:

- **M**: Stores the current number on the display to memory.
- **M+**: Adds the current displayed number to the stored memory value.
- **M-**: Subtracts the current displayed number from the stored memory value.

Undo/Redo Functions

- **Undo**: Reverts the display to the last entered expression. Useful if you make an error during input.
- **Redo**: Redoes the last undone action, allowing you to restore a previously undone input.

Mathematical Functions

EfCalc supports a wide variety of scientific functions that can handle complex calculations.

1. **Trigonometric Functions**:
    - **sin(x)**: Calculates the sine of `x` (in degrees).
    - **cos(x)**: Calculates the cosine of `x` (in degrees).
    - **tan(x)**: Calculates the tangent of `x` (in degrees).
    - **Hyp**: This is for **hyperbolic trigonometric functions**, such as `sinh`, `cosh`, and `tanh`. This button is a placeholder for future updates, but currently, it refers to basic hyperbolic trigonometry.
2. **Logarithmic and Exponential Functions**:
    - **log(x)**: Calculates the base-10 logarithm of `x`.
    - **exp(x)**: Returns the value of `e^x`, where `e` is Euler's number (approximately 2.718).
    - **sqrt(x)**: Returns the square root of `x`.
3. **Constants**:
    - **pi (π)**: Inserts the value of **pi** (3.14159...) into the display.
    - **e**: Inserts the value of **Euler's number** (2.71828...) into the display.
4. **Power and Absolute Functions**:
    - `^` **(Exponentiation)**: Raises a number to a power. For example, `2 ^ 3` will calculate 2 raised to the power of 3 (2^3 = 8).
    - **abs(x)**: Returns the absolute value of `x`, which is `x` without regard to its sign (e.g., `abs(-4)` is 4).
5. **Brackets and Parentheses**:
    - **( )**, **[ ]**, and **{ }**: These are grouping symbols that allow you to change the order of operations in complex expressions. The **Calculator** treats expressions inside brackets as priorities, evaluating them first.

Additional Features

1. **Negative Sign**:

    - The **Neg** button toggles the sign of the current number. For example, pressing **Neg** while `5` is on the screen will change it to `-5`.
2. **ANS Button**:
    - The **ANS** button recalls the last result of a calculation, which is useful when performing repeated calculations using the previous answer.

Menu Options

- **File Menu**:
    - **Quit**: Closes the EfCalc application.
- **Edit Menu**:
    - **Copy**: Copies the current display text to the clipboard.
    - **Paste**: Pastes text from the clipboard into the display.
    - **Undo/Redo**: Reverts or restores actions during input.
- **View Menu**:
    - **Toggle Day/Night Mode**: Switches between light and dark themes.
- **Help Menu**:
    - **About**: Displays information about the **EfCalc** version, author details, programming language, and other technical information.

Example Usage

1. **Basic Arithmetic**:
    - To add two numbers, simply input the numbers and press `+`. For example, `5 + 3 =` will output `8`.
2. **Trigonometric Calculation**:
    - To calculate the sine of 30 degrees:
      `sin(30) = 0.5`
3. **Logarithmic Calculation**:
    - To calculate the logarithm of 100:
      `log(100) = 2`
4. **Exponentiation**:
    - To calculate 2 raised to the power of 4:
      `2 ^ 4 = 16`
5. **Using Memory Functions**:
    - Store `12` in memory:
      Input `12`, then press **M**.
    - Add `5` to the memory:
      Input `5`, then press **M+`.
    - Recall the current memory value:
      Press **M** again to see the stored value (`17` in this case, since `12 + 5 = 17`).

Known Limitations

While **EfCalc** covers a wide range of features, it is designed as a simplified version of more advanced calculators like the **TI-84 Plus Silver Edition**. Some advanced features (such as graphing capabilities and complex equation solving) are not available.

My Final Thoughts

EfCalc version **4.3** is a robust, flexible scientific calculator that handles most basic and advanced calculations. It offers a clean, user-friendly interface with powerful functions and modes. This project has been through several iterations, from the original C version 1 to the current Python3 **version 4.3**, and is now finalized for public use.

9. Credits

EfCalc Pro originated as a personal hobby project by Dr. Eric O. Flores, initially developed in C. It was later transformed into Python, utilizing the PyQt5 framework to provide a modern, user-friendly graphical interface. The goal of EfCalc Pro is to offer a versatile and robust tool for both scientific and everyday mathematical calculations, combining power with ease of use. As of this moment I’m alone on this project I’m hoping that other can join me and continue this project.

For feedback, feature requests, or bug reports, please contact **Dr. Eric O. Flores** at eoftoro@gmail.com