Final Project: User Manual

**Introduction**

The Advanced Calculator is a graphical desktop application built with Python and Tkinter. It allows users to perform arithmetic operations, evaluate mathematical functions (e.g., square root, logarithms, trigonometric functions), and review past calculations through a history feature. The application features an intuitive interface with image-based buttons and accessibility support, making it suitable for a wide range of users.

This manual provides step-by-step instructions for installing, using, and troubleshooting the application.

**System Requirements**

To run the Advanced Calculator, ensure your system meets the following requirements:

* Operating System: Windows, macOS, or Linux
* Python Version: Python 3.6 or higher
* Required Libraries:
  + tkinter (usually included with Python)
  + Pillow (for image handling)
* Disk Space: Minimal (a few MB for the application and image files)
* Image Files:
  + calculator.png (icon for the Calculate button)
  + history.png (icon for the History button)
  + These files must be in the same directory as the application script.

**Installation**

Follow these steps to install and set up the Advanced Calculator:

* Install Python:
  + Download and install Python from [python.org](https://www.python.org/downloads/).
  + Ensure the option to add Python to your system PATH is selected during installation.
* Install the Pillow Library:
  + Open a terminal or command prompt and run:

pip install Pillow

* + This installs the Pillow library for image handling.
* Download the Application:
  + Save the calculator script (e.g., calculator.py) to a directory of your choice.
  + Ensure the calculator.png and history.png image files are in the same directory as the script. If these images are unavailable, contact the application provider or use placeholder images (50x50 pixels recommended).
* Verify Setup:
  + Confirm that the script and image files are in the same directory.
  + Ensure Python and Pillow are installed by running:
  + python --version

pip show Pillow

**Getting Started**

To launch the Advanced Calculator:

* Open a terminal or command prompt.
* Navigate to the directory containing calculator.py:

cd path/to/directory

* Run the script:

python calculator.py

* The application window will appear, displaying the calculator interface.

**User Interface Overview**

The main calculator window (400x600 pixels) includes the following components:

* Title: "Advanced Calculator" displayed at the top.
* Equation Entry Field: A text box labeled "Enter Equation" where you input mathematical expressions.
* Result Display: A label below the entry field showing the result (initially "0") or "Error" for invalid inputs.
* Buttons:
  + Calculate: Computes the entered equation (icon: calculator image).
  + History: Opens a window showing past calculations (icon: history image).
  + Exit: Closes the application.
* History Window (accessible via the History button):
  + Displays a list of previous calculations.
  + Includes a "Back to Calculator" button to return to the main window.

**Using the Calculator**

1.1 Entering Equations

* Click the "Enter Equation" text box.
* Type a mathematical expression using:
  + Numbers (e.g., 123, 3.14)
  + Operators: +, -, \*, /, ^ (exponentiation), % (modulo)
  + Parentheses: ( and )
  + Mathematical functions (see Section 6.2)
* Press the Calculate button or hit Enter to evaluate the equation.
* The result appears in the "Result" field, formatted to four decimal places (e.g., 3.1416).

Example:

* Input: 2 + 3 \* 4
* Result: 14.0000
* Input: sin(pi / 2)
* Result: 1.0000

1.2 Supported Operations and Functions

The calculator supports the following:

* Arithmetic Operators:
  + Addition (+)
  + Subtraction (-)
  + Multiplication (\*)
  + Division (/)
  + Exponentiation (^)
  + Modulo (%)
* Mathematical Functions:
  + sqrt(x): Square root of x (e.g., sqrt(16) = 4.0000)
  + log(x): Natural logarithm of x (e.g., log(2.7183) ≈ 1.0000)
  + sin(x): Sine of x (x in radians, e.g., sin(pi) ≈ 0.0000)
  + cos(x): Cosine of x (x in radians, e.g., cos(0) = 1.0000)
  + tan(x): Tangent of x (x in radians, e.g., tan(pi/4) ≈ 1.0000)
* Constants:
  + pi: Mathematical constant π (≈ 3.1416)

Notes:

* Use lowercase for function names (e.g., sin, not SIN).
* Ensure proper syntax, such as parentheses for functions (e.g., sqrt(9), not sqrt 9).
* Invalid inputs (e.g., 1/0, log(-1)) will display an error message.

1.3 Viewing Calculation History

* Click the History button.
* A new window (300x400 pixels) titled "Calculation History" opens, showing a list of past calculations in the format:

equation = result

Example:

2 + 3 \* 4 = 14.0000

sin(pi / 2) = 1.0000

* Scroll through the list to review calculations.
* Click Back to Calculator to return to the main window.

Note: The history persists only during the current session and is cleared when the application closes.

1.4 Exiting the Application

* Click the Exit button.
* A confirmation dialog appears: "Are you sure you want to exit?"
* Click Yes to close the application or No to return to the calculator.

**Accessibility Features**

The Advanced Calculator includes accessibility support for users with visual impairments:

* Button Alternate Text:
  + The Calculate button has alternate text: "Calculator Icon."
  + The History button has alternate text: "History Icon."
* These descriptions are available to screen readers, ensuring compatibility with assistive technologies.
* The interface uses clear, high-contrast fonts (Arial, size 10–16) for readability.

**Troubleshooting**

|  |  |
| --- | --- |
| **Issue** | **Solution** |
| Application fails to start with an error about  Pillow  . | Install Pillow using  pip install Pillow  . |
| Error: "Failed to load images." | Ensure  calculator.png  and  history.png  are in the same directory as  calculator.py  . Verify the files are not corrupted. |
| "Invalid characters in equation" error. | Check your input for unsupported characters (e.g., letters, special symbols). Use only numbers, operators, parentheses, and supported functions (see Section 6.2). |
| "Invalid equation" error. | Verify syntax (e.g., balanced parentheses, valid function arguments). Examples: Use  sqrt(4)  , not  sqrt 4  ; avoid  1/0  or  log(-1)  . |
| History window is empty. | The history is empty until you perform calculations in the current session. |
| Application window is unresponsive. | Close the application and restart. Ensure your system has sufficient memory. |
| Accessibility features not working. | Confirm your screen reader is configured to read Tkinter applications. Test with a compatible reader (e.g., NVDA on Windows). |