Programming 2
Assignment 2

CALCULATOR

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1.Calculator Layout

Display Screen

- **Description**: The main screen where numbers, calculations, and results are displayed.

- **Usage**: Shows the current input and any ongoing calculations. When an operation is performed, the result is displayed here.

Operation Buttons

- **Unary Operations**: Operate on a single number.

  o **⅟x (Reciprocal)**:

    ▪ **Description**: Calculates the reciprocal of a number (1 divided by the number).

    ▪ **Usage**: Enter a number, then press ⅟x to get its reciprocal.

  o **x^2 (Square)**:

    ▪ **Description**: Squares the current number (multiplies it by itself).

    ▪ **Usage**: Enter a number, then press x^2 to square it.

  o **√x (Square Root)**:

    ▪ **Description**: Calculates the square root of a number.

    ▪ **Usage**: Enter a number, then press √x to find its square root.

  o **% (Percentage)**:

    ▪ **Description**: Finds a percentage of the current number in relation to a previous number.

    ▪ **Usage**: Used after entering two numbers with a binary operator (e.g., 50 × 10 % gives 5 as the result).

  o **± (Sign Toggle)**:

    ▪ **Description**: Toggles the sign of the current number between positive and negative.

    ▪ **Usage**: Enter a number, then press ± to change its sign.

- **Binary Operations**: Operate on two numbers.

  o + (**Addition**):

    ▪ **Description**: Adds two numbers.

    ▪ **Usage**: Enter the first number, press +, enter the second number, then press = to get the result.

  o - (**Subtraction**):

    ▪ **Description**: Subtracts one number from another.

    ▪ **Usage**: Enter the first number, press -, enter the second number, then press = to get the result.

  o × (**Multiplication**):

    ▪ **Description**: Multiplies two numbers.

    ▪ **Usage**: Enter the first number, press ×, enter the second number, then press = to get the result.

  o ÷ (**Division**):

    ▪ **Description**: Divides one number by another.

    ▪ **Usage**: Enter the first number, press ÷, enter the second number, then press = to get the result.
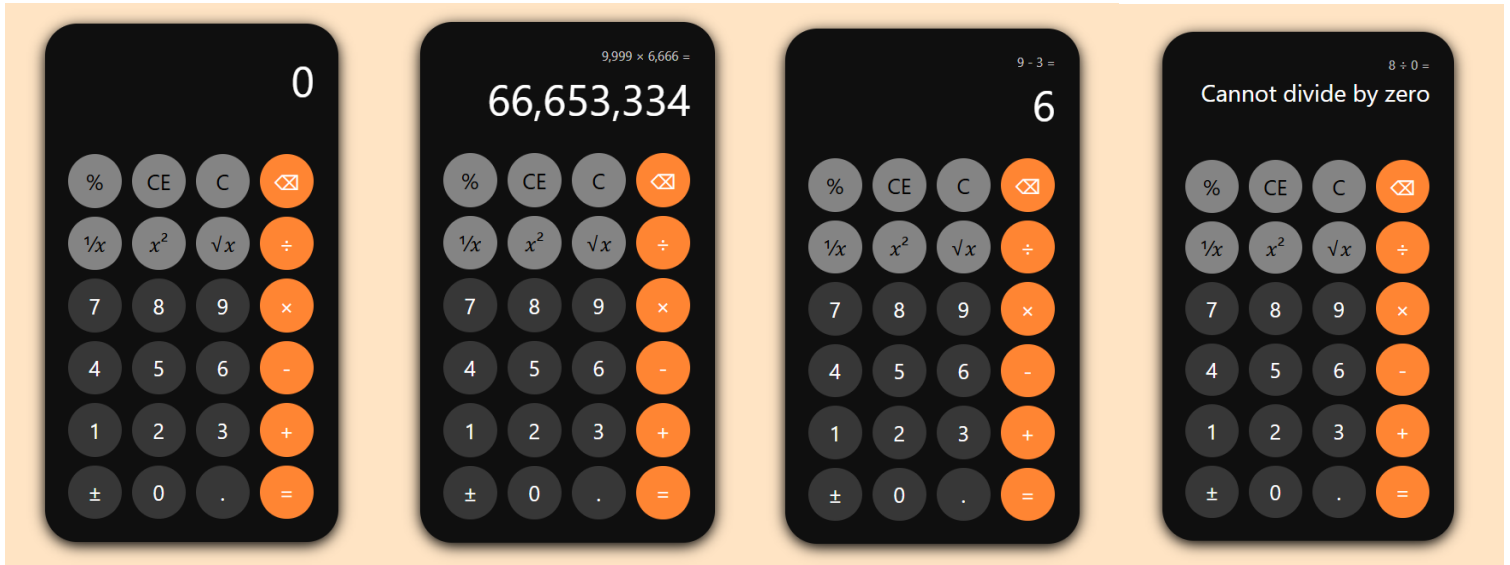
Number Buttons (0-9)

- **Description**: Buttons labeled from 0 through 9.

- **Usage**: Used to enter numbers into calculations. Pressing these buttons will display the corresponding number on the screen.

Backspace Button (⌫)

- **Description**: Deletes the last digit entered.

- **Usage**: If a mistake is made while entering a number, press ⌫ to remove the last digit.

Here's a detailed breakdown of each component in the **Microsoft Calculator Standard Mode** interface, along with its function and usage:

User Interface:

0

9,999 × 6,666 =

66,653,334

9 - 3 =

6

8 ÷ 0 =

Cannot divide by zero

% | CE | C | ⌫
¹⁄x | x² | √x | ÷
7 | 8 | 9 | ×
4 | 5 | 6 | -
1 | 2 | 3 | +
± | 0 | . | =

Features:

1. Comma-Separated Display for Operands

- **Description**: Numbers are displayed with commas as thousands separators for easier readability.

- **Usage**: As you type numbers, the Calculator automatically formats them with commas, e.g., entering 1000000 shows as 1,000,000.

2. Previous Operand and Operation Display

- **Description**: The Calculator shows the last operand and operation above the main display, like the Microsoft Calculator.

- **Usage**: When performing calculations, the previous operand and the chosen operation (like +, -, ×, or ÷) are displayed above the current input. This helps keep track of multi-step calculations and provides context for the ongoing operation.

3. Division by Zero Error Handling

- **Description**: The Calculator detects attempts to divide by zero and displays an error message.

- **Usage**: If a user tries to divide any number by zero, the Calculator displays an error (e.g., "Cannot divide by zero") instead of attempting the calculation, which prevents undefined results.

4. Overflow Error Handling

- **Description**: The Calculator handles overflow errors for extremely large numbers, with a maximum limit of $9.999999999999 \times 10^{1000}$.

- **Usage**: If a calculation exceeds this maximum limit, the Calculator will display an overflow error message. This ensures calculations remain within manageable and displayable ranges.

5. Square Root of Negative Number Error Handling

- **Description**: The Calculator displays an error when attempting to take the square root of a negative number.

- **Usage**: If a user enters a negative number and tries to apply the square root operation, the Calculator will show an error message (e.g., "Invalid input") instead of trying to compute a real number result.

How to use with example:

Example Equation

Let's say we want to evaluate the following expression:

$$(15 + 25) * 2 - (50/5) + \sqrt{81}$$

1. **Start with the First Parenthesis**:

    o   Enter 15, then press +, and enter 25.

    o   Press = to get 40.

    o   **Result**: 40.

2. **Multiply by 2**:

    o   With 40 still on the **Display Screen**, press × and then 2.

    o   Press = to get 80.

    o   **Result**: 80.

3. **Subtract Division Result**:

    o   In the **Previous Operand and Operation Display**, 80 is still showing.

    o   Enter 50, then press ÷, and enter 5.

    o   Press = to get 10.

    o   Now enter 80 from the last operation and press – and enter 10

    o   Press = to get 70.

    o   **Result**: 70.

4. **Add the Square Root Calculation**:

    o   With 70 as the current result on the **Display Screen**, enter 81 and press √x to get 9.

    o   Press + and then 9.

    o   Press = to get the final result: 79.

Final Result

$$(15 + 25) * 2 - (50 / 5) + \sqrt{81} = 79$$

- **Previous Operand and Operation Display**: Helps keep track of multi-step calculations.

- **Unary Operations (Square Root)**: Used to calculate √81.

- **Division by Zero Handling**: Although not encountered here, ensures any division is safe.

- **Error Handling**: Overflow and invalid operations are prevented, though they aren't triggered in this example.

This example illustrates how to evaluate complex equations step-by-step, combining addition, multiplication, division, and square root operations while tracking the previous calculations on the display.