

Multi-functional Calculator

Guidebook

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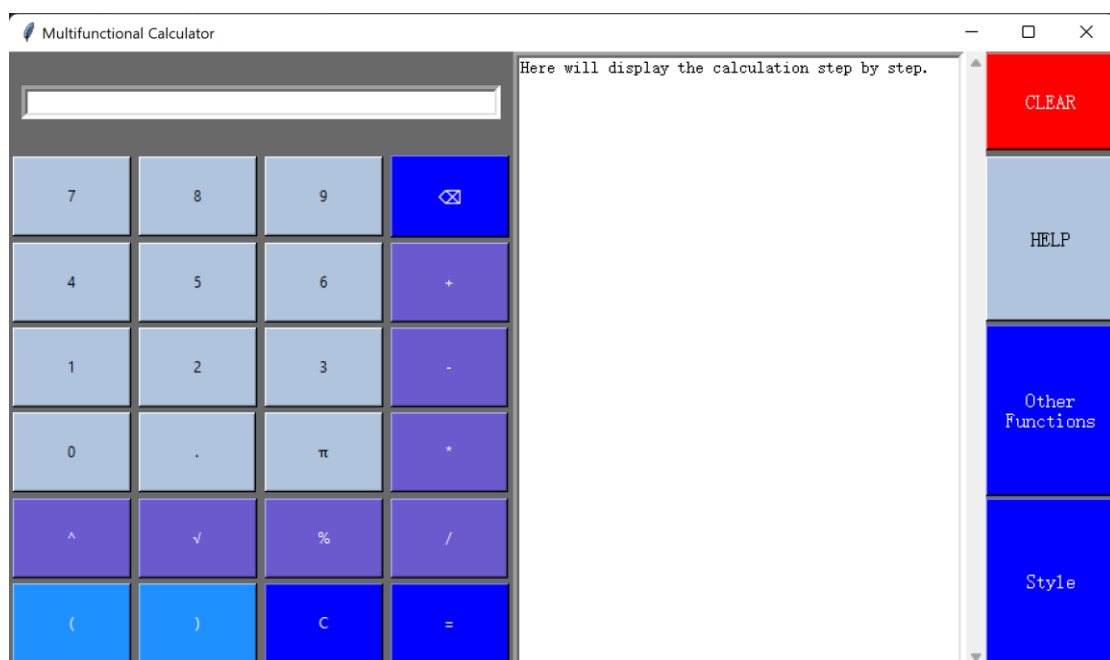
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Functionalities

Basic Arithmetic:

Below is the Basic Arithmetic Window, which is what you first see when running `user_interface.py`.



Click the buttons to enter your expression. As you finish, click “=” to begin calculation.

Any order and combination of addition, subtraction, multiplication, division, power, square root, and mod of any positive,

negative, whole, or decimal numbers are is supported.

If your expression is in the standard form, then the calculation will be displayed step-by-step.

Input:

```
-(52+6)*(2+6%3)+(((56^0)))
```

Output:

```
-(52+6)*(2+6%3)+(((56^0)))  
(Input is standard)  
= -58*(2+6%3)+(((56^0)))  
= -58*(2+0)+(((56^0)))  
= -58*2+(((56^0)))  
= -58*2+1  
= -116+1  
= -115
```

If your expression is not standard, then it will first be standardized into the form that my algorithm can process.

Input:

```
2π√4
```

Output:

```
2 π √ 4  
(Standardized to 2*3.141592653589793√4)  
= 2*3.141592653589793*2  
= 6.283185307179586*2  
= 12.566370614359172
```

Use the red “CLEAR” button at top-right to clear the output window.

Original:

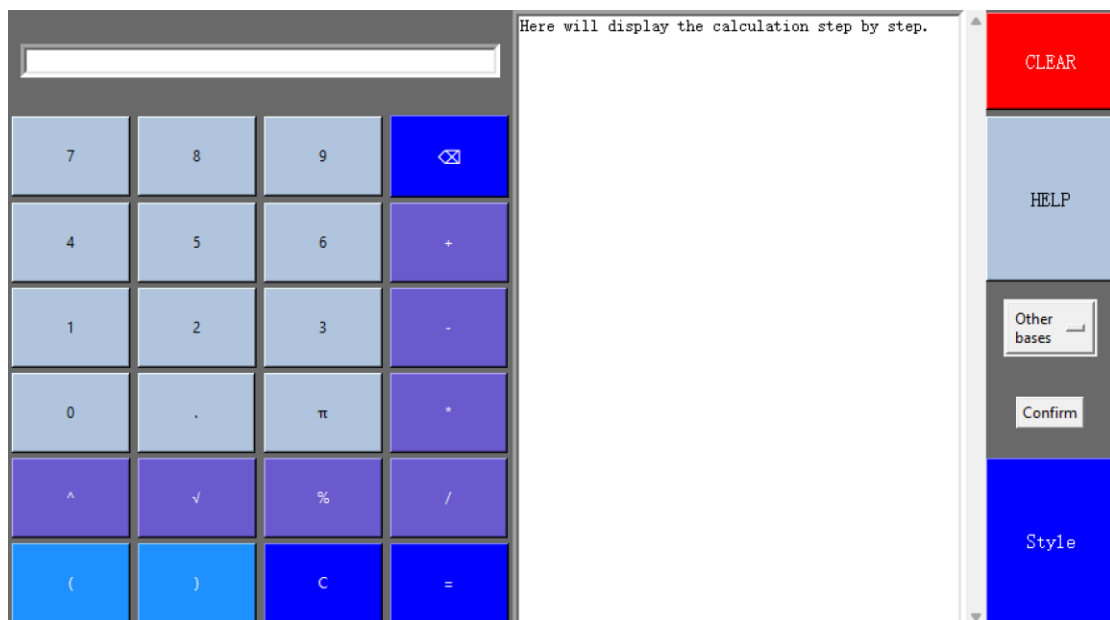
```
2 π √ 4  
(Standardized to 2*3.141592653589793√4)  
= 2*3.141592653589793*2  
= 6.283185307179586*2  
= 12.566370614359172  
  
(((5+3)^6)%2)  
(Input is standard)  
= ((8^6)%2)  
= (262144%2)  
= 0
```

Clicked “CLEAR”:

```
Here will display the calculation step by step.
```

Other Bases:

From the Basic Arithmetic window, click the “Other Functions” button at the right to select the “Other Bases”, and click “Confirm”.



The Other Bases window appears:

Calculations for other bases

Please enter each term with your keyboard

Operation 1: Base Conversion

Num_1 From Base To Base

Convert

Operation 2: Arithmetic in An Arbitrary Base:

Num_1 Operator Num_2 In Base

Calculate

Here will display the calculation step by step.

Operation 1:

The base conversion of a whole number, either positive or negative, from any base to another base.

Input:

Operation 1: Base Conversion

Num_1 From Base To Base

49 10 2

Convert

Output:

```
49 in base 10
= 110001 in base 2
```


Operation 2:

Basic Arithmetic (+, -, *, and /) for any two whole number in any base.

Input:

Operation 2: Arithmetic in An Arbitrary Base:			
Num_1	Operator	Num_2	In Base
67	*	a	16
			Calculate

Output:

```
67*a in base 16  
= 406 in base 16
```

Statistics:

From the Basic Arithmetic window, click the “Other Functions” button at the right to select the “Statistics”, and click “Confirm”.



The Statistics window appears:

Statistics

— □ ×

Output Graph

Will be Displayed

Here

Please enter each term with your keyboard

Operation 1: plot with one-dimensional data

Enter data with space as the delimiter:

Boxplot ▾

draw

Operation 2: plot with two-dimensional data

Enter data with space as the delimiter:

X Entry:

Y Entry:

Scatter Plot ▾

draw

Operation 3: show drawn graphs

There exists no stored graph! ▾

draw

Operation 4: clear all drawn graphs

CLEAR

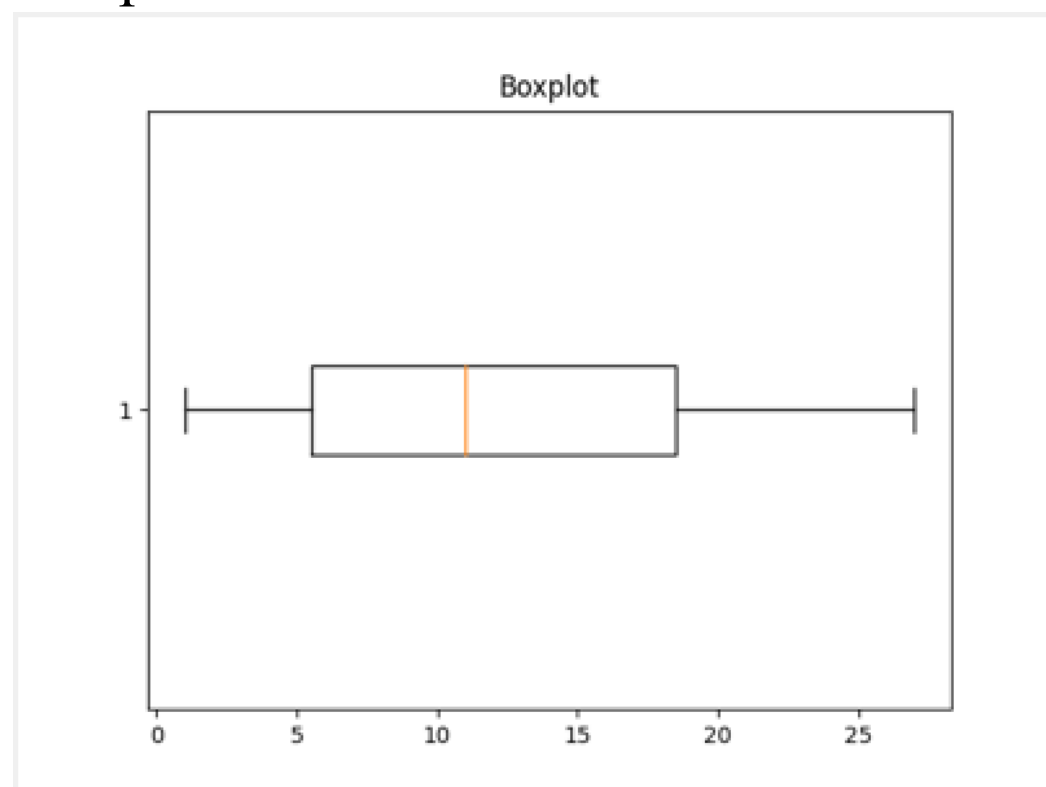
Operation 1:

Plot with one-dimensional data. Supported graph types are boxplot, histogram, and stem-and-leaf plot.

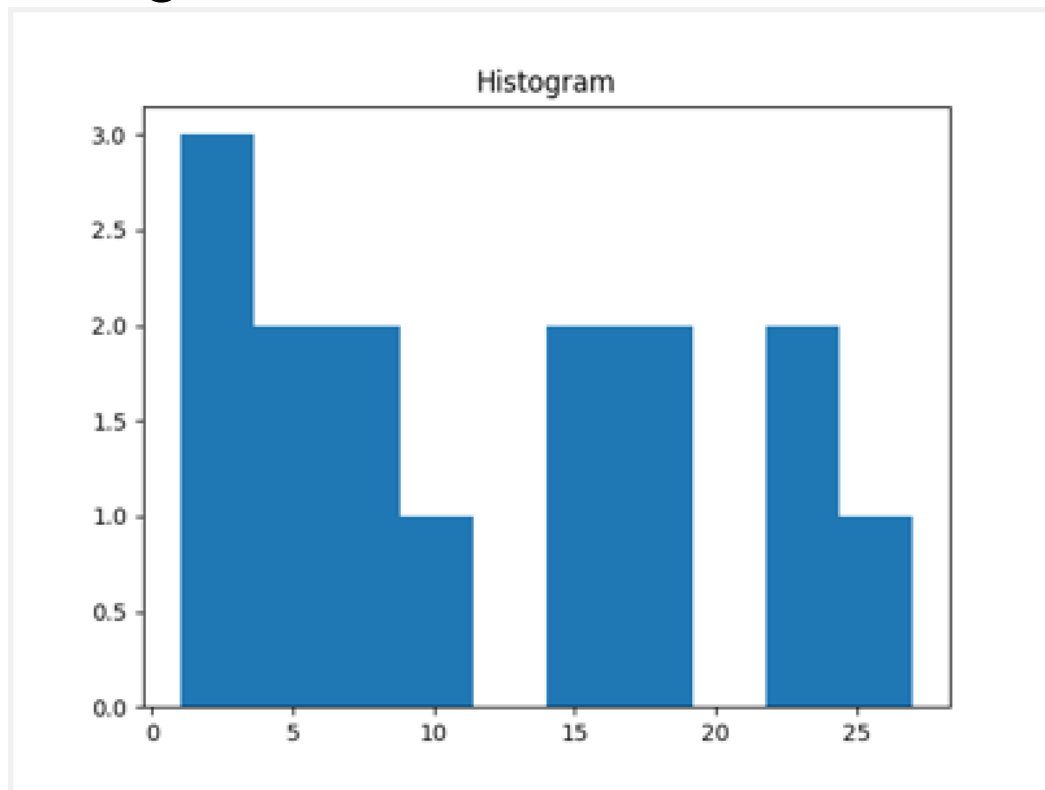
Input:

```
Operation 1: plot with one-dimensional data
Enter data with space as the delimiter:
1 11 2 22 3 5 6 8 14 16 24 7 18 27 19 8
Boxplot ☐ draw
```

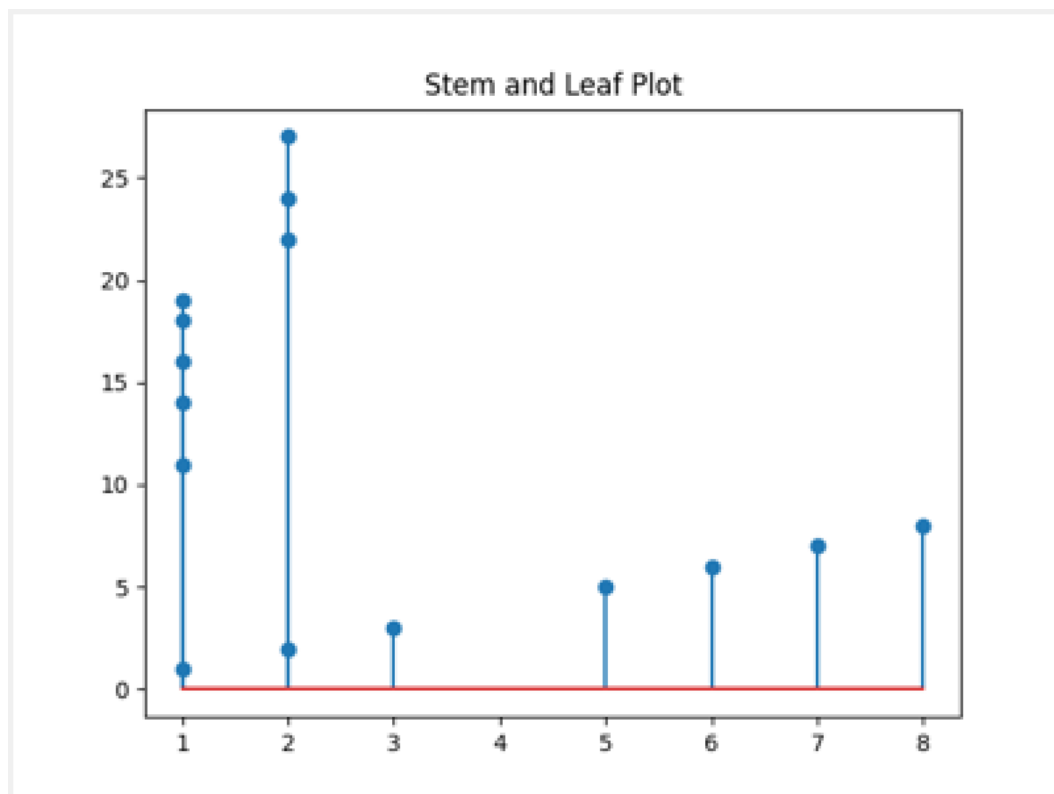
Boxplot:



Histogram:



Stem and Leaf Plot:



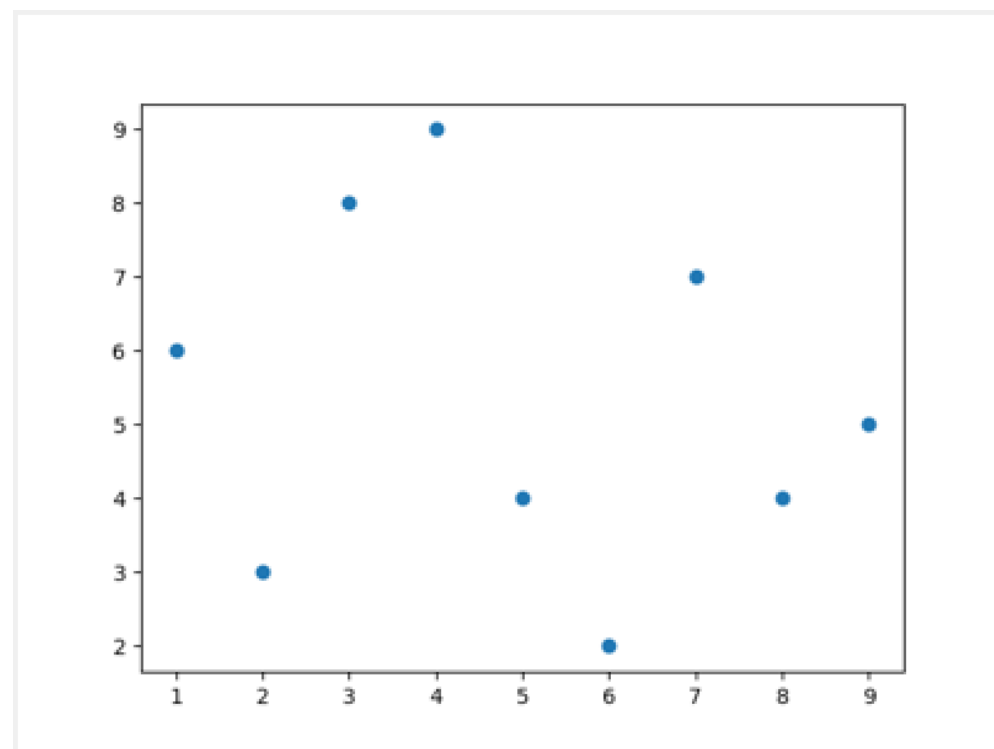
Operation 2:

Plot with two-dimensional data. Supported graph types are scatter plot, line chart, and linear regression graph.

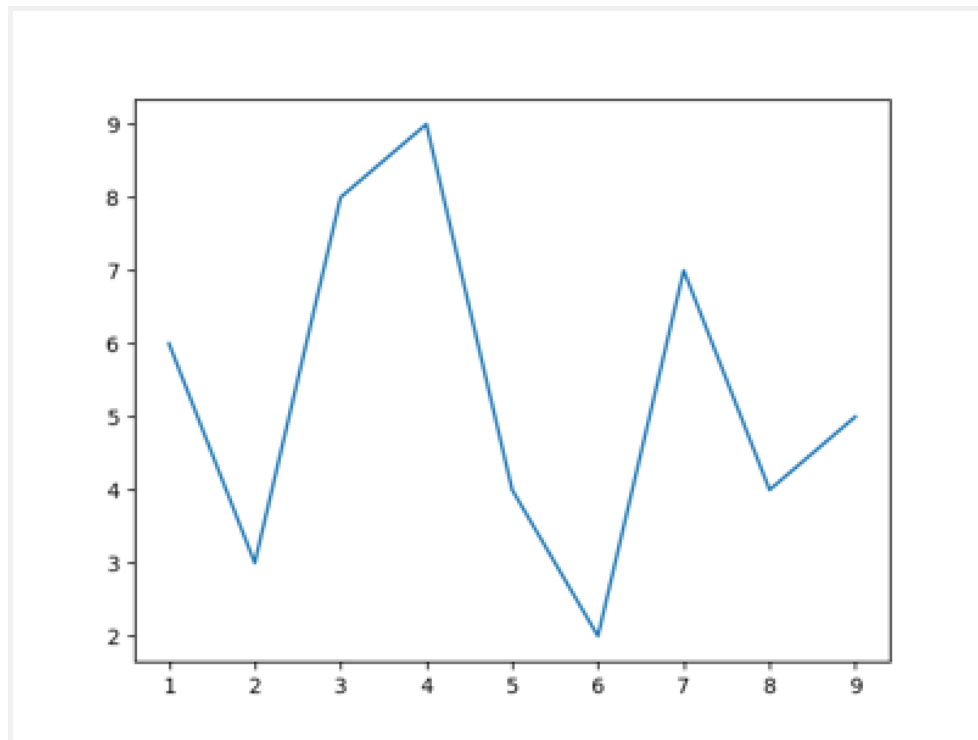
Input:

Operation 2: plot with two-dimensional data	
Enter data with space as the delimiter:	
X Entry:	1 2 3 4 5 6 7 8 9 10
Y Entry:	6 3 8 9 4 2 7 4 5 8
Scatter Plot <input type="checkbox"/>	<input type="button" value="draw"/>

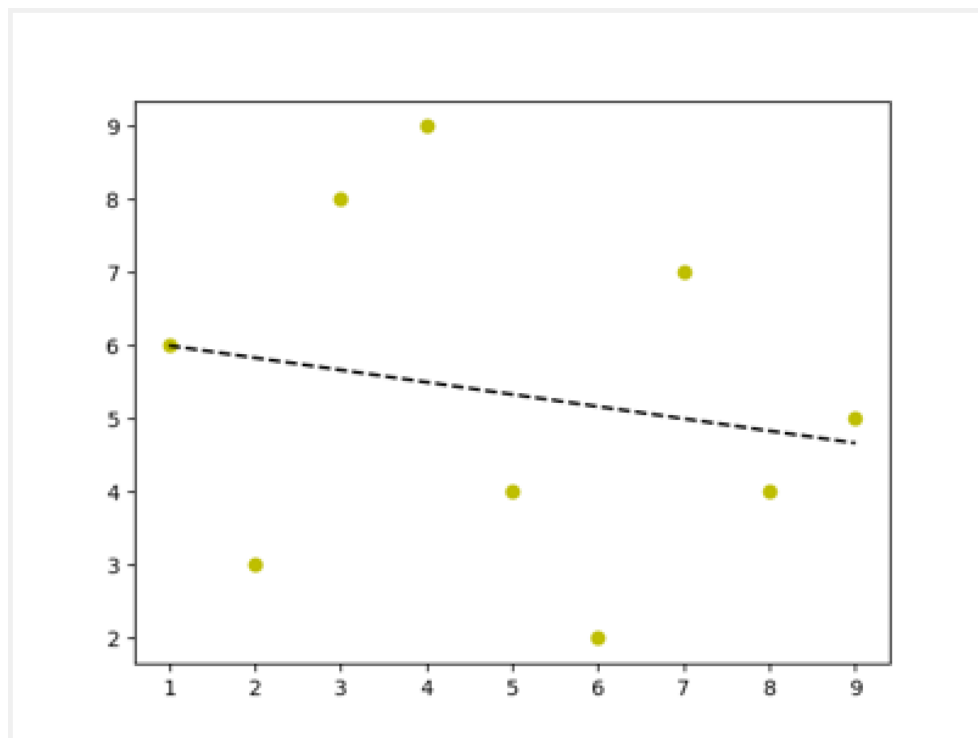
Scatter Plot:



Line Chart:



Linear Regression:



Error Handling

Basic Arithmetic:

If your input cannot be standardized to a form that my algorithm can process, the output window will generate an error message.

1.Number needed error:

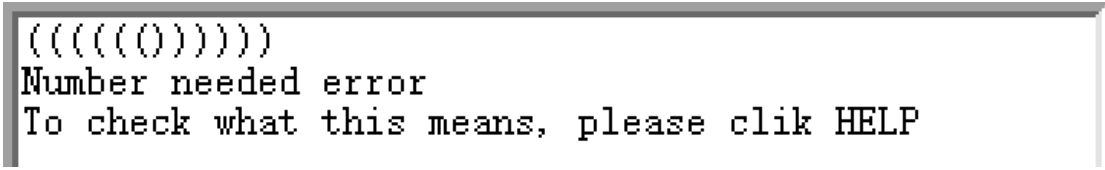
Your expression doesn't contain a number, so there is nothing to calculate.

Input:



```
((((0))))
```

Output:



```
((((0))))  
Number needed error  
To check what this means, please click HELP
```

2.Invalid char error:

It is also okay to type your expression with your computer keyboard. However, if you

type some character that is not recognizable by my algorithm, it will tell you.

Input:

```
56a
```

Output:

```
56a
Invalid char error at position 2
To check what this means, please click HELP
```

3.Bracket error

The number or position of your brackets has some problem.

Input_1:

```
((5+3)*5
```

Input_2:

```
)6+3(
```

Output:

```
((5+3)*5
Bracket error at position 7
To check what this means, please click HELP

)6+3(
Bracket error at position 0
To check what this means, please click HELP
```

4. Too many operators error:

You enter more operators than there should be.

Input:

```
6++3
```

Output:

```
6++3
Too many operators error at position 2
To check what this means, please click HELP
```

Other Bases:

The algorithm only supports whole numbers. If you type a decimal number, you will get an error message.

Input:

Operation 1: Base Conversion		
Num_1	From Base	To Base
5.1	10	2
		<input type="button" value="Convert"/>

Output:

```
5.1 in base 10  
Invalid Input
```

By the definition of base, each base has some valid characters and some invalid ones. If you type an invalid letter for the base you choose, you will get an error message.

Input:

Operation 2: Arithmetic in An Arbitrary Base:			
Num_1	Operator	Num_2	In Base
23g	<div><div>+</div><div>-</div></div>	45	16
			Calculate

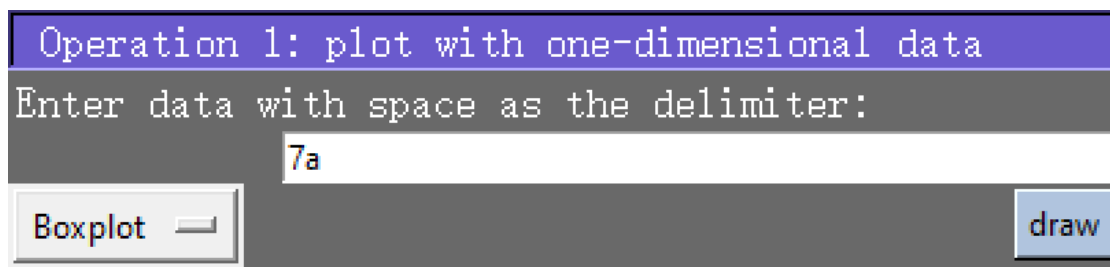
Output:

Invalid Num_1

Statistics:

If you enter invalid characters, you will get an error message.

Input:



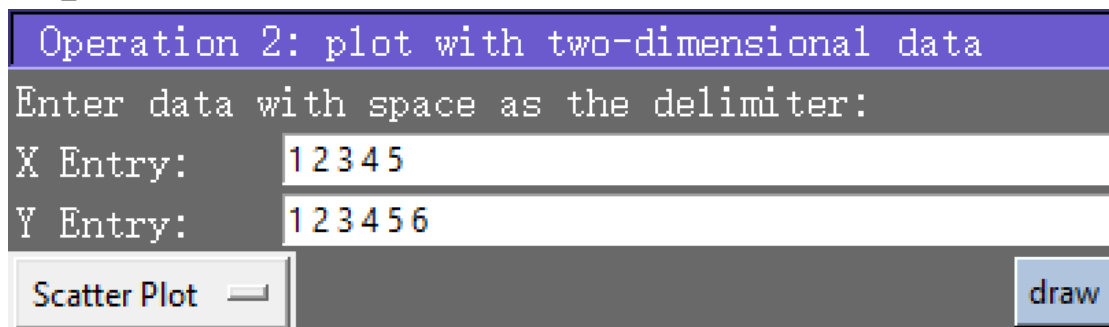
The screenshot shows a software window titled "Operation 1: plot with one-dimensional data". Below the title bar, there is a text input field containing the text "7a". To the left of the input field is a button labeled "Boxplot" with a small icon. To the right of the input field is a button labeled "draw". The input field has a light gray border and a small cursor at the end of the text.

Output:

**Invalid
Input**

When plotting with two-dimensional data, if the length of x data is different from that of y data, you will get an error message.

Input:




Operation 2: plot with two-dimensional data

Enter data with space as the delimiter:

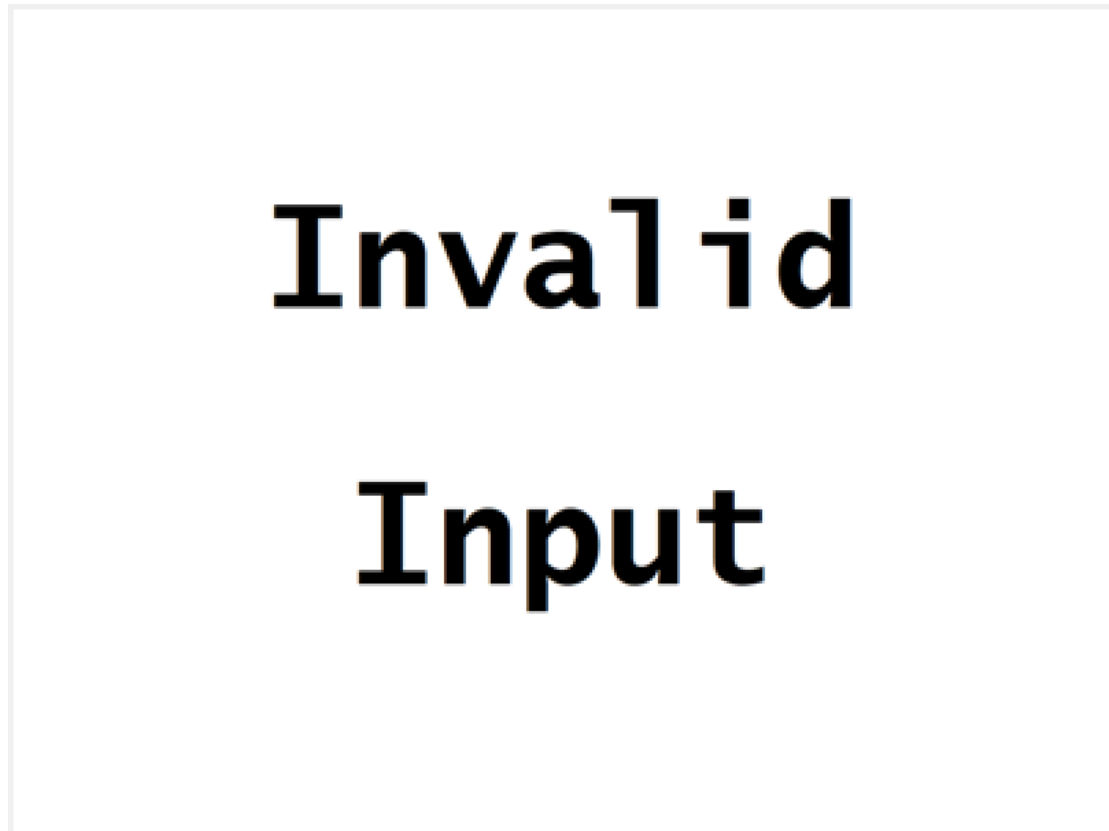
X Entry: 12345

Y Entry: 123456

Scatter Plot 

draw

Output:



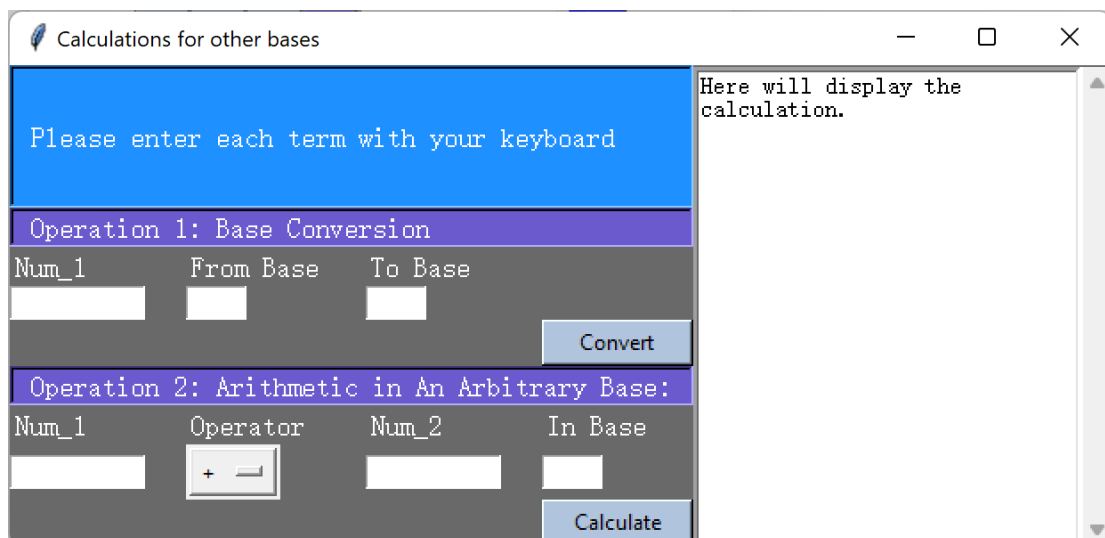
**Invalid
Input**

Style

Blue:

The default style.

Or select by clicking the “Style” button.



Statistics

—□×

Output Graph

Will be Displayed

Here

Please enter each term with your keyboard

Operation 1: plot with one-dimensional data

Enter data with space as the delimiter:

Boxplot

draw

Operation 2: plot with two-dimensional data

Enter data with space as the delimiter:

X Entry:

Y Entry:

Scatter Plot

draw

Operation 3: show drawn graphs

There exists no stored graph!

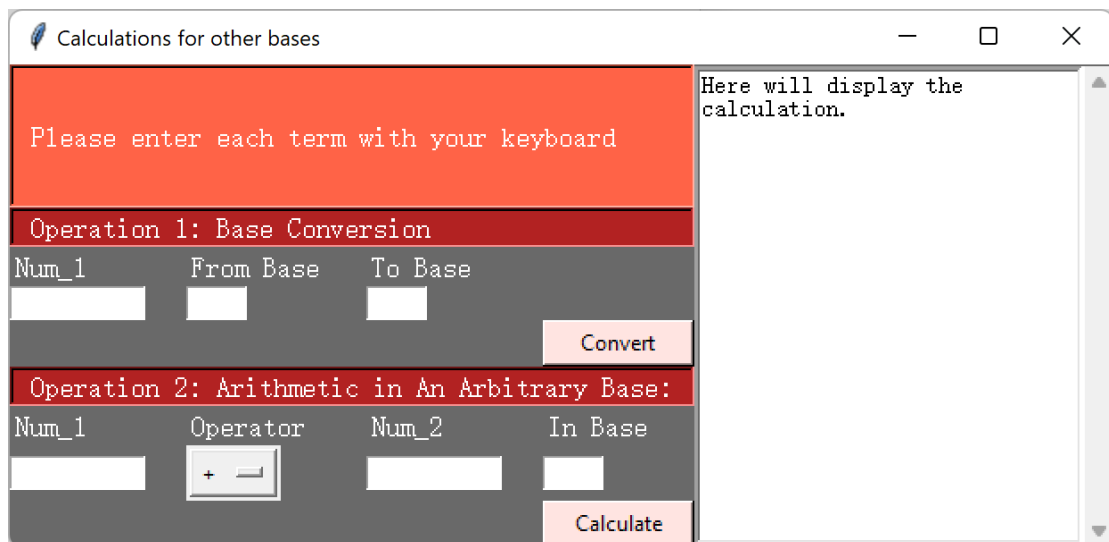
draw

Operation 4: clear all drawn graphs

CLEAR

Red:

Select by clicking the “Style” button.



Statistics

—□×

Output Graph

Will be Displayed

Here

Please enter each term with your keyboard

Operation 1: plot with one-dimensional data

Enter data with space as the delimiter:

Boxplot ▾

draw

Operation 2: plot with two-dimensional data

Enter data with space as the delimiter:

X Entry:

Y Entry:

Scatter Plot ▾

draw

Operation 3: show drawn graphs

There exists no stored graph! ▾

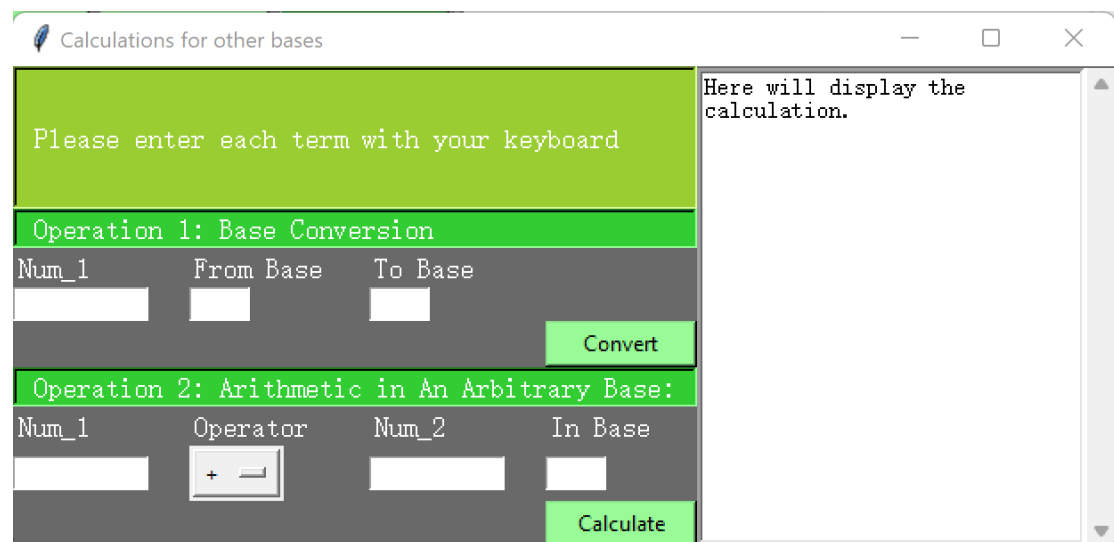
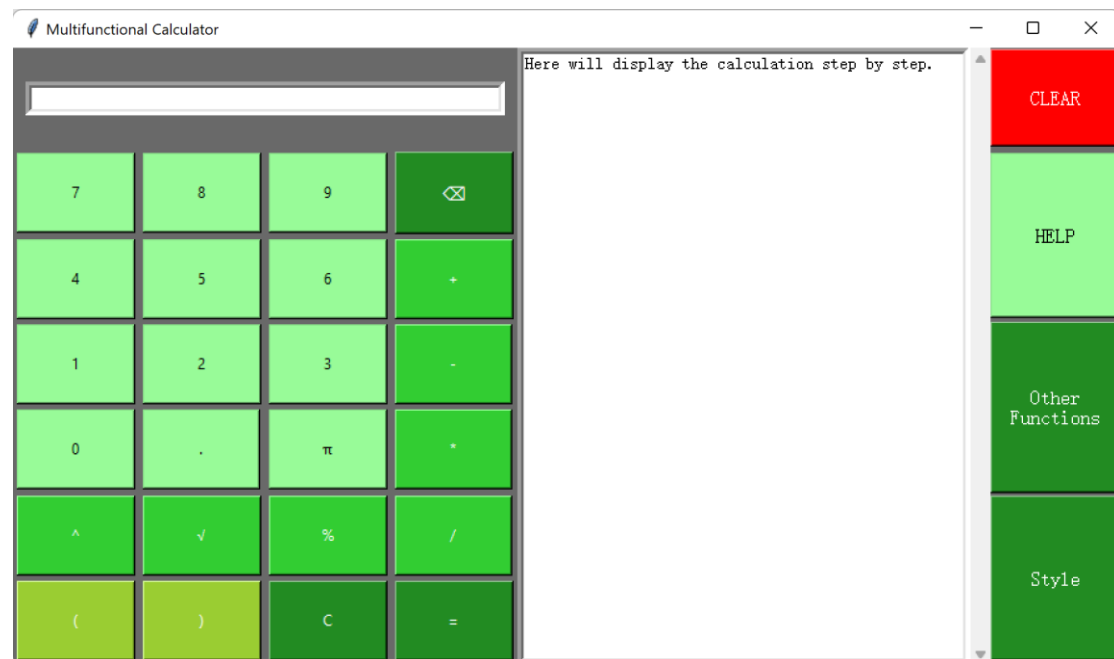
draw

Operation 4: clear all drawn graphs

CLEAR

Green:

Select by clicking the “Style” button.



Statistics

—□×

Output Graph

Will be Displayed

Here

Please enter each term with your keyboard

Operation 1: plot with one-dimensional data

Enter data with space as the delimiter:

Boxplot ▾

draw

Operation 2: plot with two-dimensional data

Enter data with space as the delimiter:

X Entry:

Y Entry:

Scatter Plot ▾

draw

Operation 3: show drawn graphs

There exists no stored graph! ▾

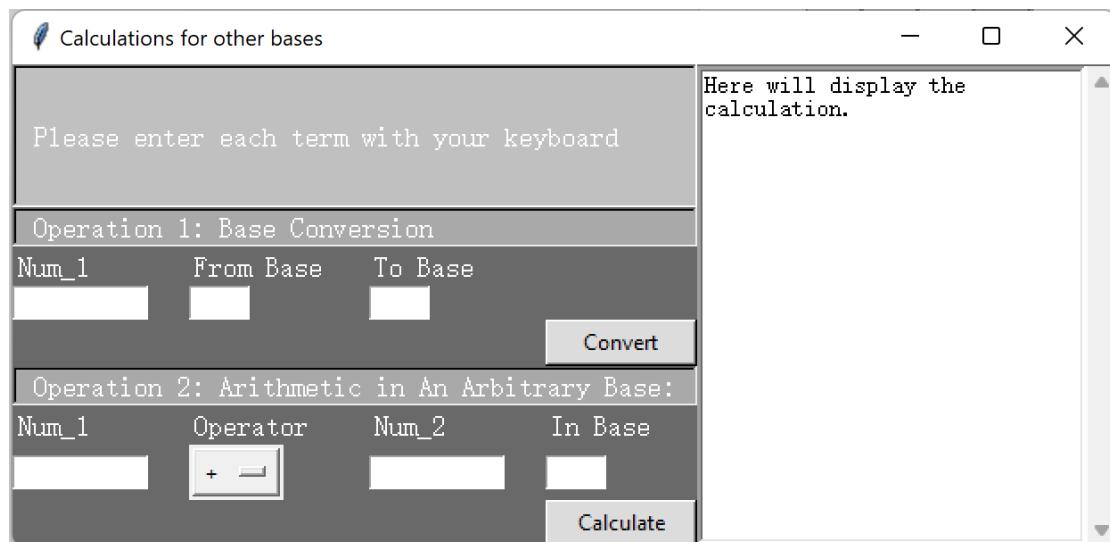
draw

Operation 4: clear all drawn graphs

CLEAR

Black:

Select by clicking the “Style” button.



Statistics

—□×

Output Graph

Will be Displayed

Here

Please enter each term with your keyboard

Operation 1: plot with one-dimensional data

Enter data with space as the delimiter:

Boxplot ▾

draw

Operation 2: plot with two-dimensional data

Enter data with space as the delimiter:

X Entry:

Y Entry:

Scatter Plot ▾

draw

Operation 3: show drawn graphs

There exists no stored graph! ▾

draw

Operation 4: clear all drawn graphs

CLEAR