

Homework 4

This homework designed for the loop practice. Please do not use if/else, array, self-defined function, and any math function (EX: pow(), abs()) in this lab.

Please use one while loop in problem 1, 2, 3 (nested loop is not allowed), but you can use additional one while loop for user continuous input purpose.

1. Write a program to approximate the value of e using the formula:

$$e = 1 + \frac{1}{1!} + \frac{1}{2!} + \frac{1}{3!} + \dots$$

- (a). Stop when the added term is less than 10^{-10} (do not add this term)
- (b). Stop when the difference between the two successive terms is less than 0.00001. (do not add the smaller term among the last two successive terms)

- 1. Please show the answer to the 11th decimal place.
- 2. In (b), you can use while or do/while.

Input/Output Example:

(a). $e = 2.71828182845$

(b). $e = 2.71828152557$

2. Write a program to approximate the value of $\sin(x)$ using the formula:

$$\sin(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \dots + \frac{(-1)^{n+1} x^{2n-1}}{(2n-1)!}$$

(read x from the keyboard).

The program stop when $\frac{(-1)^{n+1} x^{2n-1}}{(2n-1)!} < 10^{-9}$ (don't add/subtract this

term)

- a. Please let user continuously input x and stop when inputting CTRL+Z.
- b. Please output to the 11th decimal place.

Input/Output Example:

x = 3.14

sin(3.140000) = 0.00159265239

x = 1.57

sin(1.570000) = 0.99999968359

x = ^Z

3. Write a program to approximate the value of $\pi/4$ using the formula:

$$\pi/4 = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \dots$$

Stop when the added or subtracted term is less than 10^{-9} (1E-09)

(do not add or subtract this term)

Please show the answer to the 11th decimal place.

Input/Output Example:

pi/4 = 0.78539816290

4. Write a program that prompts the user to input a positive integer and then outputs the individual digits of the number. (while loop only)

Please let user continuously input x and stop when inputting CTRL+D.

Input/Output Example:

Input: 123000456

1,2,3,0,0,0,4,5,6

Input: 987654321

9,8,7,6,5,4,3,2,1

Input: ^D

5. Write the program to print the following sequence of numbers and stop when the sum of the terms exceeds 1000.

1, 1, 2, 3, 5, 8, 13, 21, . . .

Hint: (a). Each term is equal to the sum of the two proceeding terms.

(b). You can create 3 variables f1, f2 and f3.

f1 and f2 start from 1. $\Rightarrow f3 = f1 + f2$

Please use one while loop to complete this program.

Input/Output Example:

1,1,2,3,5,8,13,21,34,55,89,144,233,377,610

6. Write a program that reads an integer and converts it to multiples of 50, 20, 10, and 1. For example, if the user enters the number 285, the program should display 5*50, 1*20, 1*10, 5*1.

(a). Please let user continuously input x and stop when inputting CTRL+Z.

(b). Please use two while loops to complete this program, one for user continuous input, the other for main problem.

Input/Output Example:

x = 3030

$3030 = 60*50 + 1*20 + 1*10 + 0*1$

x = 1111

$1111 = 22*50 + 0*20 + 1*10 + 1*1$

x = ^Z

7. In cryptarithmic puzzles, mathematical equations are written using letters.

Each letter can be a digit from 0 to 9, but no two letters can be the same.
Here is a sample problem: SEND + MORE = MONEY (9567+ 1085=10652)

A solution to the puzzle is

S = 9, R = 8, O = 0, M = 1, Y = 2, E = 5, N = 6, D = 7

Question:

Write a program that finds solutions to the cryptarithmic puzzle of:

TOO + TOO + TOO + TOO = GOOD

The simplest technique is to use a nested loop for each unique letter (in this case T, O, G, D). The loops would systematically assign the digits from 0-9 to each letter.

For example,

it might first try T = 0, O = 0, G = 0, D = 0, then

T = 0, O = 0, G = 0, D = 1, then

T = 0, O = 0, G = 0, D = 2, etc. up to

T = 9, O = 9, G = 9, D = 9.

In the loop body test that each variable is unique and that the equation is satisfied.

Output the values for the letters that satisfy the equation.

You can use ternary operator or if/else if needed in this problem.

Input/Output Example:

T=1, O=6, G=0, D=4

T=4, O=9, G=1, D=6