OOP HW2 Spec

Description

One day, your boss gave you a machine to solve both a “string” and a “math” problem. But all the code in this machine was empty. Now, you are asked to inherit the parent class named “Machine” and complete the virtual function in its child classes.
You need to use Virtual Function and Polymorphism to finish the homework. If you don’t follow the rule, you will get 0 point even though the answers are correct.

Just add your codes in assigned area and necessary header files, otherwise, you will get 0 point. You can create other functions in child class if you want.

Your file name should be XXXXXXX.cpp (StudentID.cpp).

Grading

Plagiarism: -100%
Late: -100%
Wrong file name: -10%
Testing Environment: NCTU CS Workstation

The Math Problem

Given an integer “x”, you need to find two integers whose product(乘積) is equal to “x” or “x+1” and these two integers have minimum absolute difference(最小絕對值差). Then, print these two integers as your output.

Explanation

When input is: 3

x=3

1*3=3 →absolute difference is 2

x+1=4

1*4=4 →absolute difference is 3

2*2=4 →absolute difference is 0

Hence these two integers (2 and 2) have the minimum absolute difference 0 when input is 3.

Input

Your program should accept an integer in the range between 1 to ((2^16)-1).

For example:

124

Output

Print two integers which have minimum absolute difference. Print the smaller integer first if the two integers are not the same. Besides, there is a space between these two integers.

For example:

5 25

The String Problem

Given a string “str” which represent a binary number.
You’re required to find all substrings which have the same numbers of 0’s and 1’s within the substring. Besides, all 0’s in the substring should be grouped together in the substring, without being separated by any 1’s. e.g.001100 is not allowed. Same restrictions above apply to 1’s, where 1’s in the substring cannot be separated by 0’s. Print the total amount of substrings that you find that fulfills the requirements listed above. (印出滿足條件的 substring 之數量)

Note:
* Substring cannot be empty.
* Same substring may occur many times, you need to count all of them.
* The entire string is a substring, too. Don’t forget to check whether it fulfills requirement or not.

Explanation

When input is: “11001100 “
The substring satisfying the limitations include:
“1100” (11001100)、”10” (11001100)
”0011” (11001100)、”01” (11001100)
”1100” (11001100)、“10” (11001100).
The total amount of these substring is 6. As a result, the answer is 6.

Input

Your program should accept a string.
The total length of input string is between 1 and 10000.
The characters in the input string only contain 0 and 1.

For example:
1111100000

Output

Print how many substrings satisfying the limitation.

For example:
5

Make your Machine to solve above problems

Main function Description

Once your machine receives a message “math” by user, it will call the **welcome_message** function to print corresponding message, then use the next input as the parameter of “**problem_solver**” virtual function in the class “**Math_machine**” to solve the problem.
On the contrary, if your program receives a message “string”, call the **welcome_message** function to print corresponding message, then use the next input as the parameter of “**problem_solver**” virtual function in the class “**String_machine**” to solve the problem.

Make your program solve the corresponding problem until terminated by EOF.

Math and String Class Description

constructor: Initialize the protected variable for the machine. (“Math” or “String”)
welcome_message: Print the welcome message. The message format has been defined inside the function.
problem_solver: Solve the corresponding problem for string or math and print the answer.

Sample Input 1

math
124
string
10101
math
1000
string
111001

Sample Output 1

Solving the math problem.
5 25
Solving the string problem.
4
Solving the math problem.
25 40
Solving the string problem.
3

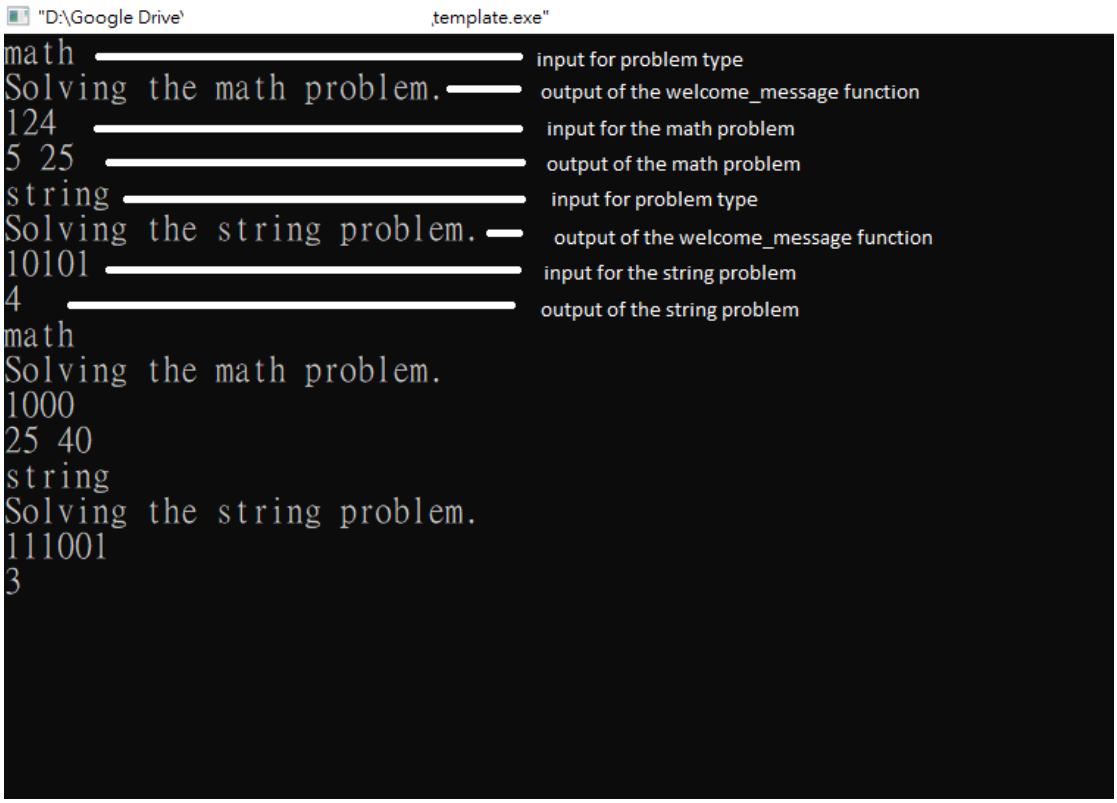
Sample Input 2

string
110011
math
333
math
17
string
1100

Sample Output 2

Solving the string problem.
4
Solving the math problem.
9 37
Solving the math problem.
3 6
Solving the string problem.
2

Example :


"D:\Google Drive\ template.exe"
math
input for problem type
Solving the math problem.
output of the welcome_message function
124
input for the math problem
5 25
output of the math problem
string
input for problem type
Solving the string problem.
output of the welcome_message function
10101
input for the string problem
4
output of the string problem
math
Solving the math problem.
1000
25 40
string
Solving the string problem.
111001
3