CPP Problem Design Example

Subject: Collatz Conjecture

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Main testing concept: Basic Number Operator

Basics	Functions
■ C++ BASICS	□ SEPARATE COMPILATION AND NAMESPACES
■ FLOW OF CONTROL	□ STREAMS AND FILE I/O
■ FUNCTION BASICS	□ RECURSION
□ PARAMETERS AND OVERLOADING	□ INHERITANCE
□ ARRAYS	□ POLYMORPHISM AND VIRTUAL FUNCTIONS
□ STRUCTURES AND CLASSES	□ TEMPLATES
□ CONSTRUCTORS AND OTHER TOOLS	□ LINKED DATA STRUCTURES
□ OPERATOR OVERLOADING, FRIENDS, AND REFERENCES	□ EXCEPTION HANDLING
□ STRINGS	□ STANDARD TEMPLATE LIBRARY
□ POINTERS AND DYNAMIC ARRAYS	□ PATTERNS AND UML

Description:

Collatz conjecture, which also known as 3N+1 conjecture, is a conjecture in mathematics that concerns a sequence defined as follows:

(1) Input N

(2) If N equals 1, end calculation

(3) $\begin{cases} N/2, & if\ N \text{ is even number} \\ N*3+1, & if\ N \text{ is odd number} \end{cases}$

(4) Goto Step 2

All the positive number that smaller than 1 million use this method to calculate will finally equal 1. You need to find out how many times you check if N equal 1 (include the number itself). The times of calculation is cycle length.

For example, if 22 is inputted,

the result will be: 22 11 34 17 52 26 13 40 20 10 5 16 8 4 2 1

the cycle length of 22 is 16.

Input:

Enter a pair of positive integer i and j, separate by space. This program allows multiple test. User can enter until read EOF. (0 < i, j < 1,000,000)

Output:

Find the maximum cycle length that can be produced by any numbers between i and j(include i and j). Print i, j and the maximum cycle length, separate by space.

Sample Input / Output：

Sample Input	Sample Output
1 10 200 100 201 210 900 1000	1 10 20 200 100 125 201 210 89 900 1000 174

■ Eazy, Only basic programming syntax and structure are required.

☐ Medium,Multiple programming grammars and structures are required. ☐ Hard,Need to use multiple program structures or complex data types.
Expected solving time: 10 minutes
Other notes: