**CPP Problem Design Example**

|  |
| --- |
| **Subject: Collatz Conjecture** |
| **Contributor: 溫勇威, 陳靖升, 鍾賢廣** |
| **Main testing concept: Basic Number Operator**   |  |  | | --- | --- | | **Basics** | **Functions** | | ■ C++ BASICS  ■ FLOW OF CONTROL  ■ FUNCTION BASICS  □ PARAMETERS AND OVERLOADING  □ ARRAYS  □ STRUCTURES AND CLASSES  □ CONSTRUCTORS AND OTHER TOOLS  □ OPERATOR OVERLOADING, FRIENDS,AND REFERENCES  □ STRINGS  □ POINTERS AND DYNAMIC ARRAYS | □ SEPARATE COMPILATION AND NAMESPACES  □ STREAMS AND FILE I/O  □ RECURSION  □ INHERITANCE  □ POLYMORPHISM AND VIRTUAL FUNCTIONS  □ TEMPLATES  □ LINKED DATA STRUCTURES  □ EXCEPTION HANDLING  □ STANDARD TEMPLATE LIBRARY  □ 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)  (4) Go to Step 2 until N equals 1.  All the positive numbers that smaller than 1,000,000 will finally equals 1 by using this method. You need to find out the cycle length of a number. (Include the number itself.)  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. (16 numbers)  Hence the cycle length of 22 is 16.  **Input:**  Enter a pair of positive integers **i** and **j** that are both smaller than 1,000,000, separated by space. This program allows multiple test. Users can enter until read EOF.  **Output:**  Find the maximum cycle length that can be produced by any numbers between i and j (including 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:** |