National University of Computer and Emerging Sciences, Lahore Campus

Course:	**Programming Fundamentals**	**Course Code:**	**CS1002**
Program:	**BS(Computer Science)**	**Semester:**	**Fall 2023**
Duration:	**N/A**	**Total Marks:**	**60**
Due Date:	**26-Sept-23**	**CLO:**	**3**
Section:	**1K**	**Page(s):**	**2**
Exam:	**Assignment 3**	**Roll No.**	

Instructions:

- *Late submissions will lead to negative marking and submissions after 20 hours past the due time will not be accepted.*
- *This is an individual assignment and the solution submitted must be your own.*
- *Any sort of plagiarism will be dealt with seriously and may lead to severe consequences including negative marking.*
- *Submit .cpp files named as XXL-XXXX_Q#X.cpp*
  i.e [your roll number]_[question number].cpp

QUESTION#1: Amicable Numbers (15)

A pair of numbers is called amicable if their factors (excluding themselves) add up to each other. For example, the numbers 220 and 284 are amicable, because the factors of 220 are [1, 2, 4, 5, 10, 11, 20, 22, 44, 55, 110] and sum to 284, while the factors of 284 are [1, 2, 4, 71, 142] and sum to 220.

Write a C++ Program which takes any two positive integers from the user finds out whether the two numbers input by the user are amicable or not.

Sample I/O:

- Enter first number of pair: 1184
  Enter second number of pair: 1210
  YES
- Enter first number of pair: 181
  Enter second number of pair: 144
  NO

QUESTION#2: Fibonacci Series (15)

Develop a program that takes a positive integer from the user and checks if it's a part of the Fibonacci sequence. A number is part of the Fibonacci sequence if it is equal to the sum of the two preceding ones.

Sample I/O:

- Enter a positive integer: 8
  YES
- Enter a positive integer: 17
  NO

QUESTION#3: Prime Pair (15)

Write a program that takes two positive integers from the user and determines whether they form a prime pair. A prime pair is a pair of numbers where both numbers are prime and the absolute difference between them is 2.

Sample I/O:

- Enter first number of pair: 11
  Enter second number of pair: 13
  YES
- Enter first number of pair: 11
  Enter second number of pair: 17
  NO

QUESTION#4: Collatz Conjecture (15)

Write a program that takes a positive integer as input and tests the Collatz Conjecture. Start with the given number and repeatedly apply the following rules:

- If the number is even, divide it by 2
- If it's odd, multiply it by 3 and add 1
- Determine in how many step the sequence eventually reaches the number 1.

Example:

Consider the number entered is 5.

5 is odd, so we multiply it by 3 and add 1: (5 * 3) + 1 = 16
16 is even, so we divide it by 2: 16 / 2 = 8
8 is even, so we divide it by 2: 8 / 2 = 4
4 is even, so we divide it by 2: 4 / 2 = 2
2 is even, so we divide it by 2: 2 / 2 = 1
It took 5 steps to reach 1.

Sample I/O:

- Enter a positive integer: 6
  It took 8 steps to reach 1.

- Enter a positive integer: 27
  It took 111 steps to reach 1.