Purpose

The purpose of this assignment is to give you practice with repetition using while and also more conditions with if statements. No FOR loops are to be used

Problem

We want to come up with some common Math computations or sequences:

- Fibonacci sequence is t the infinite sequence 1, 1, 2, 3, 5, 8, 13, … of which the first two terms are 1 and each succeeding term is the sum of the two terms immediately preceding it
- A prime number (or a prime) is a natural number greater than 1 that has no positive divisors other than 1 and itself
- The *Collatz conjecture* which says that no matter what integer you start with, applying this transformation over and over will eventually reach the value 1.

[10 points]The problem will continuously prompt the user for a number (integers only) between 1 and 1000 and do the following for each number input by the user:

a) **[5 points]**If the number is less than 1 or greater than 1000 you must display a message indicating that the input is invalid and continue to prompt the user
b) **[5 points]**If the number entered is 1000, you should stop the program.
c) In all other cases do the following:
    - **[25 points]** Generate the numbers in the Fibonacci series from the beginning until the term in the series is not greater than the number entered. Print each term in the series separated by a tab. Print only 10 numbers on one line. Also print the total number of terms in the sequence. (You MUST use a while loop to generate this sequence).
    - **[30 points]** For all numbers in the range 1 to the number entered, calculate all the prime numbers and display each prime number separated by a tab. Print only 10 numbers on one line. Also print the total number of numbers in the sequence. (You MUST use a while loop to generate this sequence).
      A prime number is a number greater than 1 and has no divisors other than 1 and the number itself
    - **[25 points]** For the Collatz Conjecture, consider this rule for transforming a positive integer **n**:
      If **n** is even, divide it by 2
      If not, multiply it by 3 and add 1

      For the number that was entered, count the number of transformations it took to reach 1 and also print the sequence of numbers leading to this.
      (You MUST use a while loop to generate this sequence).

Input

The input will come from standard input, that is, from a user at the keyboard. You will test input redirected from an input file.

Output

Output will be sent to standard output (the screen). Since the program is interactive, you must prompt the user for all inputs and you must echo each value that you read from the user. Your answer must include a concise, neat message with the correct value(s) similar to the one found in the sample outputs.

Testing

On all your assignments, including this one, it is crucial that you test your program thoroughly. Sample input and output files will provided which you can use for your testing and verifying your program output.

Programs that don't run receive a maximum of about 20 points (although I may give them a zero if it looks like all you need to do is change one or two things and resubmit). Do not add additional features that are not being asked for, since your program may not run against test inputs that I have created.

Details & Comments

- You must follow all the coding style rules as specified in our "coding guidelines". In particular:
  - You must put your name enclosed in a comment box at the top along with a brief description of what the program does, and add any other comments that are appropriate throughout the program.
  - Keep lines to a maximum length that's easy to read.
  - You must use good names for any variables you create (a full word that describes what it is there for).

Submission

Submit this assignment with the code 3P:

`submit 3P` ***`name-of-your-source-file`***

Sample Output

```
Please enter a number between 1 and 1000:
You entered: 88

Terms upto 88 in the Fibonacci sequence:
1    1    2    3    5    8    13   21   34   55

Total: 10

List of Prime Numbers between 1 and 88:
2    3    5    7    11   13   17   19   23   29
31   37   41   43   47   53   59   61   67   71
73   79   83
Total: 23

Collatz Conjecture for 88:
88->44->22->11->34->17->52->26->13->40->20->10->5->16->8->4->2->1
Total Transformations: 17

Please enter a number between 1 and 1000:
You entered: 1000

Goodbye!
```

Sample Output

Name, comments, etc.

Execution
Number outside 1-1000 range - display error message and continue
Terminate program when 1000 is entered
Prompt for input continuously after processing valid input until 1000 is entered
Fibonacci sequence
Prime numbers - Function needed, loop in function to compute, loop in caller to call numbers in sequence
Colltaz conjecture