COMP110 Introduction to Computer Programming Using MATLAB

Homework #6

Due: Wednesday, March 28, 2018, 23.59.

Loops: Fibonacci Greatest Common Divisors

The Fibonacci numbers are nature's numbering system. Given the first two Fibonacci numbers, $f_0=0$ and $f_1=1$, all remaining Fibonacci numbers can be derived iteratively by making use of the following formula:

$$f_n = f_{n-1} + f_{n-2}$$

The first few terms of the series goes as follows:

n	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
f_n	0	1	1	2	3	5	8	13	21	34	55	89	144	233	377

As the series goes to infinity, the ratio between adjacent terms converges to roughly 0.618034, an irrational number called the "golden ratio" or the "divine proportion."

The Fibonacci sequence and the Golden Ratio appear in many systems around us, from the geometry of the DNA molecule (and the human body), to the physiology of plants and animals, even to the collective behavior patterns of investors on financial markets. See http://www.world-mysteries.com/sci_17.htm for more information.

An interesting observation is that the greatest common divisor (GCD) of any two Fibonacci numbers appears to be another Fibonacci number. Look at the following examples:

$$\begin{aligned}
gcd(f_6, f_9) &= gcd(8, 34) &&= 2 &&= f_3 \\
gcd(f_6, f_{12}) &= gcd(8, 144) &&= 8 &&= f_6 \\
gcd(f_7, f_{14}) &= gcd(13, 377) &&= 13 &&= f_7 \\
gcd(f_{10}, f_7) &= gcd(55, 13) &&= 1 &&= f_1
\end{aligned}$$

Write a MATLAB program that does the following:

1. Gets two positive integer numbers, **m** and **n** from the user. If either number is not a positive integer, asks for that number again, until a proper value is given.

2. Using loop constructs, finds the **m**th and **n**th Fibonacci numbers f_m and f_n (do NOT use built-in MATLAB functions; do NOT utilize arrays).

3. Finds the greatest common divisor of f_m and f_n, by making use of loop constructs (do NOT use built-in functions for finding the GCD or factoring the numbers; do not utilize arrays; use of basic functions such as MOD(), REM(), FLOOR(), etc. are permitted).

4. Determines whether the GCD value is another Fibonacci number f_k. If so, prints the **k** value on the screen, if not, displays "GCD property of Fibonacci numbers refuted!" (do NOT use built-in MATLAB functions; do NOT utilize arrays).

5. Asks the user if s/he wants to try another pair. If yes, does the same operation again from step 1, otherwise quits the program.

The output of your program should look as below:

```
Enter first positive integer: -1
This is not a positive integer!
Enter first positive integer: 2.4
This is not a positive integer!
Enter first positive integer: 6
Enter second positive integer: 0
This is not a positive integer!
Enter second positive integer: 9

The GCD of Fibonacci numbers f(6) and f(9) is f(3).

Do you want to try another pair (y/n)? y
Enter first positive integer: 14
Enter second positive integer: 21

The GCD of Fibonacci numbers f(14) and f(21) is f(7).

Do you want to try another pair (y/n)? n
Goodbye!
>>
```

Make your program as structured as possible. Apply proper indentations. Never use BREAK, CONTINUE or RETURN.

Name your MatLab m-file as h06*yourlastname*.m and then upload it to Blackboard Learn at http://ku.blackboard.com. Anyone e-mailing his/her homework will lose points!

> *While doing all your homework assignments, remember that:*
> - *You should not work together,*
> - *You should not give or take any files,*
> - *You should not give or take help other than simple verbal hints.*