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# ShowFib.py
"""
while-loop investigations of the Fibonacci sequence and its relation
to the golden ration = (1+sqrt(5))/2.

Background:
Given a "current" Fibonacci number and its "predecessor",
the "next" Fibonacci number is the sum of the current
and the predecessor. Starting off with a 0 and 1 as
the predeecessor and the current  Fibonacci number, we get

            0,1,1,2,3,5,8,13,21,34, etc

We index the Fibonacci numbers by where they are in this
sequence, e.g.,

           0 is the zeroth Fibonacci number
          13 is the seventh Fibonaccis number
          34 is the nineth Fibonacci number

"""
import math

#Problem 1. Print out Fibonacci numbers 1 through 15

# Initializations
k = 1
x = 0  # the past Fibonacci number
y = 1  # the current Fibonacci number
z = 1  # the next Fibonacci number
ratio = float(z)/float(y)
# y is the k-th Fibonacci number
print '\n  k     kth Fib      kth Ratio '
print '---------------------------------------'
while k<=15:
   print '%3d %10d     %14.12f' %(k,y,ratio)
   k += 1
   x = y       #  Fib k-1
   y = z       #  Fib k
   z = x+y     #  Fib k+1
   ratio = float(z)/float(y)

#Problem 2. Print out Fibonacci numbers
# 1 through k where k is the first Fibonacci
# number whose ratio is < .000001

# Initializations
r = (1 + math.sqrt(5))/2
k = 1
x = 0  # the past Fibonacci number
y = 1  # the current Fibonacci number
z = 1  # the next Fibonacci number
# y is the k-th Fibonacci number
error = abs(float(z)/float(y)-r)
print '\n  k     kth Fib    kth Ratio Error '
print '---------------------------------------'
while error>=.000000001:
   print '%3d %10d     %14.12f  ' %(k,y,error)
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    k += 1
    x = y       #  Fib k-1
    y = z       #  Fib k
    z = x+y     #  Fib k+1
    error = abs(float(z)/float(y)-r)
print '%3d %10d     %14.12f  ' %(k,y,error)


#Problem 3. Print out the smallest Fibonacci
# number bigger than 1000000

# Initializations
k = 1
x = 0  # the past Fibonacci number
y = 1  # the current Fibonacci number
z = 1  # the next Fibonacci number
# y is the k-th Fibonacci number
while y<1000000:
    k += 1
    x = y       #  Fib k-1
    y = z       #  Fib k
    z = x+y     #  Fib k+1
print '\nThe smallest Fibonacci number > million is Fib %1d =  %1d' % (k,y)

#Problem 4. Print out the largest Fibonacci
# number less than 1000000

# Initializations
k = 1
x = 0  # the past Fibonacci number
y = 1  # the current Fibonacci number
z = 1  # the next Fibonacci number
# y is the k-th Fibonacci number
while z<1000000:
    k += 1
    x = y       #  Fib k-1
    y = z       #  Fib k
    z = x+y     #  Fib k+1
print '\nThe largest  Fibonacci number < million is Fib %1d =  %1d' % (k,y)
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