README

April 21, 2016

Contents

1 Problem 1: Multips of 3 and 5

If we list all the natural numbers below 10 that are multiples of 3 or 5, we get 3,5,6 and 9. The sum of these multiples is 23.

Find the sum of all the multiples of 3 or 5 below 1000.

`./1.rb`

```
multiples = (1..999).select{|i| i%3 == 0 || i%5 == 0}

p multiples.inject(0) {|sum, p| sum+p}
```

2 Problem 2: Even Fibonacci Numbers

Each new term in the Fibonacci sequence is generated by adding the previous two terms. By starting with 1 and 2, the first 10 terms will be:

```
1,2,3,5,8,13,21,34,55,89, ...
```

By considering the terms in the Fibonacci sequence whose values do not exceed four million, find the sum of the even-valued terms.

./2.rb

```
def fib(n)
  # creates a Fibonacci sequence up to last number <= 4million
  # n = 7

  # [1,2]
  # [1,2,3]
  # [1,2,3,5]
  # [1,2,3,5,8]
  # [1,2,3,5,8,13]
  # [1,2,3,5,8,13,21]

  fib = [1,2]

  while fib.last <= n
    fib.push (fib.last + fib[(fib.count-2)])
  end

  evens = fib.select{|i| i%2==0}

  p evens.inject(0){|sum,x| sum+x}

end

fib(4000000)
```

3 Problem 3: Largest Prime Factor

The prime factors of 13195 are 5, 7, 13 and 29.

What is the largest prime factor of the number 600851475143?

./3.rb

```
require 'prime'

def get_factors(n)
```

```
  prime_array = []
  p = 2

  if n < 2
    return p
  end

  while p < n
    if n%p == 0 && Prime.prime?(p)
      prime_array.push(p)
      p prime_array
    end
    p +=1
  end

  return prime_array
end

p get_factors(600851475143)
```

4 Problem 4: Largest Palindrome Product

A palindromic number reads the same both ways. The largest palindrome made from the product of two 2-digit numbers is $9009 = 91 \times 99$.

Find the largest palindrome made from the product of two 3-digit numbers.

```
./4.rb
```

```
def is_palindrome?(n)
  string = n.to_s
  mid = string.length/2

  a = string[0...mid]

  if string.length.even?
    b = string[mid..-1]
  else
    b = string[mid+1..-1]
  end
```

```
  a == b.reverse
end

def get_factors_max(high,low)

  prods = {}
  pals = []

  high.downto(low).each do |i|

    a = i
    b = i

    until b == low-1
      if is_palindrome?(a*a)
        puts "PAL"
        prods["#{a}*(#{a})"] = a*a
        puts prods["#{a}*(#{a})"]
        pals.push a*a
      else
        if is_palindrome?(a*(b-1))
          puts "PAL"
          prods["#{a}*(#{b-1})"] = a*(b-1)
          puts prods["#{a}*(#{b-1})"]
          pals.push a*(b-1)
        end
      end
      b = b-1
    end

  end

  max = pals.max

  return pals
end

def largest_palindrome
```

```
  a = 999.downto(100).to_a
  a2 = a

  high = 999
  highest_possible = 999*999
  low = 100
  lowest_possible = 100*100

  get_factors_max(high,low)

end

p largest_palindrome
p largest_palindrome.max
```

5 Problem 5: Smallest Multiple

2520 is the smallest number that can be divided by each of the numbers from 1 to 10 without any remainder. What is the smallest positive number that is *evenly divisible* by all of the numbers from 1 to 20?

```
./5.rb
```

```
i = 20

while (i%2 != 0 ||
         i%3 != 0 ||
           i%4 != 0 ||
             i%5 != 0 ||
               i%6 != 0 ||
                 i%7 != 0 ||
                   i%8 != 0 ||
                     i%9 != 0 ||
                       i%10 != 0 ||
                         i%11 != 0 ||
                           i%12 != 0 ||
                             i%13 != 0 ||
                               i%14 != 0 ||
                                 i%15 != 0 ||
                                   i%16 != 0 ||
                                     i%17 != 0 ||
```

```
                                          i%18 != 0 ||
                                            i%19 != 0 ||
                                              i%20 != 0)
    i = i+1
  end

p i
```

6 Problem 6: Sum Square Difference

The sum of the squares of the first ten natural numbers is,

```
1^2 + 2^2 + ... + 10^2 = 385
```

The square of the sum of the first ten natural numbers is,

```
(1 + 2 + ... + 10)^2 = 55^2 = 3025
```

Hence the difference between the sum of the squares of the first ten natural numbers and the square of the sum is 3025 - 385 = 2640.

Find the difference between the sum of the squares of the first one hundred natural numbers and the square of the sum.

```
./6.rb
```