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# File: FindPrimeFactors.py
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# Description of Program: Input a series of arbitrary positive integers
# and return for each a list of its prime factors. Exit when the user enters 0


import math

# main function of the program where it will tell you the prime factors or other
responses
def main():
    factors = []
    print("Find Prime Factors:")
    number = eval(input("Enter a positive integer (or 0 to stop): "))
    print(forTheFirstInput(number))
    while number != 0:
        number = eval(input("Enter a positive integer (or 0 to stop): "))
        if number == 0:
            return "Goodbye!"
        else:
            if number == 1:
                print("  1 has no prime factorization." + '\n')
            elif number < 0:
                print("  Negative integer entered.  Try again." + '\n')

            # when the number is greater than 1 and if it has prime factors
            elif number > 1:
                if isPrime(number) is True:
                    factors.append(number)
                    print("  The prime factorization of " + str(number) + " is: " +
str(factors) + '\n')
                    factors.clear()
                elif isPrime(number) is False:
                    print(primeFactorization(number))
                    factors.clear()


def forTheFirstInput(num):
    factors = []
    if num == 0:
        return "Goodbye!"
    else:
        if num == 1:
            print("  1 has no prime factorization." + '\n')
        elif num < 0:
            print("  Negative integer entered. Try again." + '\n')

        # when the number is greater than 1 and if it has prime factors
        elif num > 1:
            if isPrime(num) is True:
                factors.append(num)
                return "  The prime factorization of " + str(num) + " is: " +
str(factors) + '\n'
            elif isPrime(num) is False:
                return primeFactorization(num)

# Finding the prime factorizations from the given inputted number
def primeFactorization(num):
    divisors = 2
    factors = []
    primeNumber = 3
    originalNum = num

    # dividing the input value by 2 until it can't anymore
    while num > 1:
        if num % divisors == 0:
            factors.append(divisors)
            num = num / 2

        # divides by the input values by prime numbers to see if it's a factor
        elif num % divisors != 0:
            for primeNumber in range (3, findNextPrime(primeNumber) + 1):
                while num % primeNumber == 0:
                    factors.append(primeNumber)
                    num = num / primeNumber
    return  "  The prime factorization of " + str(originalNum) + " is: " +
str(factors) + '\n'

# Got this from class slides: slide 6. Finding if the inputted number is prime or
not
def isPrime(num):
    if num < 2 or num % 2 == 0:
        return num == 2

    divisor = 3
    while (divisor <= math.sqrt( num )):
        if num % divisor == 0:
            return False
        else:
            divisor += 2
    return True

# Got this from class slides: slide 6. Finding the next prime number after the
inputted number
def findNextPrime(num):
    if num < 2:
        return 2
    if num % 2 == 0:
        num -= 1
    guess = num + 2

    while (not isPrime( guess )):
        guess += 2
    return guess

print(main())
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