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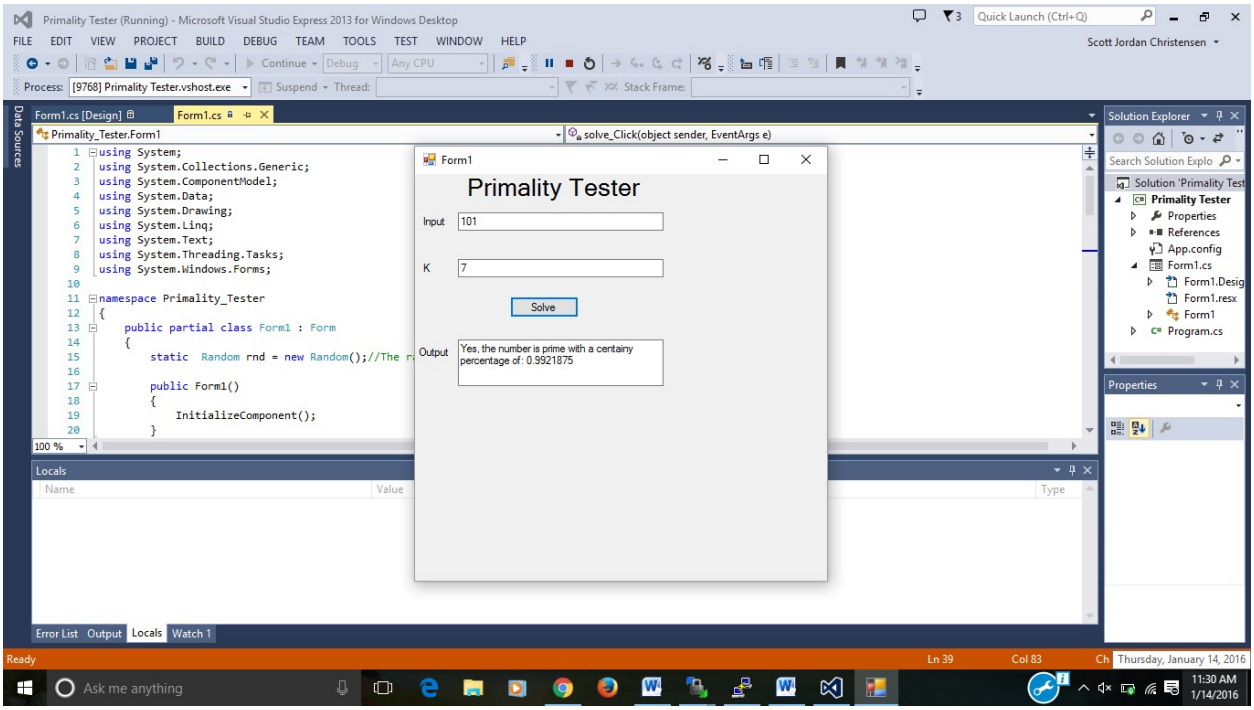
CS 312

Project 1 Submission



The program's Big O is O(N*M^3). In the main function, solve_Click, all if does is call the primalityTester to run N times. Each loop in the primality tester calls the modExponential function when computing the proper number to mod, which takes O(M^3) time. Thus, multiplying these together preforms this whole Primality Tester algorithm in O(N*M^3) time.

The function to compute the probability of correctness is pretty straightforward. It is computed to be 1-(1/2)^N, where N is the number of times you'd run the Primality test using a different A. Should the number fail the Primality Test, it would drop the correctness percentage to less than 50% and fail.

Form1.cs

```
using System;
using System.Collections.Generic;
using System.ComponentModel;
using System.Data;
using System.Drawing;
using System.Linq;
using System.Text;
using System.Threading.Tasks;
using System.Windows.Forms;

namespace Primality_Tester
{
    public partial class Form1 : Form
    {
        static  Random rnd = new Random();//The random number used in the primaility
testing.

        public Form1()
        {
            InitializeComponent();
        }


        private void solve_Click(object sender, EventArgs e)
        {
            long num = Convert.ToInt64(input.Text);
            int timesTester = Convert.ToInt32(k.Text);
            Console.WriteLine(num + " " + timesTester);

            //Take number through Feridai's Little Theorem primality tester
            double answer = primalityTester(num, timesTester);

            Console.WriteLine("Answer is " + answer);
            if(answer < 0.5)
            {
                output.Text = "No, the number is composite.";
            }
            else
            {
                output.Text = "Yes, the number is prime with a centainy percentage of: "
+ answer;
            }
        }

        private double primalityTester(long candidate, int timesTester)
        {
            //We will run the primalityTester operation k number of times in order to
increase our confidence in our operations
            double error = 1;
            for (int i = 0; i < timesTester; i++)
            {
                long randomNumber = 1;
                int num = rnd.Next(1, (int)candidate);
                randomNumber = (long)num;

                Console.WriteLine("rand num is " + randomNumber);
```

```
                Console.WriteLine(Math.Pow(randomNumber, candidate - 1));

                //Tests to see if the numbers really are relatively prime while using a
function to find a^n-1
                if(modExpo(randomNumber, candidate - 1, candidate) == 1)
                {
                    Console.WriteLine("yes, error is " + error + "\n");
                    error = error / 2;
                }
                else
                {
                    return 0;
                }
            }

            return 1 - error;
        }

        //This function will find what x^y is using the modular exponentiation algorithm.
        long modExpo(long x, long y, long N)
        {
            Console.WriteLine(x + " " + y + " " + N);

            if (y == 0) return 1;

            long z = modExpo(x, y / 2, N);

            if(y%2 == 0)//Sees if the number is even of not.
            {
                return ((long)Math.Pow(z, 2)) % N;
            }
            else
            {
                return (x * ((long)Math.Pow(z, 2))) % N;
            }
        }

        private void label1_Click(object sender, EventArgs e)
        {

        }

        private void label3_Click(object sender, EventArgs e)
        {

        }

        private void label4_Click(object sender, EventArgs e)
        {

        }
    }
}
```