Data Structure Report

Complex numbers

Name: Mahmoud Mohamed Ahmed Gadallah

Sec: 6

Content

Complex class

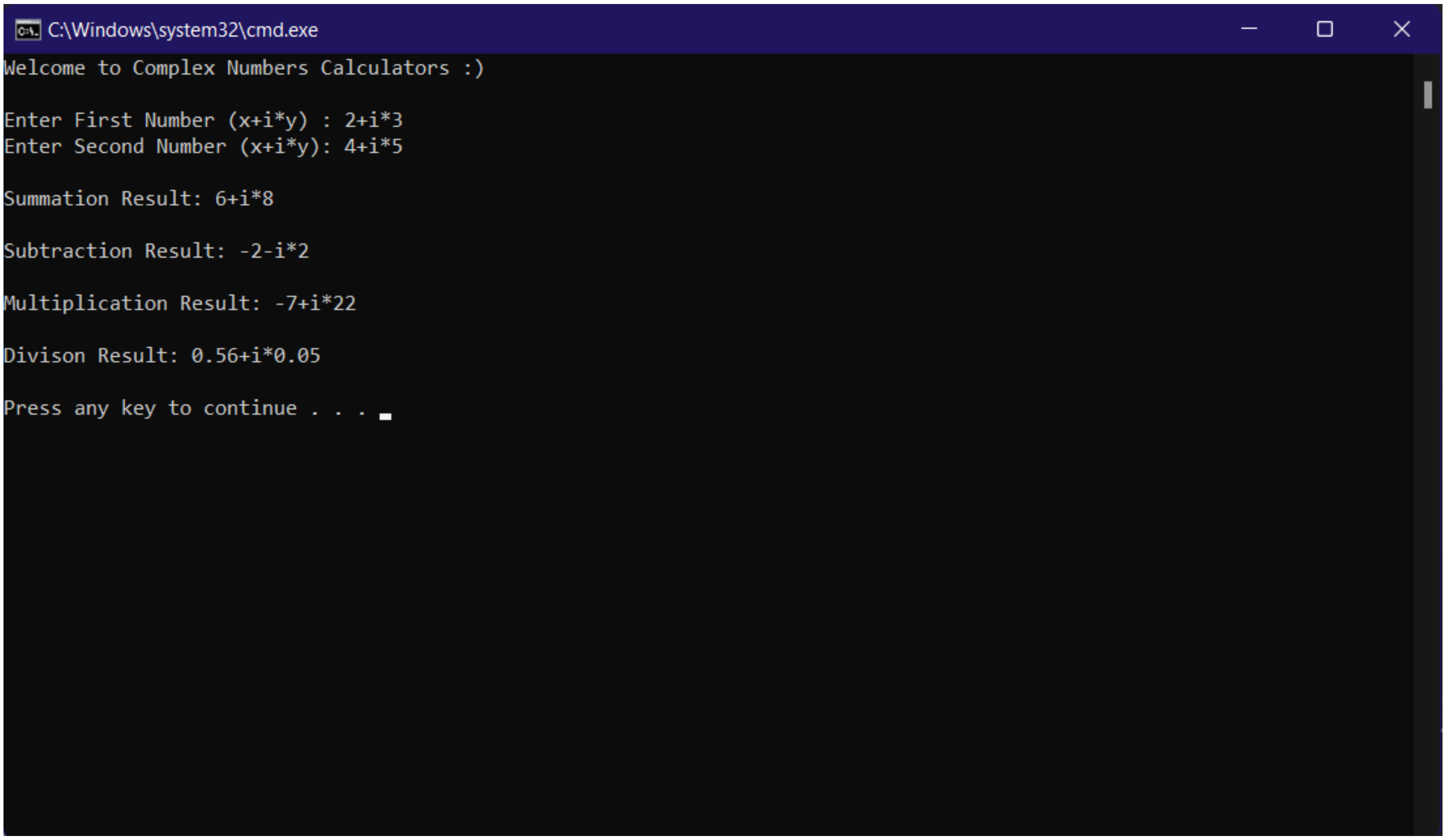
This class contains all functions that we can use to manipulate complex numbers

```
/*
 * Complex class contains some utilities "methods" to deal with complex numbers
 * Change: method to take complex number as string and convert it to real part and imaginary
part
 * Add: method that takes 2 complex numbers as strings and return summation of them as
string
 * Sub: method that takes 2 complex numbers as srings and return subtraction of them as
string
 * Multi: method that takes 2 complex numbers as string and return multiplication of them as
string
 * Devide: method that takes 2 complex numbers as string and return devision of them as
string
 */
using System;
using System.Collections.Generic;
using System.Linq;
using System.Runtime.InteropServices;
using System.Text;
using System.Threading.Tasks;

namespace Complex_Number_App
{
    internal class Complex
    {
        /*
         * Change method to convert from complex number as string to real part and imginary
part
         * pre: passing complex number as string & passing real variable by ref & passing
img variable by ref
         * post: assign real part of num in real and imaginary part in img
         */
        public static void Change(string num, ref double real, ref double img)
        {
            if (num.Contains("+"))  //check if img part is positive or negative
            {
                real = double.Parse(num.Split(new string[] { "+i*" },
StringSplitOptions.None)[0]);  //cutting real part
                img = double.Parse(num.Split(new string[] {"+i*"},
StringSplitOptions.None)[1]); //cutting imag part
            }
            else
            {
                real = double.Parse(num.Split(new string[] { "-i*" },
StringSplitOptions.None)[0]);
                img = double.Parse(num.Split(new string[] { "-i*" },
StringSplitOptions.None)[1]);
            }
        }

        /*
         * Add method to add 2 complex numbers
         * pre: passing 2 complex numbers as strings and passing result variable as string
by ref
         * post: change value of res with the answer of summation
         */
        public static void Add(string num1, string num2, ref string res)
        {
            double real1 = 0, img1 = 0, real2 = 0, img2 = 0;

            //invoking Change function to get real and imginary part of each number
            Change(num1, ref real1, ref img1);
            Change(num2, ref real2, ref img2);

            double realRes = real1 + real2;
            double imgRes = img1 + img2;

            if (imgRes > 0)
                res = realRes + "+i*" + imgRes;
            else
                res = realRes + "-i*" + -imgRes;
        }


        /*
         * Sub method to add 2 complex numbers
         * pre: passing 2 complex numbers as strings and passing result variable as string
by ref
         * post: change value of res with the answer of subtraction
         */
        public static void Sub(string num1, string num2, ref string res)
        {
            double real1 = 0, img1 = 0, real2 = 0, img2 = 0;
            //invoking Change function to get real and imginary part of each number
            Change(num1, ref real1, ref img1);
            Change(num2, ref real2, ref img2);

            double realRes = real1 - real2;
            double imgRes = img1 - img2;

            if (imgRes > 0)
                res = realRes + "+i*" + imgRes;
            else
                res = realRes + "-i*" + -imgRes;
        }

        /*
         *  Multi method to multi 2 complex numbers
         *  pre: passing 2 complex numbers as strings and passing result variable as string 
by ref
         *  post: change value of res with the answer fo mulitplication
         */
        public static void Multi(string num1, string num2, ref string res)
        {
            double real1 = 0, img1 = 0, real2 = 0, img2 = 0;

            //invoking Change function to get real and imginary part of each number
            Change(num1, ref real1, ref img1);
            Change(num2, ref real2, ref img2);

            double realRes = real1 * real2 - img1 * img2;
            double imgRes = real1 * img2 + real2 * img1;

            if (imgRes > 0)
                res = realRes + "+i*" + imgRes;
            else
                res = realRes + "-i*" + -imgRes;
        }


        /*
         *  Multi method to multi 2 complex numbers
         *  pre: passing 2 complex numbers as strings and passing result variable as string 
by ref
         *  post: change value of res with the answer fo mulitplication
         */
        public static void Divide(string num1, string num2, ref string res)
        {
            double real1 = 0, img1 = 0, real2 = 0, img2 = 0;
            //invoking Change function to get real and imginary part of each number
            Change(num1, ref real1, ref img1);
            Change(num2, ref real2, ref img2);

            img2 = -img2;

            double realRes = Math.Round((real1 * real2 - img1 * img2) / (real2 * real2 + 
img2 * img2), 2);
            double imgRes = Math.Round((real1 * img2 + real2 * img1) / (real2 * real2 + img2 
* img2), 2);

            if (imgRes > 0)
                res = realRes + "+i*" + imgRes;
            else
                res = realRes + "-i*" + -imgRes;
        }
    }
}
```

Main Class

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Threading.Tasks;

namespace Complex_Number_App
{
    internal class Program
    {
        static void Main(string[] args)
        {
            Console.WriteLine("Welcome to Complex Numbers Calculators :)\n");

            Console.Write("Enter First Number (x+i*y) : ");
            string num1 = Console.ReadLine();

            Console.Write("Enter Second Number (x+i*y): ");
            string num2 = Console.ReadLine();


            string res = "";
            Complex.Add(num1, num2, ref res);       //invoking Add method
            Console.WriteLine($"\nSummation Result: {res}\n");

            Complex.Sub(num1, num2, ref res);           //invoking Sub method
            Console.WriteLine($"Subtraction Result: {res}\n");


            Complex.Multi(num1, num2, ref res);     //invoking Multi method
            Console.WriteLine($"Multiplication Result: {res} \n");

            Complex.Divide(num1, num2, ref res);    //invokin Divide method
            Console.WriteLine($"Divison Result: {res} \n");
        }
    }
}
```

Testing



```
Welcome to Complex Numbers Calculators :)

Enter First Number (x+i*y) : 2+i*3
Enter Second Number (x+i*y): 4+i*5

Summation Result: 6+i*8

Subtraction Result: -2-i*2

Multiplication Result: -7+i*22

Divison Result: 0.56+i*0.05

Press any key to continue . . .
```