<u>complexNumber</u>

A structure called complex is defined to represent a complex number. Each complex number consists of the real and imaginary parts as follows:

```
typedef struct {
    double real;
    double imag;
} Complex;
```

Write C functions that perform addition, subtraction, multiplication and division operations on two complex numbers. The function prototypes are given as follows:

```
Complex add(Complex c1, Complex c2);
Complex mul(Complex c1, Complex c2);
Complex sub(Complex *c1, Complex *c2);
Complex div(Complex *c1, Complex *c2);
```

Formula

Complex Number Arithmetic:

$$(a + bi) + (c + di) = (a + c) + (b + d)i$$

$$(a + bi) - (c + di) = (a - c) + (b - d)i$$

$$(a + bi) \times (c + di) = (ac - bd) + (ad + bc)i$$

$$\frac{a + bi}{c + di} = \frac{ac + bd}{c^2 + d^2} + \frac{bc - ad}{c^2 + d^2} \cdot i$$

getcalc.com

[source: https://getcalc.com/math-complex-numbers-arithmetic-calculator.htm]

Write a C program that handles complex number arithmetic using the arithmetic functions implemented. The program will read the choice of operation (e.g. addition, subtraction, multiplication, division and quit) and two complex numbers, and display the result.

A sample program to test the functions is given below:

```
#include <stdio.h>
#include <math.h>
typedef struct {
    double real;
    double imag;
} Complex;
Complex add(Complex c1, Complex c2);
Complex mul(Complex c1, Complex c2);
Complex sub(Complex *c1, Complex *c2);
Complex div(Complex *c1, Complex *c2);
int main()
{
    int choice;
    Complex input1, input2, result;

    printf("Complex number operations: \n");
    printf("1 - addition \n");
    printf("2 - subtraction \n");
    printf("3 - multiplication \n");
    printf("4 - division \n");
    printf("5 - quit \n");
    do {
        printf("Enter your choice: \n");
```

```
        scanf("%d", &choice);
        if (choice == 5)
            return 0;
        printf("Enter Complex Number 1: \n");
        scanf("%lf %lf", &input1.real, &input1.imag);
        printf("Enter Complex Number 2: \n");
        scanf("%lf %lf", &input2.real, &input2.imag);
        switch (choice) {
            case 1: result = add(input1, input2);
                break;
            case 2: result = sub(&input1, &input2);
                break;
            case 3: result = mul(input1, input2);
                break;
            case 4: result = div(&input1, &input2);
                break;
        }
        printf("complex(): real %.2f imag %.2f\n",
                result.real, result.imag);
    } while (choice<5);
    return 0;
}
Complex add(Complex c1, Complex c2)
{
    /* write your code here */
}
Complex sub(Complex *c1, Complex *c2)
{
    /* write your code here */
}
Complex mul(Complex c1, Complex c2)
{
    /* write your code here */
}
Complex div(Complex *c1, Complex *c2)
{
    /* write your code here */
}
```

Some test input and output sessions are given below:

(1) Test Case 1:
```
Complex number operations:
1 - addition
2 - subtraction
3 - multiplication
4 - division
5 - quit
Enter your choice:
1
Enter complex number 1:
1 1
Enter complex number 2:
2 2
complex(): real 3.00 imag 3.00
Enter your choice:
5
```

(2) Test Case 2:
```
Complex number operations:
1 - addition
2 - subtraction
3 - multiplication
4 - division
```

```
5 - quit
Enter your choice:
2
Enter complex number 1:
3 3
Enter complex number 2:
2 2
complex(): real 1.00 imag 1.00
Enter your choice:
5
```

(3) Test Case 3:
```
Complex number operations:
1 - addition
2 - subtraction
3 - multiplication
4 - division
5 - quit
Enter your choice:
3
Enter complex number 1:
3 3
Enter complex number 2:
4 6
complex(): real -6.00 imag 30.00
Enter your choice:
5
```

(4) Test Case 4:
```
Complex number operations:
1 - addition
2 - subtraction
3 - multiplication
4 - division
5 - quit
Enter your choice:
4
Enter complex number 1:
1 1
Enter complex number 2:
2 2
complex(): real 0.50 imag 0.00
Enter your choice:
5
```