Assignment #5
Joshua Jackson
250 722 551

Question1_Part1

Code:

```c
#include <stdio.h>
#include <stdlib.h>

//structure complex_t
struct complex_t{
    double real;
    double imaginary;
};

//void declaration of functions
struct complex_t multiply(struct complex_t x, struct complex_t y);
struct complex_t divide(struct complex_t *x, struct complex_t *y);

//main function
int main(void){
    //main vairables from structure complex_t
    struct complex_t input_one, input_two, output_one, output_two;

    //asking for input of real and imaginary numbers
    printf("Enter Real Number and Imaginary Number (ex. 4 + i3 enter 4 3): \n");
    scanf("%lf", &input_one.real);
    scanf("%lf", &input_one.imaginary);

    printf("Enter Real Number and Imaginary Number: \n");
    scanf("%lf", &input_two.real);
    scanf("%lf", &input_two.imaginary);

    //test print functions
   // printf("Complex #1 is: %.2lf + i%.2lf\n", input_one.real, input_one.imaginary);
   // printf("Complex #2 is: %.2lf + i%.2lf\n", input_two.real, input_two.imaginary);

    //assigning declared variables the returns of mult and division functions
    output_one = multiply(input_one, input_two);
    output_two = divide(&input_one, &input_two);

    //printing multiplication
    printf("Multiplication: (%.2lf + i%.2lf) x (%.2lf + i%.2lf) = %.2lf +
i(%.2lf)\n", input_one.real, input_one.imaginary, input_two.real,
input_two.imaginary, output_one.real, output_one.imaginary);

    //printing division
    printf("Division: (%.2lf + i%.2lf) / (%.2lf + i%.2lf) = %.2lf + i(%.2lf)\n",
input_one.real, input_one.imaginary, input_two.real, input_two.imaginary,
output_two.real, output_two.imaginary);
```

```
}

//mutiply function
struct complex_t multiply(struct complex_t x, struct complex_t y)
{
    //definign structure variable
    struct complex_t sum;
    //mult equation
    sum.real = ((x.real * y.real)-(x.imaginary * y.imaginary));
    sum.imaginary = ((y.real * x.imaginary)+(x.real * y.imaginary));

    return sum;
}

//divide function with pointer parameters
struct complex_t divide(struct complex_t *x, struct complex_t *y)
{
    //structure variable with pointer
    struct complex_t *sum;

    //using malloc to assign space for sum
    sum = (struct complex_t *)malloc(sizeof(struct complex_t));
    if (!sum) {
        exit(0);
    }
    //checking to see denominator will not be equal to zero
    if ((y->imaginary*y->imaginary)+(y->real*y->real)== 0) {
        printf("Invalid Numbers\n");
        exit(0);
    }else
    //division calc work
    sum->real = ((x->real*y->real)+(y->imaginary*x->imaginary))/((y->imaginary*y-
>imaginary)+(y->real*y->real));
    sum->imaginary = ((y->real*x->imaginary)-(x->real*y->imaginary))/((y->real*y-
>real)+(y->imaginary*y->imaginary));

        return *sum;

}
```

Test Cases:

Test Case	Input	Output
1	Complex 1: 4.00 + i3.00 Complex 2: 5.00 + i6.00 (Two Complex Numbers)	Enter Real Number and Imaginary Number (ex. 4 + i3 enter 4 3): : 4 3 Enter Real Number and Imaginary Number: 5 2 Multiplication: (4.00 + i3.00) x (5.00 + i2.00) = 14.00 + i(23.00) Division: (4.00 + i3.00) / (5.00 + i2.00) = 0.89 + i(0.24)
2	Complex 1: 4 Complex 2: 5 (Two real numbers)	Enter Real Number and Imaginary Number (ex. 4 + i3 enter 4 3): 4 0 Enter Real Number and Imaginary Number: 5 0 Multiplication: (4.00 + i0.00) x (5.00 + i0.00) = 20.00 + i(0.00) Division: (4.00 + i0.00) / (5.00 + i0.00) = 0.80 + i(0.00)
3	Complex 1: 0 + i5 Complex 2: 0 + i6 (two imaginary numbers)	Enter Real Number and Imaginary Number (ex. 4 + i3 enter 4 3): 0 5 Enter Real Number and Imaginary Number: 0 6 Multiplication: (0.00 + i5.00) x (0.00 + i6.00) = -30.00 + i(0.00) Division: (0.00 + i5.00) / (0.00 + i6.00) = 0.83 + i(0.00)
4	Complex 1: 5 Complex 2: 0 + i4 (one real one imaginary)	Enter Real Number and Imaginary Number (ex. 4 + i3 enter 4 3): 5 0 Enter Real Number and Imaginary Number: 0 4 Multiplication: (5.00 + i0.00) x (0.00 + i4.00) = 0.00 + i(20.00) Division: (5.00 + i0.00) / (0.00 + i4.00) = 0.00 + i(-1.25)

5	Complex 1: 0 + i5 Complex 2: 6 (one imaginary one real, different order)	Enter Real Number and Imaginary Number (ex. 4 + i3 enter 4 3): 0 5 Enter Real Number and Imaginary Number: 6 0 Multiplication: (0.00 + i5.00) x (6.00 + i0.00) = 0.00 + i(30.00) Division: (0.00 + i5.00) / (6.00 + i0.00) = 0.00 + i(0.83)
6	Complex 1: 0 + i0 Complex 2: 6 + i5 (one zero and one complex)	Enter Real Number and Imaginary Number (ex. 4 + i3 enter 4 3): 0 0 Enter Real Number and Imaginary Number: 6 5 Multiplication: (0.00 + i0.00) x (6.00 + i5.00) = 0.00 + i(0.00) Division: (0.00 + i0.00) / (6.00 + i5.00) = 0.00 + i(0.00)
7	Complex 1: 6 + i5 Complex 2: 0 + i0 (one complex, and one zero) System exits since denominator can’t equal 0	Enter Real Number and Imaginary Number (ex. 4 + i3 enter 4 3): 6 5 Enter Real Number and Imaginary Number: 0 0 Invalid Numbers

Question1_Part2

Code:

```
#include <stdio.h>
#include <stdlib.h>

//structure complex_t
typedef struct
{
    double real;
    double imaginary;
} complex_t;

//void declaration of functions
complex_t multiply(complex_t x, complex_t y);
complex_t divide(complex_t *x, complex_t *y);

//main function
int main(void){

    //declaring variables of structure type
     complex_t input_one, input_two, output_one, output_two;

    //asking for user input for imaginary and real numbers
    printf("Enter Real Number and Imaginary Number (ex. 4 + i3 enter 4 3): \n");
    scanf("%lf", &input_one.real);
    scanf("%lf", &input_one.imaginary);

    printf("Enter Real Number and Imaginary Number: \n");
    scanf("%lf", &input_two.real);
    scanf("%lf", &input_two.imaginary);


    //testing print functions
    //printf("Complex #1 is: %.2lf + i%.2lf\n", input_one.real, input_one.imaginary);
    //printf("Complex #2 is: %.2lf + i%.2lf\n", input_two.real, input_two.imaginary);

        output_one = multiply(input_one, input_two);
        output_two = divide(&input_one, &input_two);

    //printing multiplication
    printf("Multiplication: (%.2lf + i%.2lf) x (%.2lf + i%.2lf) = %.2lf + i(%.2lf)\n",
input_one.real, input_one.imaginary, input_two.real, input_two.imaginary,
output_one.real, output_one.imaginary);

    //printing division
    printf("Division: (%.2lf + i%.2lf) / (%.2lf + i%.2lf) = %.2lf + i(%.2lf)\n",
input_one.real, input_one.imaginary, input_two.real, input_two.imaginary,
output_two.real, output_two.imaginary);
```

```
}

//mutiply function two parameters
complex_t multiply(complex_t x, complex_t y)
{
    //declaring structure variable for fuction
    complex_t sum;
        //multiplication calc work
        sum.real = ((x.real * y.real)-(x.imaginary * y.imaginary));
        sum.imaginary = ((y.real * x.imaginary)+(x.real * y.imaginary));

    return sum;
}

//divide function two pointer parameters
complex_t divide(complex_t *x, complex_t *y)
{
    //defining variable pointer
    complex_t *sum;
    //allocating space with check to ensure enough space
    sum = (complex_t *)malloc(sizeof(complex_t));
    if (!sum) {
        exit(0);
    }
    //checking that denominator does not equal zero
    if ((y->imaginary*y->imaginary)+(y->real*y->real) == 0){
        printf("Invalid Numbers\n");
        exit(0);
    }
    //division calc work
    sum->real = ((x->real*y->real)+(y->imaginary*x->imaginary))/((y->imaginary*y-
>imaginary)+(y->real*y->real));
    sum->imaginary = ((y->real*x->imaginary)-(x->real*y->imaginary))/((y->real*y-
>real)+(y->imaginary*y->imaginary));

    //returning pointer
    return *sum;
}
```

Test Cases:

Test Case	Input	Output
1	Complex 1: 6 + i4 Complex 2: 3 + i2 (two complex)	Enter Real Number and Imaginary Number (ex. 4 + i3 enter 4 3): 6 4 Enter Real Number and Imaginary Number: 3 2 Multiplication: (6.00 + i4.00) x (3.00 + i2.00) = 10.00 + i(24.00) Division: (6.00 + i4.00) / (3.00 + i2.00) = 2.00 + i(0.00)
2	Complex 1: 6 + i0 Complex 2: 5 + i0 (two real)	Enter Real Number and Imaginary Number (ex. 4 + i3 enter 4 3): 6 0 Enter Real Number and Imaginary Number: 5 0 Multiplication: (6.00 + i0.00) x (5.00 + i0.00) = 30.00 + i(0.00) Division: (6.00 + i0.00) / (5.00 + i0.00) = 1.20 + i(0.00)
3	Complex 1: 0 + i5 Complex 2: 0 + i9 (two imaginary)	Enter Real Number and Imaginary Number (ex. 4 + i3 enter 4 3): 0 5 Enter Real Number and Imaginary Number: 0 9 Multiplication: (0.00 + i5.00) x (0.00 + i9.00) = -45.00 + i(0.00) Division: (0.00 + i5.00) / (0.00 + i9.00) = 0.56 + i(0.00)
4	Complex 1: 5 + i0 Complex 2: 0 + i7 (one real, one imaginary)	Enter Real Number and Imaginary Number (ex. 4 + i3 enter 4 3): 5 0 Enter Real Number and Imaginary Number: 0 7 Multiplication: (5.00 + i0.00) x (0.00 + i7.00) = 0.00 + i(35.00) Division: (5.00 + i0.00) / (0.00 + i7.00) = 0.00 + i(-0.71)
5	Complex 1: 0 + i5 Complex 2: 7 + i0 (one imaginary, one complex)	Enter Real Number and Imaginary Number (ex. 4 + i3 enter 4 3): 0 5 Enter Real Number and Imaginary Number: 7 0 Multiplication: (0.00 + i5.00) x (7.00 + i0.00) = 0.00 + i(35.00) Division: (0.00 + i5.00) / (7.00 + i0.00) = 0.00 + i(0.71)

6	Complex 1: 0 + i0 Complex 2: 4 + i8 (one zero, one complex)	Enter Real Number and Imaginary Number (ex. 4 + i3 enter 4 3): 0 0 Enter Real Number and Imaginary Number: 4 8 Multiplication: (0.00 + i0.00) x (4.00 + i8.00) = 0.00 + i(0.00) Division: (0.00 + i0.00) / (4.00 + i8.00) = 0.00 + i(0.00)
7	Complex 1: 8 + i4 Complex 2: 0 + i0 (one complex, one zero)	Enter Real Number and Imaginary Number (ex. 4 + i3 enter 4 3): 8 4 Enter Real Number and Imaginary Number: 0 0 Invalid Numbers