Assignment #5

Joshua Jackson

250 722 551

Question1\_Part1

Code:

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| #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:

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| --- | --- | --- |
| 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:

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| --- |
| #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 |