ECE 175 Homework Assignment 8

Due Date: by 11.59 pm on Tuesday November 2, 2021 via D2L Drop-box

Submission Instructions: Submit only .c flies (hw8p1.c, hw8p2.c) in the designated Assignment Dropbox on D2L.

Conventions: Name your C programs as *hw**x**p**y**.c* where ***x*** corresponds to the homework number and ***y*** corresponds to the problem number.

If each .c file is not properly named, 1 point will be deducted from your homework score.

Write comments in your programs. Programs with no comment will receive PARTIAL credits. Refer to previous homework handouts for minimum required comments in your program.

Relevant Programming Concepts: Strings, Structures, Structure arrays

Problem 1(30 points): Complex Number Calculator

For a brief overview on complex numbers see http://mathworld.wolfram.com/ComplexNumber.html

Write a C program to create a complex number calculator. Your calculator shall be able to compute the following:

- Addition of two complex numbers: z1 + z2
- Multiplication of two complex numbers: z1 * z2
- Computation of the magnitude and phase (in degrees) of a complex number z.

The program should ask the user which of the three operations they wish to perform. It then asks the user to enter the appropriate values for the complex numbers and performs the necessary computation.

Your program shall use

- The structure Complex

```
typedef struct Complex_ {
        double RealPart ;
        double ImagPart ;
} Complex ;
```

- The following functions

```
Complex read_complex ( void );              // reads a complex number from the keyboard
void print_complex ( Complex Z);            // prints a double number in the form (a+bi)
Complex add_complex ( Complex Z1 , Complex Z2 );   // output z3 , z3 = z1 + z2
Complex mul_complex ( Complex Z1 , Complex Z2 );   // output z3 , z3 = z1 * z2
void par_complex ( Complex Z, double *mag_z , double *Angle_z ); // magnitude and angle of Z in deg.[1]
```

[1] Hint: Use the atan2 function for a four quadrant arctangent. For more information see *https://www.tutorialspoint.com/c_standard_library/c_function_atan2.htm*

Sample Code Execution 1: **Bold** text indicates information entered by the user

*** Complex Number Calculator ***
Enter "Add" for addition, "Mult" for multiplication, "MA" for magnitude and angle, or "Exit" to quit: **Add**
Enter a complex number: **3 29**
Enter a complex number: **5 -18**
(3.000+29.000i)+(5.000-18.000i)=(8.000+11.000i)

Enter "Add" for addition, "Mult" for multiplication, "MA" for magnitude and angle, or "Exit" to quit: **Mult**
Enter a complex number: **-2 10**
Enter a complex number: **5 -3**
(-2.000+10.000i)*(5.000-3.000i)=(20.000+56.000i)

Enter "Add" for addition, "Mult" for multiplication, "MA" for magnitude and angle, or "Exit" to quit: **MA**
Enter a complex number: **4 -3**
(4.000-3.000i) has a magnitude of 5.000 at an angle of -36.870 degrees

Enter "Add" for addition, "Mult" for multiplication, "MA" for magnitude and angle, or "Exit" to quit: **MA**
Enter a complex number: **-4 -3**
(-4.000-3.000i) has a magnitude of 5.000 at an angle of -143.130 degrees

Enter "Add" for addition, "Mult" for multiplication, "MA" for magnitude and angle, or "Exit" to quit: **Exit**

Problem 2 (40 points): Automatic Teller Machine Simulation (ATMS).

Create a C program that simulates an Automatic Teller Machine (ATM). Your program shall

- Read banking information from the file *BankData.dat* into a 10-element structure array. The file *BankData.dat* contains data information for 10 banking customers.
- Interact with the user to perform the necessary banking operations; which include
  - Prompt a user for account number and pin. Reject incorrect information.
  - Ask the user which transaction they choose to perform.
    - Display account balances.
    - Deposit/withdraw funds to/from checking/savings account.
    - Transfer funds from one account to another.
    - Allow the user to reset their PIN.

- Save the updated banking information to the file *UpdatedBankData.dat*

Your program shall use

- The structure *UserAccount*

```
typedef struct UserAccount_{
	char FirstName[50];
	char LastName[50];
	int AccountNumber;
	int Pin;
	float SavingsBalance;
	float CheckingBalance;
}UserAccount;
```

- The following functions

```
void ReadBankData(FILE *inp, UserAccount AccountInfo[]);   // Read info from file
void WriteBankData(FILE *inp, UserAccount AccountInfo[]);  // Write info to file
void DepositWithdraw(UserAccount *CurrentUser);            // deposit or withdraw
void MoneyTransfer(UserAccount *CurrentUser);              // xfer money
void PinReset(UserAccount *CurrentUser);                   // reset pin
void PrintBalance(UserAccount CurrentUser);                // print balance
```

From the *BankData.dat,* let's use entry of (Note that there are **10 account information in the file all of which is read in to the structure array**). **Your program will read in the entries for all 10 users and then select the correct user based on the account number and PIN number entered by the user.**

Justin
Thyme
303030
2468
0.11
-55.63

Sample Code Execution 1: **Bold** text indicates information entered by the user

Enter your account number: **123456**
Enter your pin number: **1234**
Incorrect Information
Welcome to ECE 175 ATMS
Enter your account number: **303030**
Enter your pin number: **1234**
Incorrect Information
Welcome to ECE 175 ATMS
Enter your account number: **303030**
Enter your pin number: **2468**

Hello Justin Thyme
Select Transaction
1. Account Balance
2. Deposit or Withdrawal
3. Money Transfer
4. PIN Reset:
1
Your Savings Account Balance is 0.11
Your Checking Account Balance is -55.63
Would you like to perform another transaction? (Y/N): **y**

Select Transaction
1. Account Balance
2. Deposit or Withdrawal
3. Money Transfer

4. PIN Reset:
2
** Deposit or Withdraw **
1. Deposit
2. Withdraw
2
Which Account?
1. Checking Account
2. Savings Account
1
How much? **100**
Insufficient Funds. Request Denied!!!
Your Savings Account Balance is 0.11
Your Checking Account Balance is -55.63
Would you like to perform another transaction? (Y/N): **Y**

Select Transaction
1. Account Balance
2. Deposit or Withdrawal
3. Money Transfer
4. PIN Reset:
2
** Deposit or Withdraw **
1. Deposit
2. Withdraw
1
Which Account?
1. Checking Account
2. Savings Account
1
How much? **100**
Your Savings Account Balance is 0.11
Your Checking Account Balance is 44.37
Would you like to perform another transaction? (Y/N): **y**

Select Transaction
1. Account Balance
2. Deposit or Withdrawal
3. Money Transfer
4. PIN Reset:
3
** Transfer **
1. From Checking to Savings
2. From Savings to Checking
1
How much? **1000**

Insufficient Funds. Request Denied!!!
Your Savings Account Balance is 0.11
Your Checking Account Balance is 44.37
Would you like to perform another transaction? (Y/N): **y**

Select Transaction
1. Account Balance
2. Deposit or Withdrawal
3. Money Transfer
4. PIN Reset:
3
** Transfer **
1. From Checking to Savings
2. From Savings to Checking
1
How much? **10**
Your Savings Account Balance is 10.11
Your Checking Account Balance is 34.37
Would you like to perform another transaction? (Y/N): **y**

Select Transaction
1. Account Balance
2. Deposit or Withdrawal
3. Money Transfer
4. PIN Reset:
3
** Transfer **
1. From Checking to Savings
2. From Savings to Checking
2
How much? **50**
Insufficient Funds. Request Denied!!!
Your Savings Account Balance is 10.11
Your Checking Account Balance is 34.37
Would you like to perform another transaction? (Y/N): **y**

Select Transaction
1. Account Balance
2. Deposit or Withdrawal
3. Money Transfer
4. PIN Reset:
3
** Transfer **
1. From Checking to Savings
2. From Savings to Checking
2

How much? **5**
Your Savings Account Balance is 5.11
Your Checking Account Balance is 39.37
Would you like to perform another transaction? (Y/N): **Y**

Select Transaction
1. Account Balance
2. Deposit or Withdrawal
3. Money Transfer
4. PIN Reset:
4
Enter new pin number > 1000 and < 9999: **1000**
Enter new pin number > 1000 and < 9999: **123**
Enter new pin number > 1000 and < 9999: **56789**
Enter new pin number > 1000 and < 9999: **5555**
Pin Reset Successful
Would you like to perform another transaction? (Y/N): **n**
Goodbye

The *UpdatedBankData.dat* entry is then (Observe that other account have no change except the account of **Justin Thyme)**

```
Crystal
Ball
101010
1234
12000.25
2000.13
Joe
King
202020
4321
400.65
22.96
Justin
Thyme
303030
5555
5.11
39.37
Hugh
Raye
404040
8642
139.21
9.19
Jim
Nasium
505050
1357
2000.32
4150.14
Holly
```

```
Wood
606060
7531
9.23
6.88
Jack
Pott
707070
6789
101.20
305.66
Ima
Bugg
808080
9876
10.30
-4.20
Bennie
Factor
909090
3579
11021.22
12.30
Don
Keigh
919191
9753
23.45
-5.20
```