Part B - Foundations

Compound Types and Privacy

Workshop 3

In this workshop, you are to define a compound type with private data and public member functions.

LEARNING OUTCOMES

Upon successful completion of this workshop, you will have demonstrated the abilities

- to design a compound type
- to privatize data within a compound type
- to access data within an object of the compound type through public member functions
- to summarize what you have learned in the task

SUBMISSION POLICY

The “in-lab” section is to be completed **during your assigned lab section**. It is to be completed and submitted by the end of the workshop. If you do not attend the workshop, you can submit the “in-lab” section along with your “at-home” section (a 30% late deduction will be assessed). The “at-home” portion of the lab is **due the day before you next scheduled workshop.**

All your work (all the files you create or modify) must contain your name, Seneca email and student number.

You are responsible to regularly back up your work.

CREDIT CARD CLASS – IN-LAB SECTION

Get the lab files from the git repository (Github).You can use one of the following two ways:

1: On the lab computer or Matrix, issue this command to clone (download) the Workshop3 repository. (Select one of the two depending on your own preference)

```
> git clone https://github.com/Seneca-244200/BTP-Workshop3.git
```

2: On a browser open this URL and click on Download Zip button to download the Workshop3 files in compressed zip format.
https://github.com/Seneca-244200/BTP-Workshop3

All the files needed for this workshop is already created and ready to use, if you are using windows platform on visual studio, just click on w3_in_lab.vcxproj to open the project.

Design and code a class named **`CreditCard,`** in **`CreditCard.h`** and **`CreditCard.cpp`**.

Please note the compilation safeguards in the header file and the sict namespace. Starting from next workshop you must add these statements to your code.

Adding predefined values to the project:

In the **`CreditCard`**.h file, you must define the following constants:

MAX_NAME_LENGTH with a value of 40. This value represents the maximum number of characters for the name of a cardholder.

MIN_INST_NUMBER with a value of 100. This is the lowest valid institution code.

MAX_INST_NUMBER with a value of 999. This is the highest valid institution code

MIN_EXP_YEAR with a value of 2017. The lowest valid value for the card's expiration year

MAX_EXP_YEAR with a value of 2037. The highest valid value for the card's expiration year

MIN_CARD_NUMBER with a value of 4000000000000000. The lowest valid value for the card number.

MAX_CARD_NUMBER with a value of 4000999999999999. The highest valid value for the card number.

Create the **`CreditCard`** Class with the following six members.

- **`m_cardHolderName`** of type **`char[MAX_NAME_LENGTH]`**
- **`m_cardNumber`** of type **`unsigned long long`**
- **`m_institutionCode`** of type **`int`**
- **`m_expiryYear`** of type **`int`**
- **`m_expiryMonth`** of type **`int`**
- **`m_numberInTheBack`** of type **`int`**

Ensure that only member functions of the class can access these data members.

The CreditCard class must have the following members:

- **`void name(const char cardHolderName[])`**
- **`void initialize(unsigned long long creditCardNumber,`**
- **`int instCode,`**
- **`int expiryYear,`**
- **`int expiryMonth,`**
- **`int numberInTheBack)`**
- **`void write() const;`**
- **`bool isValid() const;`**

The **`name()`** function copies the string from the parameter (**`cardHolderName)`** into the data member string (**`m_cardHolderName)`**.

The **`initialize()`** function sets the **`m_cardNumber, m_institutionCode, m_expiryYear, m_expiryMonth and m_numberInTheBack`** data members with the information received from the parameters.

The **`isValid()`** function returns true if the information contained in the object represents a valid credit card. The function returns false otherwise. A credit card object is valid if:

- The cardholder name has at least one character.
- The credit card number is in the range of MIN_CARD_NUMBER and MAX_CARD_NUMBER
- The institution code is in the range of MIN_INST_NUMBER and MAX_INST_NUMBER
- The expiry year is in the range of MIN_EXP_YEAR and MAX_EXP_YEAR
- The expiry month is between 1 and 12
- The number in the back is positive and has no more than 3 digits.

The **`write()`** function checks if the Credit Card object is valid. If so, it displays the current **`CreditCard`** object. The following is an example for how the data would be displayed. It si only an example and you are not to hardcode this sample data:

```
Cardholder: Jane Doe
Card Number: 4999012398760001
Institution: 301
Expires: 10/2018
Number at the back: 505
```

The **`write()`** function does not generate any output if the **`CreditCard`** object is not valid.

The main program that uses your new class contains the following code.

```
// BTP200 Workshop 3: Compound types and privacy
// File       w3_in_lab.cpp
// Version 1.0
// Date       2017/01/15
// Author     Ed Arvelaez
// Description
// This file is used to demonstrate classes in C++ and
// how member variables can be defined as private but
// accessed through member functions
//
// Revision History
/////////////////////////////////////////////////////////
// Name                    Date                    Reason
//
/////////////////////////////////////////////////////////

#include <iostream>
#include "CreditCard.h"
using namespace std;
using namespace sict;

int main() {
	CreditCard myCC;
	char name[41];
	int instCode;
	int expiryYear;
	int expiryMonth;
	unsigned long long cardNumber;
	int backNumber;
	char slash;

	cout << "Credit Card app" << endl <<
		"==================" << endl << endl;
	cout << "Please enter your name: ";
	cin >> name;

	do {
		cout <<
			"Please enter your credit card number, institution code, " <<
```

```
                    "expiry date, and security number as follows: " <<
                    "4000123412341234 999 12/1234 999" << endl << "> " ;

            cin >> cardNumber >> instCode >> expiryMonth >> slash >> expiryYear >>
                       backNumber ;

            cout << endl;
            myCC.name(name);
            myCC.initialize(cardNumber, instCode, expiryYear, expiryMonth, backNumber);
            myCC.write();
        } while (!myCC.isValid() && cout << "Invalid input" << endl );
        cout << endl << "Thank you!" << endl;
        return 0;

}
```

Compiling and running the above code with your CreditCard.cpp should “exactly” generate the following output:

```
Credit Card app
===================

Please enter your name: John
Please enter your credit card number, institution code, expiry date, and security
number as follows: 4000123412341234 999 12/1234 999
> 1000111122223333 17 17/1972 15

Invalid input
Please enter your credit card number, institution code, expiry date, and security
number as follows: 4000123412341234 999 12/1234 999
> 4000111122223333 17 17/1972 15

Invalid input
Please enter your credit card number, institution code, expiry date, and security
number as follows: 4000123412341234 999 12/1234 999
> 4000111122223333 301 17/1972 15

Invalid input
Please enter your credit card number, institution code, expiry date, and security
number as follows: 4000123412341234 999 12/1234 999
> 4000111122223333 301 12/1972 15

Invalid input
Please enter your credit card number, institution code, expiry date, and security
number as follows: 4000123412341234 999 12/1234 999
> 4000111122223333 301 12/2020 15

Cardholder: John
Card Number: 4000111122223333
Institution: 301
Expires: 12/2020
Number at the back: 15
```

```
Thank you!
```

IN-LAB SUBMISSION (50%)

To test and demonstrate execution of your program use the same data as the output example above.

If not on matrix already, upload your **`CreditCard.h`**, **`CreditCard.cpp`** and **`w3_in_lab.cpp`** to your matrix account. Compile and run your code and make sure everything works properly.

Then run the following script from your account: (replace profname.proflastname with your professors Seneca userid)

```
~profname.proflastname/submit 200_w3_lab <ENTER>
```

and follow the instructions.

Please note that a successful submission does not guarantee full credit for this workshop.

If the professor is not satisfied with your implementation, your professor may ask you to resubmit. Resubmissions will attract a penalty.

AT HOME SECTION: (40%)

For the “At Home” Section of the workshop copy the CreditCard Module (**`CreditCard.h`** and **`CreditCard.cpp`**) to your at-home directory and do the following:

1 - Create two private constant member functions called writeName and writeCardInfo. These two methods return void and have no arguments.

writeName, displays the name portion of the write() function only (no newline after):

```
CardHolder: John
```

writeCardInfo displays the number portion of the write() function only (no newline after and no space or comma before):

```
Card Number: 4000111122223333
Institution: 301
Expires: 12/2020
Number at the back: 15
```

2- Modify the write function of CreditCard by adding two Boolean arguments; displayName and displayCardInfo.

Using the two private write functions written in part 1 and default value for arguments re-implement the write function to work as follows:

`write()` – will provide the same output as before

`write(false)` – will only output the card information

`write(true, false)` – will only display the name

`write(false, false)` – will not output anything

The main program that uses your new implementation contains the following code.

```
// BTP200 Workshop 3: Compound types and privacy
// File       w3_at_home.cpp
// Version 1.0
// Date       2017/01/15
// Author     Ed Arvelaez
// Description
// This file is used to demonstrate classes in C++ and
// how member variables can be defined as private but
// accessed through member functions
//
// Revision History
/////////////////////////////////////////////////////////
// Name                    Date                    Reason
//
/////////////////////////////////////////////////////////

#include <iostream>
using namespace std;
#include "CreditCard.h"
using namespace sict;

void writeAll(const CreditCard& );

int main() {
       CreditCard myCC;
       char name[41];
       int instCode;
       int expiryYear;
```

```
	int expiryMonth;
	unsigned long long cardNumber;
	int backNumber;
	char slash;

	cout << "Credit Card app" << endl <<
		"==================" << endl << endl;
	cout << "Please enter your name: ";
	cin >> name;

	do {
		cout <<
			"Please enter your credit card number, institution code, " <<
			"expiry date, and security number as follows: " <<
			"4000123412341234 999 12/1234 999" << endl << "> ";

		cin >> cardNumber >> instCode >> expiryMonth >> slash >> expiryYear >>
			backNumber;

		cout << endl;
		myCC.name(name);
		myCC.initialize(cardNumber, instCode, expiryYear, expiryMonth, backNumber);
	} while (!myCC.isValid() && cout << "Invalid input" << endl);
	cout << endl << "Thank you!" << endl;
	writeAll(myCC);
	return 0;
}

void writeAll(const CreditCard& card)
{
	card.write();
	cout << endl << "-------------" << endl;
	card.write(false);
	cout << endl << "-------------" << endl;
	card.write(true, false);
	cout << endl << "-------------" << endl;
	card.write(false, false);

}
```

Compiling and running the above code with your CreditCard.cpp and CreditCard.h should “exactly” generate the following output:

```
Credit Card app
==================

Please enter your name: John
Please enter your credit card number, institution code, expiry date, and
security number as follows: 4000123412341234 999 12/1234 999
> 1111222233334444 301 12/2020 505

Invalid input
Please enter your credit card number, institution code, expiry date, and
security number as follows: 4000123412341234 999 12/1234 999
> 4000111122223333 301 12/2020 505
```

```
Thank you!
Cardholder: John
Card Number: 4000111122223333
Institution: 301
Expires: 12/2020
Number at the back: 505
-------------
Card Number: 4000111122223333
Institution: 301
Expires: 12/2020
Number at the back: 505
-------------
Cardholder: John
-------------
```

REFLECTION (10%)

1- In a file called reflect.txt and using examples from your own code explain which features of object orientation you used.
2- Explain your understanding of the do-while loop written in the main program, especially the condition that makes it stop. Also explain the choice of type for storing the credit card number.

AT-HOME SUBMISSION

To test and demonstrate execution of your program use the same data as the output example above.

If not on matrix already, upload your **`CreditCard.h`** and **`CreditCard.cpp`** , **`w3_at_home.cpp and reflect.txt`** to your matrix account. Compile and run your code and make sure everything works properly.

Then run the following script from your account: (replace profname.proflastname with your professors Seneca userid)

```
~profname.proflastname/submit 200_w3_home <ENTER>
```

and follow the instructions.

Please note that a successful submission does not guarantee full credit for this workshop.

If the professor is not satisfied with your implementation, your professor may ask you to resubmit. Resubmissions will attract a penalty.