CSC 155 *Computer Science I* LAB 2

Student Name _____ Section _____

Instructor _____ Due Date _____

Project	1	2	3	4	5	6	TOTAL
Maximum Points	2 points	2 points	2 points	2 points	1 point	1 point	10 points
Your Score							

PROJECT ONE

Objective To type, compile and execute a program that computes compound interest.

PROJECT DESCRIPTION

This project consists of typing the code of the compound interest program, shown in **Figure 1** which follows, and running the program for various compound interest scenarios.

Information About This Project

The formula to compute the compound amount of principal reinvested is as follows:

$$A = P(1 + i)^n$$

where

A is the compounded amount reinvested over time
P is the principal or the amount invested
i is annual interest rate per period.
n is the total number of compounding periods

An example of computing compound interest follows.

Example

Susan invests $1,000 in a compounding interest bearing account. If the interest rate on the account is 8.0%, compounded semi-annually, how much will her compound amount and compound interest be at the end of 5 years?

Solution

Compounding semi-annually means that there are two interest payment periods per year. Thus in this example $P = \$1{,}000$, $n = 2$ periods $\cdot$ 5 years or 10 total periods and the rate every semi-annual period is $i = 0.08 / 2$ or 0.04. Therefore the compound amount A at the end of year 5 would be

$$\begin{aligned} A &= P(1 + i)^n \\ &= \$1{,}000(1 + 0.04)^{10} \\ &= \$1{,}000(1.480244285) \\ &= \$1{,}480.24, \text{ rounded to the nearest cent.} \end{aligned}$$

The interest earned would be the difference between the original principal and the accumulated amount or

$$A - P = \$1{,}480.24 - \$1{,}000.00 = \$480.24$$

Note that if compounding occurs annually, semi-annually, quarterly or monthly, i must be adjusted by the number of interest rates payment periods per year. For example, if interest is compounded quarterly there are 4 interest payments per year. Thus the number of payment periods in 5 years for Susan would be $n = 4(5)$ or 20 and the interest rate per period would be $i = r / m = 0.08 / 4 = 0.02$ where r is the annual rate and m is the number of compounding periods per year.

Student Name _____ Section _____

PROJECT ONE

For this project, you will be introduced to the power function `pow()` from the `<math>` library, which will help calculate compound interest and compound (accumulated amount) and `<iomanip>` which helps format your output.

Steps To Complete This Project

STEP 1 **Open the UNIX `emacs` Text Editor and Type the Program Code**

Open a new UNIX session and, at the UNIX command prompt, type the following command to invoke the `emacs` editor.

```
emacs lab2prj1.cpp
```

When the `emacs` editor opens, type the code shown in **Figure 1**, exactly as it appears, except substitute your own name in place of Sammy Student.

Figure 1 Program Code for the Compound Interest Program

```
/*************************************************************\
 *compound interest program: by Sammy Student, today's date
\*************************************************************/
#include <iostream>
#include <cmath>
#include <iomanip>
using namespace std;
void main()
{
  double rate_per, cp, ncp, deposit, compound_amount, xint;
  char answer;
do
{
  cout << "Compute compound interest/future value\n" << endl;
  cout << "Enter annual interest rate as a decimal:      ";
  cin >> rate_per;
  cout << "Enter number of compounding periods per year: ";
  cin >> cp;
  rate_per = rate_per / cp;
  cout << "Enter total number of compounding periods:    ";
  cin >> ncp;
  cout << "Enter amount of deposit(no $ or comma):       ";
  cin >> deposit;
  compound_amount = deposit * pow((1 + rate_per), ncp);
  xint = compound_amount - deposit;
  cout << "\nCompound amount   = $"
       << setiosflags(ios::fixed | ios::showpoint)
       << setprecision(2) << compound_amount << endl;
  cout << "Compound interest = $"
       << setprecision(2) << xint << endl;
  cout << "\nCompute another compound interest amount?" << endl;
  cout << "(Y/N)? ";
  cin >> answer;
}while(answer == 'y' || answer == 'Y');
}
```

Student Name _____ Section _____

PROJECT ONE

STEP 2 **Perform a Test Run of your Program**

Compile and run your program with the following scenario.

Sample Program Run Data

Principal $ 500.00
Rate 5 %, compounded quarterly
Time 5 years

Your output screen should be similar to the following.

Sample Program Run

```
Compute compound interest/future amount

Enter annual interest rate as a decimal:       0.05
Enter number of compounding periods per year:  4
Enter total number of compounding periods:     20
Enter amount of deposit(no $ or comma):        500.00

Compound amount   = $641.02
Compound interest = $141.02

Compute another compound interest amount?
(Y/N)? Y
```

With your program working correctly, proceed to the next step.

STEP 3 **Compile and Run your Program**

After you verify that your program is executing properly, run your program for each of the following scenarios. Enter your responses in the spaces provided.

For each of these scenarios, assume that a $ 1,000 deposit amount is invested at 4 % for 5 years. Print screen snapshots of each of the scenarios and paste them in an MS Word document. Use the keyboard shortcut [Alt] + [Print Screen] to capture a screen snapshot and [Ctrl] + [V] to paste the snapshot.

- If interest is compounded annually, what would be the

  Compound amount at the end of 5 years _____ .

  Compound interest at the end of 5 years _____ .

- If interest is compounded semiannually, what would be the

  Compound amount at the end of 5 years _____ .

  Compound interest at the end of 5 years _____ .

- If interest is compounded quarterly, what would be the

  Compound amount at the end of 5 years _____ .

  Compound interest at the end of 5 years _____ .

- If interest is compounded monthly, what would be the

  Compound amount at the end of 5 years _____ .

  Compound interest at the end of 5 years _____ .

STEP 4 **Print Your Program Code**

Finally, print your program code and submit it for credit together with your screen snapshots.

Student Name _____ Section _____

PROJECT TWO

Objective To write a simple program, execute (run) the program for some particular values and then observe the output.

PROJECT DESCRIPTION

Write a program that computes the month (February) ending balance in a personal checking account. At the beginning of February the balance was $ 971.82 . During the same month, checks were written for the following items: two music CDs - $ 32.50 , pants - $ 35.60 , rent - $ 550.00 and three books - $ 174.67. Also, during February, $ 125.00 was deposited into the account and a maintenance fee of $ 30.00 was deducted from the account.

Information About This Project

This program illustrates sequential program logic. The complete pseudocode for the above program is listed below. When converting this pseudocde to C++ code, use a `cout` statement to display a message to the program user and `cin` to store a user's response to a message.

- Begin the program by including appropriate header files.
- Use comment statements to write programmer's remarks such as programmer name, date, course and assignment.
- Define a `main()` program function, which incorporates the code that follows.
- Within the `main()` program function, declare any variables which will be used throughout the program.
- Display a message to the user indicating that this program determines the month end balance for February.
- Display a message, which requests the pertinent month from the program user.
- Store the user's response in a character variable named `month`.
- Display a message, which requests the beginning of the month account balance.
- Store the user's response in a real variable named `balance`.
- Display a message, which requests the amount of the check that paid for the music CDs.
- Store the user's response in a real variable named `music`.
- Decrease the account balance by the amount of the variable `music`.
- Display a message, which requests the amount of the check that paid for the pants.
- Store the user's response in a real variable named `clothes`.

PROJECT TWO

- Decrease the account balance by the amount of the variable `clothes`.
- Display a message, which requests the amount of the check that paid for the rent.
- Store the user's response in a real variable named `rent`.
- Decrease the account balance by the amount of the variable `rent`.
- Display a message, which requests the amount of the check that paid for the books.
- Store the user's response in a real variable named `books`.
- Decrease the account balance by the amount of the variable `books`.
- Display a message, which requests the amount of deposit made to the account.
- Store the user's response in a real variable named `deposit`.
- Increase the account balance by the amount of the variable `deposit`.
- Decrease the account balance by the amount of the account maintenance fee.
- Display a message to the user stating: " the ending balance for the month of (display appropriate month) is."
- Display account balance for the end of the month.
- Close the `main()` program function to end the program.

Note: when requesting a character string, such as the name of a month, from the program user, use a size - defined character variable. A code example of utilizing such a variable is given below.

```
//sample code segment for a size - defined char variable
//declares character variable (maximum size is 20)
char month[20];
//requests the name of the month from the program user
cout << "enter the month ";
//stores the user's response in the variable named month
cin >> month;
//displays the user's response back to the user
cout << "the month you entered is: " << month << endl;
```

Student Name _____ Section _____

PROJECT TWO

Steps To Complete This Project

STEP 1 **Open the UNIX emacs Text Editor and Type the Program Code**

Open a new UNIX session and, at the UNIX command prompt, type the following command to invoke the emacs editor.

```
emacs lab2prj2.cpp
```

When the emacs editor opens, write the program code necessary to accept the input items and display the required output items of the above project. Use the hints given to you in the next step to write your code.

STEP 2 **Translate Exactly the Given Pseudocode into C + + Program Code**

Follow the exact preceding pseudocode to write your program.
Include your name, date and course title in the heading portion of your code.
Also, include program code that will allow your output to be manipulated such that dollar values are displayed with the typical currency format of a $ dollar sign and two decimal places.

STEP 3 **Compile and Run your Program**

Compile and run your program. Test your program by using the given information within the ***Project Description*** portion of this project.

STEP 4 **Print Your Program Code**

Finally, print your program code and attach it to this lab packet for credit.
Include for submission, a run time image of your program showing any required output.

Student Name _____ Section _____

PROJECT THREE

Objective To write a program that computes a monthly telephone bill.

PROJECT DESCRIPTION

Write a program that computes the monthly telephone bill for the Higgins Connection Company (HCC). Each customer has a base charge of $ 13.00 per month and is charged for each local and long distance call.

Your program should prompt the user for the customer name and the number of local calls made during the given month. The charge for each local call is $ 0.25 .

Your program should also prompt the user for the number of long distance calls made during the month and the total number of minutes of long distance usage. The charge for each long distance call is $ 0.35 plus $ 0.40 per minute.

The local and long distance charges are then added to compute the total bill.

Compute the grand total of the bill by adding to the total bill each of (1) an 8.75 % county tax on the total bill, (2) a 3.00 % federal tax on the total bill and (3) a flat $ 2.00 account maintenance fee.

Information About This Project

This particular program makes use of variable accumulators, that is the value of a particular variable accumulates from an initial value to some final value. For example, the following program segment declares and uses an accumulating variable named `total`, whose initial value of 13.00 increments by the amount corresponding to the charge of the local calls.

```
//sample code segment for an accumulating variable

int local;
//declares integer variable local

double total = 13.00;
//declares accumulating variable total, initial value 13.00

cout << "\nHow many local calls were made?";
//requests the number of local calls from the program user

cin >> local;
 //stores the user's response in the variable local

total = total + 0.25 * local;
//uses assignment statement to add to the variable total
//by adding the amount of the local calls to total
```

The above program description requires the user to enter a customer name. The program code segment that you can use to ask the user for the name of the customer and store that name in a variable called name is given below and uses the `getline()` function, which is a part of the `<iostream>` library.

```
//sample code segment for the getline() function

char name[40];
```

Student Name _____ Section _____

PROJECT THREE

```
//declares character variable (maximum size is 40)
cout << "\nWhat is the customer's name? ";
//requests the name of the customer from the program user
cin.getline(name, 40);
 //stores the user's response in the variable name
cout << "customer name:    " << name << endl;
 //displays the customer name to the user
```

Steps To Complete This Project

STEP 1 **Open the UNIX emacs Text Editor and Type the Program Code**

Open a new UNIX session and, at the UNIX command prompt, type the following command to invoke the emacs editor.

```
emacs lab2prj3.cpp
```

In the new C++ source file, write the program code which will allow the user to enter the necessary input items and then use these items to compute the required output value(s). Include code that will allow your output to be manipulated such that dollar values are displayed with the typical currency format of a $ dollar sign and two decimal places. The Input, Process and Output requirements for this program are summarized below.

Input

- the customer name
- number of local calls
- number of long distance calls
- number of long distance minutes

Process

- compute the current total bill by adding the base charge to the local calls charge
- determine the new current total bill by adding the long distance calls charge to the above sum
- add the county tax to the current total bill
- add also the federal tax to the current total bill
- finally, add the account maintenance fee to the current total bill to arrive at the grand total

Output

- the customer name
- the number of local calls
- the number of long distance calls
- the subtotal (before taxes and before any maintenance fee)
- the amount of taxes (both county and federal)
- the overall grand total

STEP 2 **Compile and Run your Program**

Compile and run your program. Test the operation of your program using appropriate numbers for your input variables.

STEP 3 **Print your Program Code and your Run Time Output**

When completed, print your program source code as well as the program output(s). Attach the hardcopies to your lab cover sheet for credit.

Student Name _____ Section _____

PROJECT FOUR

Objective To write a program that computes the depreciation of a business asset.

PROJECT DESCRIPTION

In accounting, depreciation is an allowance made for a loss in value of business - use property. One method for computing the depreciation of a business - use asset is the double declining balance method, or DDB abbreviated. Using this method, the depreciation for a particular year in the life of the asset can be expressed by the following formula.

$$D = \frac{2C}{N}\left[1 - \frac{2}{N}\right]^{Y-1}$$

where,

D is the depreciation for one year
C is the original cost of the asset
N is the estimated life
Y is the year for which depreciation is calculated

Write, compile and run a program application, which computes the depreciation of a business - use asset using the double declining balance method. Test your program mathematically by determining the value of D, shown above, when $C = 5000$, $N = 5$ and $Y = 2$.

Information About This Project

This particular program illustrates the essentials of sequential program control whereby input items are entered individually into a program and a desired result is computed.

Steps To Complete This Project

STEP 1 **Open the UNIX `emacs` Text Editor and Type the Program Code**

Open a new UNIX session and, at the UNIX command prompt, type the following command to invoke the `emacs` editor.

```
emacs lab2prj4.cpp
```

In the new C++ source file, write the program, which will allow the user to enter the necessary input items and then use these items to compute the required output value(s). The Input, Process and Output requirements for this program are summarized below.

Input

- the original asset cost
- the estimated asset life
- the year for which depreciation is calculated

Process

- compute the depreciation for one particular year

Student Name _____ Section _____

PROJECT FOUR

Output

- display the depreciation for one particular year

STEP 2 **Compile and Run your Program**

Compile and run your program. Test your program by using the given values provided within the ***Project Description*** portion of this project. The correct result to arrive at is 1200. If you do not arrive at this value, check if your assignment statement that computes *D* has parentheses around the entire exponent quantity ($Y - 1$).

STEP 3 **Print your Program Code and your Run Time Output**

When you have determined that your program is fully functional, print your program source code as well as a snapshot of your program output which shows the correct value of *D* for the sample data given in the ***Project Description*** portion of this project. Attach the hardcopies to your lab cover sheet for credit.

Student Name _____ Section _____

PROJECT FIVE

Objective To write, compile and execute a simple sequence control program.

PROJECT DESCRIPTION

This particular project requires you to write, compile and execute a program that computes the dollar value of the coins in a piggy bank.

Information About This Project

This project consists of writing the code of a program that computes the total amount in a piggy bank, which is an object that holds monetary coins. Allow for the chance that your piggy bank could contain half - dollars, quarters, dimes, nickels and pennies. The main things to consider here are (1) the number of coins of each type that are in the piggy bank and (2) the total monetary value of each type of coin.

Steps To Complete This Project

Here are some useful steps to help you complete this project.

→ Include in your program heading portion, comment statements that contain the typical remarks such as your name, course information, date and project / lab assignment. Example comment statements include:

```
//Source Code for the Piggy Bank Program
//Student Name:
//Course:
//Lab Number:
//Date:
//Instructor:
```

→ Within your `main()` program, include also opening statements that the user will read such as:

```
cout << "Welcome to the Piggy Bank Program!" << endl;
cout << "This program finds the value of the coins";
cout << "in your piggy bank." << endl;
```

→ Once you have completed the coding, running and testing aspects of your program code, determine the value of the coins in the piggy bank for each of the following scenarios.

John's Piggy Bank

Number of Half - Dollars	12
Number of Quarters	18
Number of Dimes	32
Number of Nickels	27
Number of Pennies	93

The total value of all the coins in the piggy bank is $ _____ .

Student Name _____ Section _____

PROJECT FIVE

Carol's Piggy Bank

Number of Half - Dollars	2
Number of Quarters	22
Number of Dimes	17
Number of Nickels	38
Number of Pennies	74

The total value of all the coins in the piggy bank is $ _____ .

Finally print a copy of your program source and attach it to your lab cover sheet for credit. Also, attach hardcopy of your program output showing the results for each of the scenarios shown below.

Student Name _____ Section _____

PROJECT SIX

Objective To solve a mathematical problem using a computer programming language.

PROJECT DESCRIPTION

Create a computer language program that will compute the slope, the horizontal or x - intercept and the vertical or y - intercept of an algebraic linear equation of the form:

$$A\,x + B\,y = C$$

The program should prompt the user to input the three constants A, B and C and then should produce an output indicating the numerical value of the slope and the y - intercept.

Also, include pseudocode and a flowchart as layouts of your program. Create your flowchart in MS Word using Word's Drawing toolbar.

Information About This Project

In the field of Algebra, a linear equation is one that has the general form:

$$A\,x + B\,y = C$$

where A, B and C are constant numbers and x and y are the variables.

An example would be:

$6\,x - 4\,y = 24$ is a linear equation where
$A = 6,\ B = -4$ and $C = 24$

The graph of a linear equation $A\,x + B\,y = C$, of course, is a straight line which is characterized as having a slope value as well as a horizontal or x - intercept and a vertical or y - intercept.

the slope m is given in terms of A and B as the following ratio:

$m = -A / B$

the x - intercept is given as the expression that follows:

x - intercept $= C / A$

the y - intercept is given as the expression that follows:

y - intercept $= C / B$

Example

An example would be:

$6\,x - 4\,y = 24$ is a linear equation where $A = 6$, $B = -4$ and $C = 24$

and the slope m is;

$m = -(6 / -4)$ or $3 / 2$

the x - intercept is;

x - intercept $= 24 / 6$ or 4

and the y - intercept is:

y - intercept $= 24 / -4$ or -6

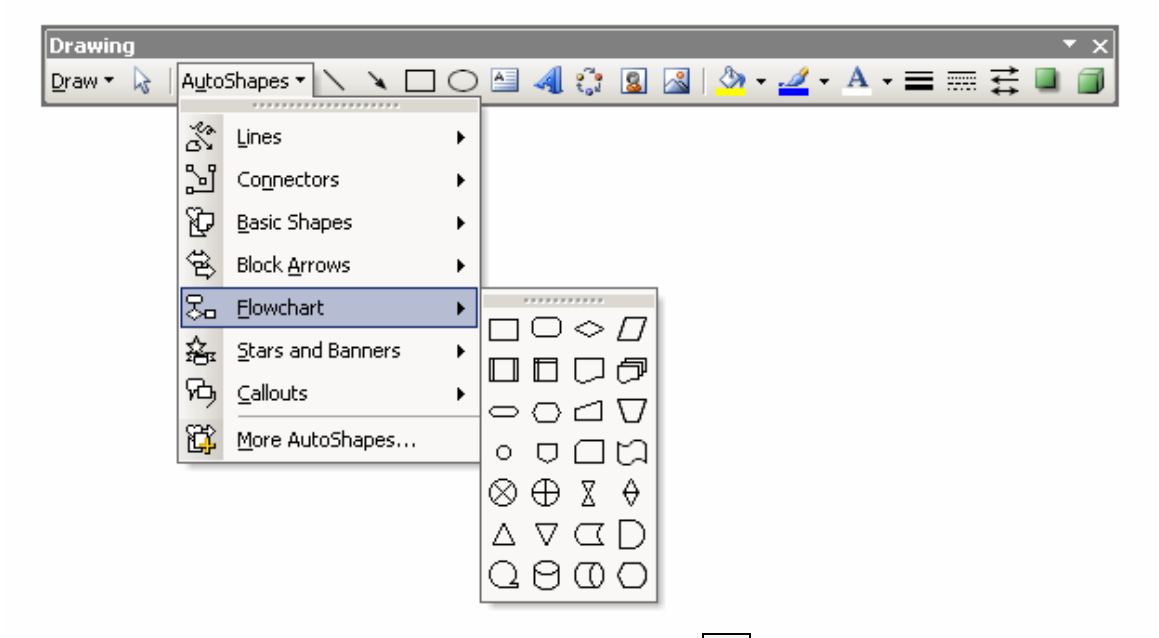
Student Name _____ Section _____

PROJECT SIX

Note: to use MS Word's Drawing toolbar perform the following steps . . .

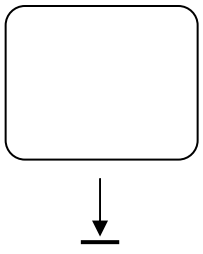
→ Open the **Drawing** Toolbar (if it is not already) by clicking the View menu, pointing to Toolbars and selecting Drawing . Your toolbar should look like the toolbar just below.

You may now select flowchart symbols from the pull - down list of the AutoShapes button as shown below. After you select from a flowchart symbol, left click once onto it and go to a spot on your document you want to place your symbol and then left click once again. Your symbol now appears on your document.



→ To place text in your symbol, left click once on the 'text box' icon, then inside your desired flow chart symbol, left click and drag a desired text box size.

→ To add flow lines to connect your symbols, click once on the " arrow " icon and place the cross hair of the cursor that appears at the base and center of your symbol as shown below. Left click again on your mouse and drag your cursor to your desired arrow length and then release your mouse click.



Student Name _____ Section _____

PROJECT SIX

Steps To Complete This Project

STEP 1 **Open the UNIX emacs Text Editor and Type the Program Code**

Open a new UNIX session and, at the UNIX command prompt, type the following command to invoke the emacs editor.

```
emacs lab2prj6.cpp
```

In the new C++ source file, write the program, which will allow the user to enter the necessary input items and then use these items to compute the required output value(s).

STEP 2 **Compile and Run your Program**

Compile and run your program. Use the sample information included in the ***Information About This Project*** section to test your program.

STEP 3 **Print your Program Code and Your Run Time Output**

When you have determined that your program is fully functional, print your program source code as well as your pseudocode and your completed flowchart. Attach the hardcopies to your lab cover sheet for credit.