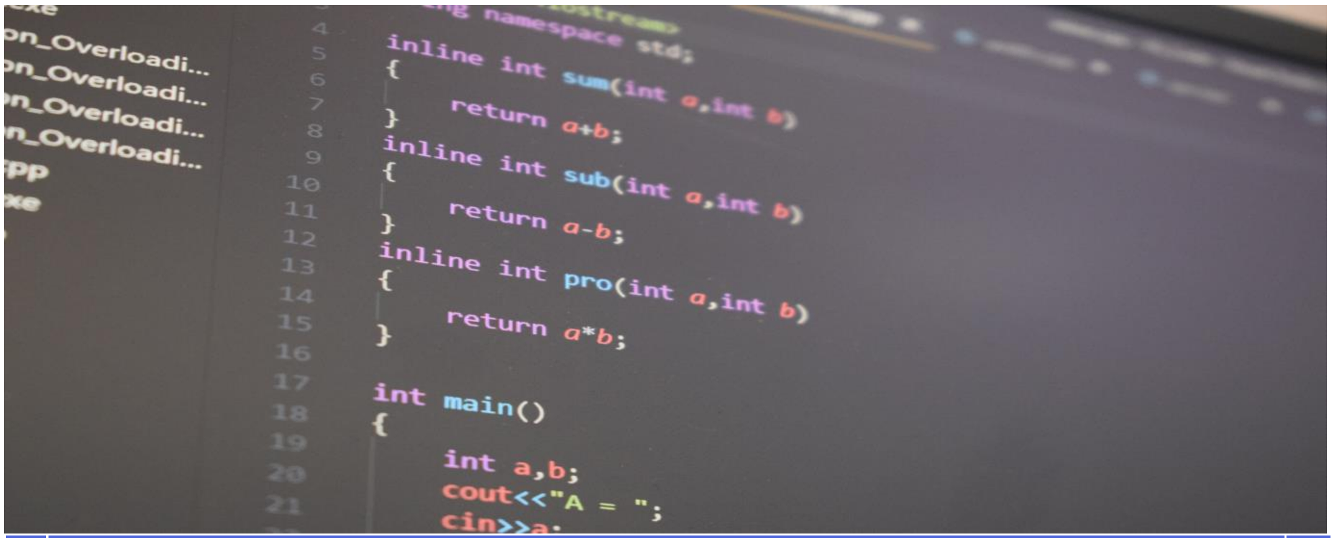


```
inline int sum(int a,int b)
{
    return a+b;
}
inline int sub(int a,int b)
{
    return a-b;
}
inline int pro(int a,int b)
{
    return a*b;
}

int main()
{
    int a,b;
    cout<<"A = ";
```

CS105 – Development Principles-2

Assessment 2

Diploma in Software Development
Yoobee Online

CASE STUDY REPORT

GILBERTO GABON
Author
270204759@yoobeestudent.ac.nz

1. **Section 1 – Question 1: Pointer to Objects**
    a. **Task 1: Code for the scenario – contains creation of classes and the output display:**

```
/*********************************************************************************
* Title       : CS-105 Development Principles-2 Assessment 2
* File        : healthapp.cpp
* Purpose     : Section 1 - Question 1: Pointer to Objects
*               This program showcases the use of pointer to objects.
* Parameters  : N/A
* Returns     : N/A
* Author      : Gilberto Gabon - Student No.: 270204759
*********************************************************************************/

#include <iostream>
#include <string>

using namespace std;

// define the class
class HealthActivity
{
private:
   int walkingSteps;
   float runningDistance;
   string name;

public:
   HealthActivity(string username, int steps, float distance) // class constructor
   {
      name = username;
      walkingSteps = steps;
      runningDistance = distance;
   }

   // Getter functions
   string GetName()
   {
      return name;
   }
   int GetSteps()
   {
      return walkingSteps;
   }
   float GetRuns()
   {
      return runningDistance;
   }
   // Display data from the class
   void displayData()
   {
      cout << "Name: " << name << endl;
      cout << "Steps: " << walkingSteps << " steps" << endl;
      cout << "Walking + Running: " << runningDistance << " kms" << endl;
   }
};

// this setFunction() receives an array of pointers to objects from the class HealthActivity
void setFunction(HealthActivity *ptrUsers[5])
{
   int walkSteps = 0;
   float runKms = 0.00;
   string name = "";
   for (int i = 0; i < 5; i++)
   {
      cout << "Enter the name, number of steps and walking + running distance: ";
      cin >> name;
      cin >> walkSteps;
      cin >> runKms;
      ptrUsers[i] = new HealthActivity(name, walkSteps, runKms); // create the object and save the address of that object to
the array
   }
}

// this getFunction() receives an array of pointers to objects from the class HealthActivity
void getFunction(HealthActivity *ptrUsers[5])
{
   int sumSteps = 0;
   float sumDistance = 0.00, avgSteps = 0.00, avgDistance = 0.00;
   for (int i = 0; i < 5; i++)
   {
      ptrUsers[i]->displayData();          // call the method to display the data of the current object
      sumSteps += ptrUsers[i]->GetSteps();   // accumulate the number of steps taken
      sumDistance += ptrUsers[i]->GetRuns(); // accumulate the distance taken
   }
   avgSteps = sumSteps / 5;       // computer for the average of the number of steps taken
   avgDistance = sumDistance / 5; // compute for the average of the distances taken
   cout << "Average steps of 5 users: " << avgSteps << " steps" << endl;
   cout << "Average distance of walking + running for 5 users: " << avgDistance << " kms" << endl;
}

int main()
{
   HealthActivity *ptrUsers[5]; // define an array of pointers to objects
   setFunction(ptrUsers);      // get user inputs
   getFunction(ptrUsers);      // display outputs

   return 0;
}
```

b. Task 2: Process to solve the problem

i. A **class HealthActivity** was created first with the following:

- Properties:

- Private: These are variables to store user information including number of steps walking and the distance travelled.
  1. **int walkingSteps;** //number of steps waked
  2. **float runningDistance;** // records distance covered
  3. **string name;** //name of the user

- Methods:
  - Public: These are getters and setter functions
    1. v**oid displayData()** //method to display contents of the object, i.e. name, steps, and walking+running distance
    2. **string GetName()** //function to get the name
    3. **int GetSteps()** //function to get the number of steps taken
    4. **float GetRuns()** //function to get the distance run+walked

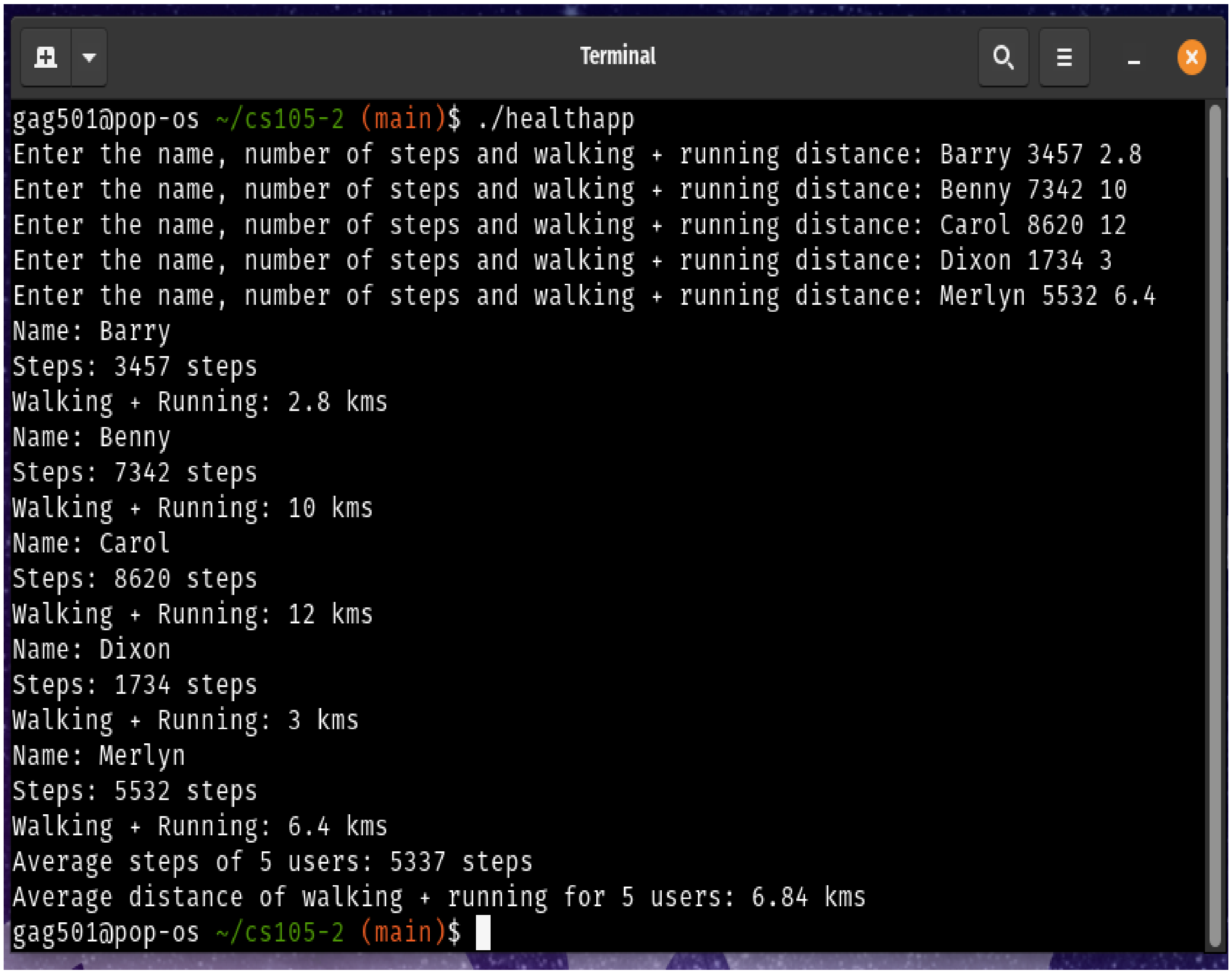
ii. void setFunction(HealthActivity *ptrUsers[5]) and void getFunction(HealthActivity *ptrUsers[5]) were created next. Both of these functions receive an array of pointers to objects from the class HealthActivity.

iii. The setFunction() is used to take inputs from the user. Inside a for..loop, the user is asked to enter the name, steps, and distance walked and run. Once inputs are done, a new object of the type HealthActivity is created. The address of this object is then saved into an array of pointers. The loop goes for five (5) users.

iv. The getFunction() is used to display the contents of the array of pointers to objects of type HealthActivity. Inside this function, a call is made to the display() method of the object from the class HealthActivity. The total number of steps and the total distance covered are also computed inside this function. The averages for the steps and distances covered are then computed and displayed.

v. In the **main()** function, a pointer to an array of objects of the class HealthActivity containing five (5) elements is defined. Then the setFunction() is called with the pointer variable being passed as an argument. After the execution of the setFunction(), the getFunction() is then called with the pointer variable passed as an argument. This function displays the contents to the array of pointers.

c. **Screenshot**



```
gag501@pop-os ~/cs105-2 (main)$ ./healthapp
Enter the name, number of steps and walking + running distance: Barry 3457 2.8
Enter the name, number of steps and walking + running distance: Benny 7342 10
Enter the name, number of steps and walking + running distance: Carol 8620 12
Enter the name, number of steps and walking + running distance: Dixon 1734 3
Enter the name, number of steps and walking + running distance: Merlyn 5532 6.4
Name: Barry
Steps: 3457 steps
Walking + Running: 2.8 kms
Name: Benny
Steps: 7342 steps
Walking + Running: 10 kms
Name: Carol
Steps: 8620 steps
Walking + Running: 12 kms
Name: Dixon
Steps: 1734 steps
Walking + Running: 3 kms
Name: Merlyn
Steps: 5532 steps
Walking + Running: 6.4 kms
Average steps of 5 users: 5337 steps
Average distance of walking + running for 5 users: 6.84 kms
gag501@pop-os ~/cs105-2 (main)$
```

2. **Section 2 – Question 2: Polymorphism**
   a. **Task 1: Code for the scenario – contains creation of classes and the output display**

```
/*****************************************************************************
```

```
* Title       : CS-105 Development Principles-2 Assessment 2
* File        : videostore.cpp
* Purpose     : Section 2 - Question 2: Polymorphism
*               This program showcases inheritance and polymorphism
* Parameters  : N/A
* Returns     : N/A
* Author      : Gilberto Gabon - Student No.: 270204759
*************************************************************************************/

#include <iostream>
#include <string>
#include <math.h>
#include <vector>
#include <limits>

using namespace std;

// Base Class
class VideoGame
{
private:
   string title;
   float price;

public:
   // Virtual function to get data inputs from user. Made this virtual function for dynamic binding
   virtual void getVideoData()
   {
      cin.ignore(numeric_limits<std::streamsize>::max(), '\n'); // this clears the buffer thereby ensuring that any pending
newline character does not get fed into variable and eventually causing a skip in the input
      cout << "Enter title of game: ";
      getline(cin, title); // direct straight saving to the class' property
      cout << "       Enter price: ";
      cin >> price; // direct straight saving to the class' property
   }

   // Display data from the class. Make this function a virtual function to effect dynamic binding
   virtual void display()
   {
      cout << "\n**********************************" << endl;
      cout << "      Title: " << title << endl;
      cout << "      Price: " << price << endl;
   }
};

// Derived Class
class ComputerGame : public VideoGame
{
private:
   string os;

public:
   // display() function - function overriding - polymorphism. This display() function has added the display of the OS type.
   void display()
   {
      VideoGame::display();               // call the display function of the base class
      cout << "     OS Type: " << os << endl; // then add the derived class' display method
      cout << "*********************************" << endl;
   }

   // getVideoData() function - function overriding - polymorphism. This getVideoData() function has added the input for
the OS of the game
   void getVideoData()
   {
      VideoGame::getVideoData();                        // call the getVideoData() function of the base class
      cin.ignore(numeric_limits<std::streamsize>::max(), '\n'); // clear the buffer
      cout << "   Operating System: ";
      getline(cin, os); // save straight to the class property
   }
};

// Derived Class
class ConsoleGame : public VideoGame
{
private:
   string os;

public:
   // display() function - function overriding - polymorphism. This display() function has added the display of the console
type.
   void display()
   {
      VideoGame::display();               // call the display function of the base class
      cout << "Console Type: " << os << endl; // then add the derived class' display method
      cout << "*********************************" << endl;
   }

   // getVideoData() function - function overriding - polymorphism. This getVideoData() function has added the input for
the console type of the game
   void getVideoData()
   {
      VideoGame::getVideoData();
      cin.ignore(numeric_limits<std::streamsize>::max(), '\n'); // clear the buffer
      cout << "      Console type: ";
      getline(cin, os); // direct - straight saving to the object's property
   }
};

int main()
{

   vector<VideoGame *> ptrVideoGames; // Define the vector array that will contain all the pointer to objects. This is a
pointer variable that is a vector of type VideoGame

   ComputerGame *ptrgames;   // Define the pointer to the game objects
   ConsoleGame *ptrconsoles; // Define the pointer to the console objects
```

```
    // int choice = 1, ch = 1;
    char choice = ' ', ch = ' ';

    cout << "\n*****************************************************************************" << endl;
    cout << "               Video Games Data Entry" << endl;
    cout << "*****************************************************************************" << endl;

    while (true)
    {
        ptrgames = new ComputerGame;   // always create a new object for every iteration
        ptrconsoles = new ConsoleGame; // always create a new object for every iteration

        cout << "Do you want to enter data for a Computer Game [o] or a Console Game [c]: ";

        cin >> ch;

        if (ch == 'o' || ch == 'O')
        {
            ptrgames->getVideoData();         // get games input - this made the code cleaner by placing the routine to take user
input inside the Base Class and the specific data inputs are then defined in the Derived classes.
            ptrVideoGames.push_back(ptrgames); // save into the array of pointers
        }
        else
        {
            if (ch == 'c' || ch == 'C')
            {
                ptrconsoles->getVideoData();         // get console inputs - this made the code cleaner by placing the routine to
take user input inside the Base Class and the specific data inputs are then defined in the Derived classes.
                ptrVideoGames.push_back(ptrconsoles); // save into the array of pointers
            }
            else
            {
                cout << "Please select only 'o' or 'c'" << endl;
                continue; // this causes to loop back to the top - avoiding the execution of code below
            }
        }

        cout << "\nDo you want to add another item (y/n)? ";
        cin >> choice;
        if (choice == 'n' || choice == 'N')
        {
            break;
        }
    }

    cout << "\n*****************************************************************************" << endl;
    cout << "                          Video Games List:" << endl;
    cout << "*****************************************************************************" << endl;

    for (int j = 0; j < (int)ptrVideoGames.size(); j++)
    {
```

```
    ptrVideoGames[j]->display(); // polymorphism in action! The function display() here calls the relevant display()
function based on the kind of object contained in the current element of the array of pointers
  }

  return 0;
}
```

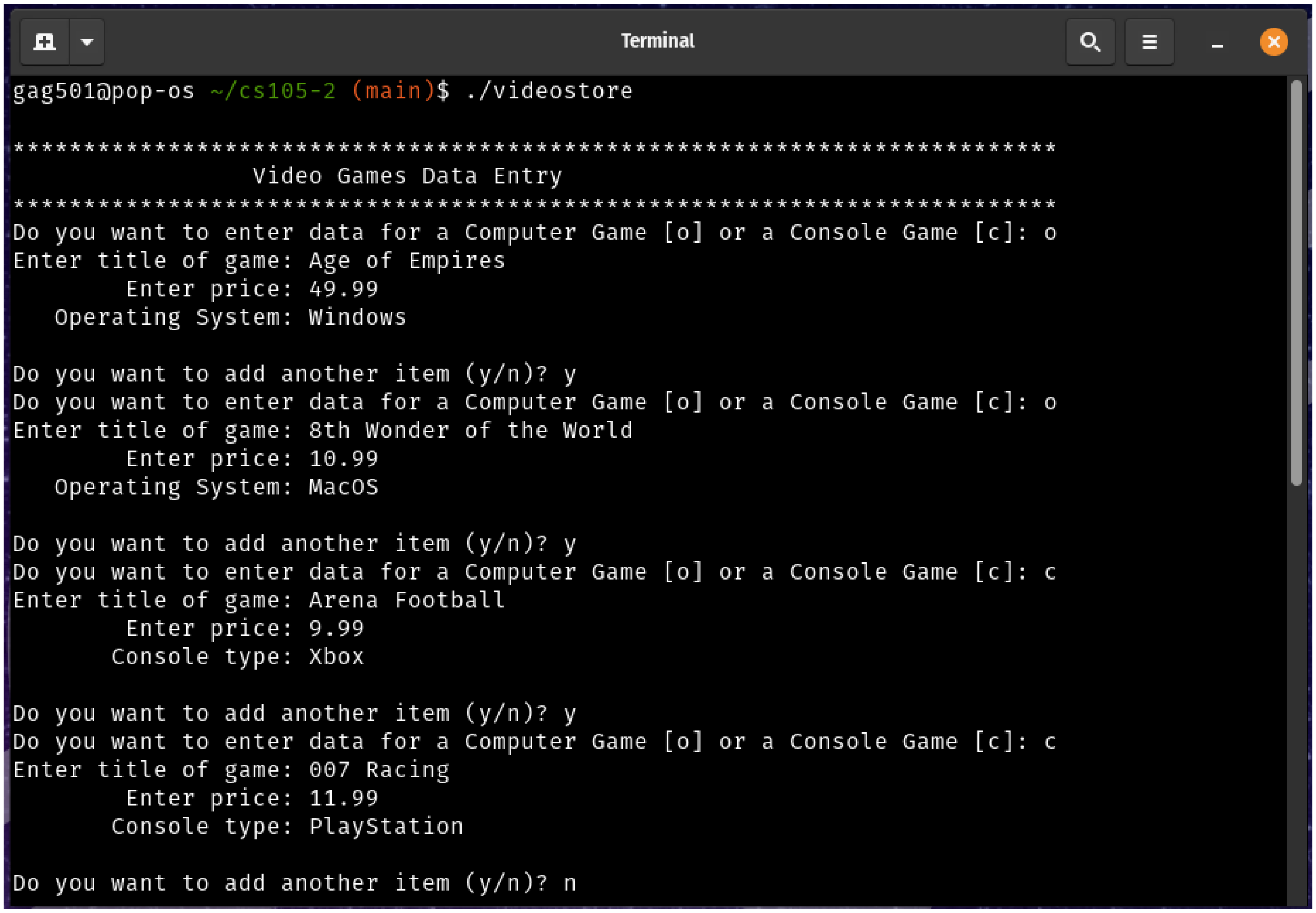
b. Task 2: Process to solve the problem

- A **class VideoGame** was created first with the following:
  - Properties:
    - Private: These are variables to store information about a video
      1. string title; //holds the title of the game
      2. float price; //holds the price of the game
  - Methods:
    - Public: These are getters and setter functions
      1. **virtual void getVideoData()** // Virtual function to get data inputs from user. Made this virtual function for dynamic binding
      2. **virtual void display()** // Display data from the class. Made this function a virtual function to effect dynamic binding
- Next, two (2) Derived classes are created, namely ComputerGame and ConsoleGame. Each derived class has added its own properties and methods. Class ComputerGame and ConsoleGame, added a property ‘os’ to contain the operating system or the console type of each ComputerGame or ConsoleGame object. Added also in each of these derived classes are two (2) methods:
  1. **void display()** - which displays the video information inherited from the base class VideoGame plus the the added property ‘os’ that contains the operating system of the ComputerGame or the Console type object.
  2. **void getVideoData()** - this gets the user input for the title and price (inherited from the base class VideoGame) and the added property ‘os’ of the ComputerGame class or the console type of the ConsoleGame class.

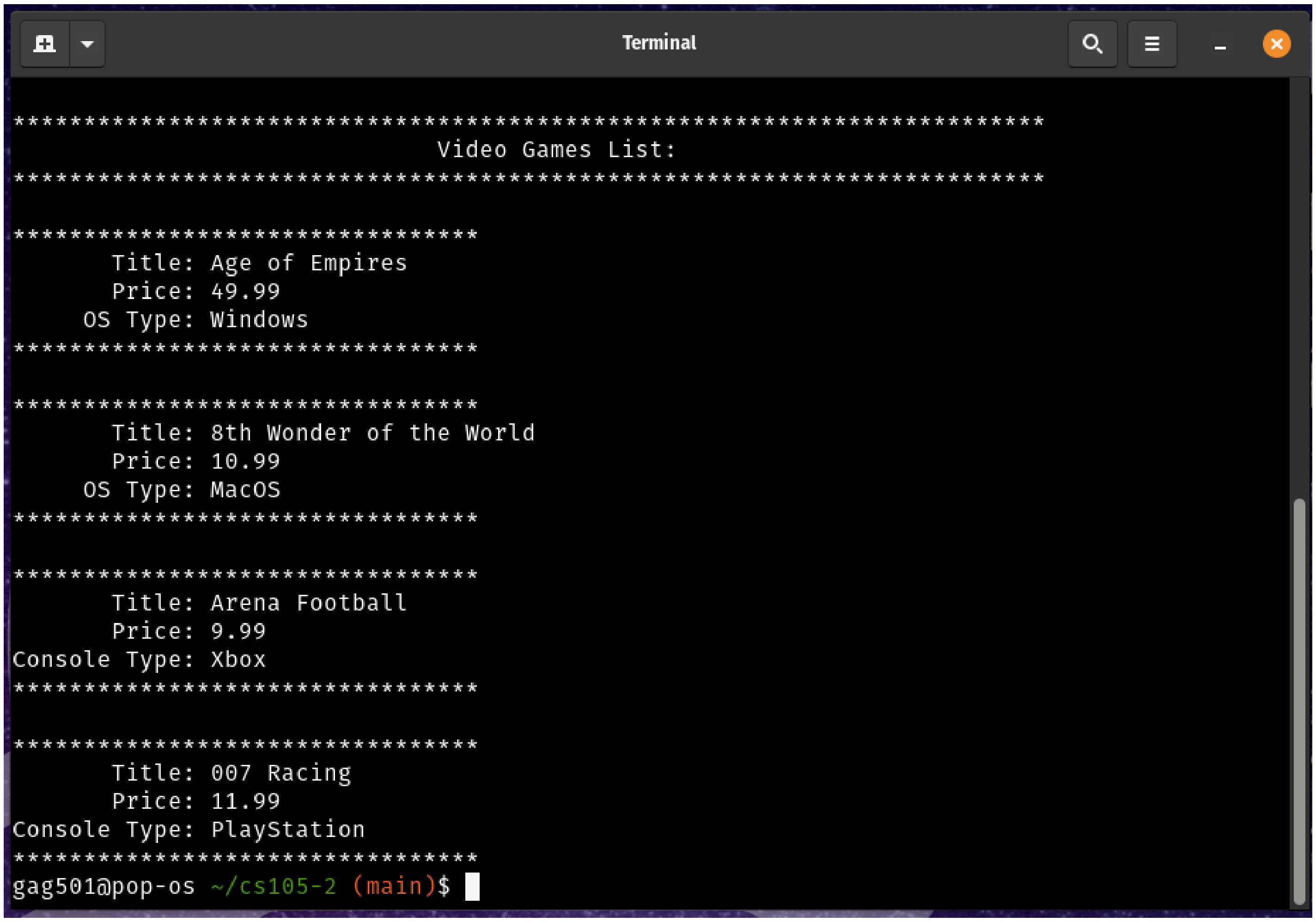
- In the **main()** function, a vector of type VideoGame class pointer is defined - **ptrVideoGames**. Pointers for ComputerGame and ConsoleGame classes are also defined. Variables that will hold the user's menu choices are defined too ('choices', and 'ch').
- Following the variables definition area, the code goes into a 'while' loop to repeatedly ask the user for inputs (game title, price, and operating system/console type). Each iteration in the loop creates new objects for each of the derived classes. This loop continues until the user chooses to end it by answering the 'n' to the question whether to add another item or not.
- While inside the 'while' loop, the user is asked to choose between entering data for ComputerGame (o) or ConsoleGame (c). If the user chooses 'c', then program asks the user to enter the video data by calling the **ptrgames->getVideoData()** method. The call is made using the pointer **ptrgames**. Once all the data is entered, it is then added to the **vector array ptrVideoGame** to save the data. If the user chooses 'o', the program also asks for the user inputs by calling the **ptrconsoles->getVideoData()** method**.** The call is made using the pointer **ptrconsoles.** Once all the data is entered, the program saves the data into **vector array ptrVideoGames.**

The loop continues by asking the user if he/she wants to continue adding items. If the user answers yes, then the loop continues and repeats the process. If the user says no, then the program exits from the loop and displays the contents of the vector array pointer **ptrVideoGames**. The call to display is done inside a loop of finite length, i.e. the length of the vector array **ptrVideoGames.** Inside the loop, the display() method for each element in the vector array is called. Each element contains a pointer to an object of either from the derived class ComputerGame or ConsoleGame. By doing dynamic data binding, run-time polymorphism is effected.

c. Screenshot



```
gag501@pop-os ~/cs105-2 (main)$ ./videostore

**************************************************************************
                 Video Games Data Entry
**************************************************************************
Do you want to enter data for a Computer Game [o] or a Console Game [c]: o
Enter title of game: Age of Empires
        Enter price: 49.99
   Operating System: Windows

Do you want to add another item (y/n)? y
Do you want to enter data for a Computer Game [o] or a Console Game [c]: o
Enter title of game: 8th Wonder of the World
        Enter price: 10.99
   Operating System: MacOS

Do you want to add another item (y/n)? y
Do you want to enter data for a Computer Game [o] or a Console Game [c]: c
Enter title of game: Arena Football
        Enter price: 9.99
       Console type: Xbox

Do you want to add another item (y/n)? y
Do you want to enter data for a Computer Game [o] or a Console Game [c]: c
Enter title of game: 007 Racing
        Enter price: 11.99
       Console type: PlayStation

Do you want to add another item (y/n)? n
```



```
*************************************************************************
                              Video Games List:
*************************************************************************

*********************************
       Title: Age of Empires
       Price: 49.99
     OS Type: Windows
*********************************

*********************************
       Title: 8th Wonder of the World
       Price: 10.99
     OS Type: MacOS
*********************************

*********************************
       Title: Arena Football
       Price: 9.99
Console Type: Xbox
*********************************

*********************************
       Title: 007 Racing
       Price: 11.99
Console Type: PlayStation
*********************************
gag501@pop-os ~/cs105-2 (main)$
```

3. **Section 2 – Question 3: Operator Overloading**
   a. **Task 1: Code for the scenario – contains creation of classes and the output display**

```
/*********************************************************************************
* Title       : CS-105 Development Principles-2 Assessment 2
* File        : complex.cpp
* Purpose     : Section 2 - Question 3: Operator Overloading
*               This program showcases operator overloading for '+', '-', '*' and using this on complex numbers
* Parameters  : N/A
* Returns     : N/A
* Author      : Gilberto Gabon - Student No.: 270204759
*********************************************************************************/

#include <iostream>
#include <string>
#include <stdlib.h>
#include <math.h>
```

```
using namespace std;

class Complex
{
private:
   int a, b;

public:
   Complex(int var1, int var2)
   {
      a = var1;
      b = var2;
   }

   string GetComplexNum()
   {
      return to_string(a) + " + " + to_string(b) + "i";
   };

   // Overload the '+' operator to add two complex number and return the sum in a string format
   string operator+(Complex const &otherNum)
   {
      string retVal = "";
      int sumA = 0, sumB = 0;

      sumA = this->a + otherNum.a;
      sumB = this->b + otherNum.b;

      retVal = to_string(sumA) + " + " + to_string(sumB) + "i";

      return retVal;
   }

   // Overload the '-' operator to subtract two complex number and return the difference in a string format
   string operator-(Complex const &otherNum)
   {
      string retVal = "", optrString = " + ";
      int diffA = 0, diffB = 0;

      diffA = this->a - otherNum.a;
      diffB = this->b - otherNum.b;
      optrString = diffB < 0 ? " - " : " + ";

      retVal = to_string(abs(diffA)) + optrString + to_string(abs(diffB)) + "i";

      return retVal;
   }

   // Overload the '*' operator to multiply two complex number and return the result in a string format
   string operator*(Complex const &otherNum)
   {
      string retVal = "", optrString = " + ";
      int prodA = 0, prodB = 0;
```

```
        prodA = (this->a * otherNum.a) - (this->b * otherNum.b);
        prodB = (this->a * otherNum.b) + (this->b * otherNum.a);

        retVal = to_string(prodA) + optrString + to_string(prodB) + "i";

        return retVal;
    }
};

void displayAddition(Complex num1, Complex num2)
{
    cout << "Addition" << endl;
    cout << "C1: " << num1.GetComplexNum() << endl;
    cout << "C2: " << num2.GetComplexNum() << endl;
    cout << "C3: " << num1 + num2 << endl; // add two complex numbers with the '+' operator as an overloaded operator
}

void displaySubtraction(Complex num1, Complex num2)
{
    cout << "Subtraction" << endl;
    cout << "C1: " << num1.GetComplexNum() << endl;
    cout << "C2: " << num2.GetComplexNum() << endl;
    cout << "C3: " << num1 - num2 << endl; // subtract two complex numbers with the '-' operator as an overloaded
operator
}

void displayMultiplication(Complex num1, Complex num2)
{
    cout << "Multiplication" << endl;
    cout << "C1: " << num1.GetComplexNum() << endl;
    cout << "C2: " << num2.GetComplexNum() << endl;
    cout << "C3: " << num1 * num2 << endl; // multiply two complex numbers with the '*' operator as an overloaded
operator
}

int main()
{
    Complex num1(3, 2); // initialize first complex number;
    int realNum, imaginaryNum;
    int choice = 0;

    cout << "1st Complex number: " << num1.GetComplexNum() << endl
        << endl;

    cout << "Enter 2nd Complex number values:" << endl;
    cout << "Enter real value: ";
    cin >> realNum;
    cout << "Enter imaginary value: ";
    cin >> imaginaryNum;

    Complex num2(realNum, imaginaryNum); // define complex number2
    while (choice != 4)
    {
        cout << "\nChoose Operation from Menu:" << endl;
        cout << "1. Addition" << endl;
        cout << "2. Subtraction" << endl;
        cout << "3. Multiplication" << endl;
        cout << "4. Exit" << endl;
        cout << "\nPlease enter your option: ";
        cin >> choice;
        switch (choice)
        {
        case 1:
            displayAddition(num1, num2);
            break;
        case 2:
            displaySubtraction(num1, num2);
            break;
        case 3:
            displayMultiplication(num1, num2);
            break;

        default:
            break;
        }
    }

    return 0;
}
```

b. Task 2: Process to solve the problem

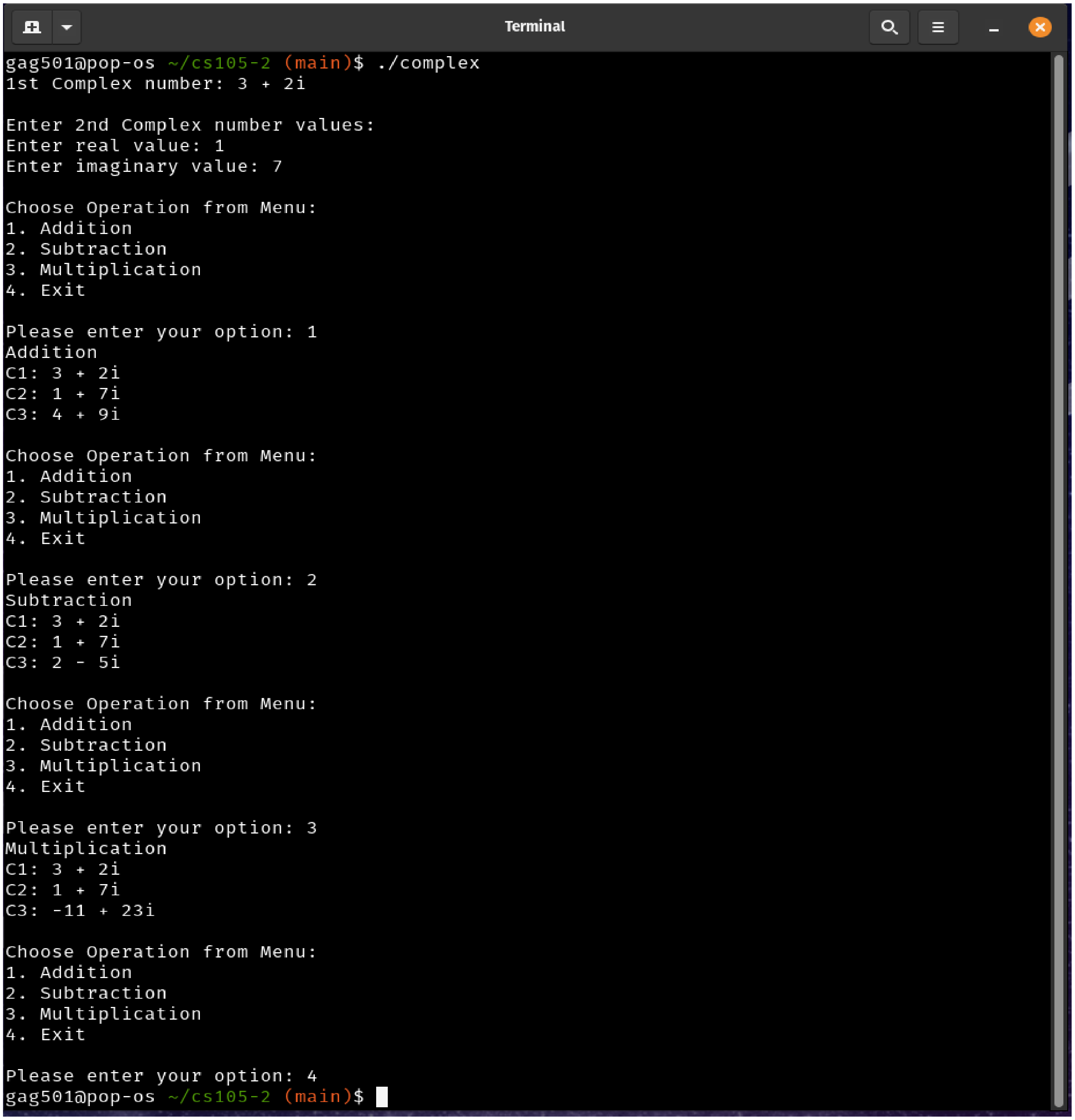
vi. A **class Complex** was created first with the following:

- Properties:
    - Private: These are variables to store information on the real and imaginary numbers.
        1. **int a;** //real number
        2. **Int b;** // imaginary number coefficient
- Methods:
    - Public: These are getters and overloading functions
        1. **Complex(int var1, int var2)** //Constructor function for the class
        2. **string GetComplexNum()** //returns a string for the complex number which contains the real number and the imaginary number
        3. **string operator+(Complex const &otherNum)** //overloading of the '+' operator to add two (2) complex numbers

4. **string operator-(Complex const &otherNum)** //overloading of the '-' operator to subtract two (2) complex numbers
5. **string operator*(Complex const &otherNum)** //overloading of the '*' operator to multiply two (2) complex numbers

- **void displayAddition(Complex num1, Complex num2)** - utility function to display the result of the addition of two (2) complex numbers.
- **void displaySubtraction(Complex num1, Complex num2)** - utility function to display the result of the subraction of two (2) complex numbers.
- **void displayMultiplication(Complex num1, Complex num2)** - utility function to display the result of the multiplication of two (2) complex numbers.
- In the **main()** function, the first complex number is defined by creating a variable (object) named **num1** with the type Complex class. This object is created using the constructor of this class. Initial values are saved into this class through the constructor's execution.
- The program then proceeds to ask for user inputs for the second complex numbers. Inputs asked from the user are the real and the coefficient of the imaginary number. The second complex number is created by calling the Complex class constructor and feeding into the constructor the real and imaginary numbers
- Once done, the application continues and goes into a 'while' loop for the display of the application menu. The user is asked to choose from a range of different operations, i.e. Addition, Subtraction, Multiplication, Exit.
- On selection of the operation, the appropriate function is called to display the result of operation of the two (2) complex numbers.

b. Screenshot



```
gag501@pop-os ~/cs105-2 (main)$ ./complex
1st Complex number: 3 + 2i

Enter 2nd Complex number values:
Enter real value: 1
Enter imaginary value: 7

Choose Operation from Menu:
1. Addition
2. Subtraction
3. Multiplication
4. Exit

Please enter your option: 1
Addition
C1: 3 + 2i
C2: 1 + 7i
C3: 4 + 9i

Choose Operation from Menu:
1. Addition
2. Subtraction
3. Multiplication
4. Exit

Please enter your option: 2
Subtraction
C1: 3 + 2i
C2: 1 + 7i
C3: 2 - 5i

Choose Operation from Menu:
1. Addition
2. Subtraction
3. Multiplication
4. Exit

Please enter your option: 3
Multiplication
C1: 3 + 2i
C2: 1 + 7i
C3: -11 + 23i

Choose Operation from Menu:
1. Addition
2. Subtraction
3. Multiplication
4. Exit

Please enter your option: 4
gag501@pop-os ~/cs105-2 (main)$
```