LASALLE COLLEGE VANCOUVER

Mid-Term Exam

VGP 131 - Object Oriented Programming in C++ II

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May 3, 2022

EXAM INSTRUCTION

- The aim of this task is to create three classes (Country, Temperature and City) to store data from txt files and relate them coherently.
- Each city has a country that can be connected by ISO code and 16 temperatures (max and min) that represent 16 days and can be merged by city id.
- Each problem presents its own score, the sum of all scores is 100.

Student's Number:
Student's Name:

(10 POINTS) PROBLEM 1

Create a class called Country where the data members are: **country name** and **ISO code**. This class must have at least one Constructor, Copy Constructor, Assignment Operator and overload the insertion operator << to perform output for user-defined.

```
class Country{

    string nameCountry;
    string codeISO;

    Country(string name = "Brazil", string code = "BR");
    Country(const Country& obj);
    Country& operator=(const Country& obj);
    friend std::ostream& operator<<(std::ostream& os, const Country& c);

};
```

```
// Country class test
Country C("Canada", "CA");
std::cout << C;

//The desired output for the code above is:
Country name: Canada
ISO Code: CA
```

(10 POINTS) PROBLEM 2

Create a function called collectCountry to collect data from the countries.txt file in order to transform them into objects of the Country class and store them in a vector.

countries.txt

```
1   Country name: Venezuela; ISO code: VE
2   Country name: India; ISO code: IN
3   Country name: Italy; ISO code: IT
4   Country name: Russian; ISO code: RU
5   Country name: Mexico; ISO code: MX
6   Country name: Brazil; ISO code: BR
7   Country name: Vanuatu; ISO code: VU
8   Country name: Great Britain; ISO code: GB
9   Country name: Mexico; ISO code: MX
10  Country name: United States; ISO code: US
11  Country name: Israel; ISO code: IL
```

Figure 0.1: countries.txt file

```
void collectCountry(vector<Country>& v, ifstream& infile){

};
```

```
ifstream inFile;
inFile.open("countries.txt");
if (!inFile)
{
    cout << "The␣input␣file␣does␣not␣exist.␣"
         << "Program␣terminates." << endl;
   return 1;
}
vector<Country> countries;

collectCountry(countries, inFile);

for(const Country & c : countries){
    cout << c;
}
```

```
//The desired output for the code above is:
Country name: Venezuela
ISO Code: VE
Country name: India
ISO Code: IN
Country name: Italy
ISO Code: IT
Country name: Russian
ISO Code: RU
Country name: Mexico
ISO Code: MX
Country name: Brazil
ISO Code: BR
Country name: Vanuatu
ISO Code: VU
Country name: Great Britain
ISO Code: GB
Country name: Mexico
ISO Code: MX
Country name: United States
ISO Code: US
Country name: Israel
ISO Code: IL
```

(10 POINTS) PROBLEM 3

Create a class called Temperature with data members and member functions as shown below.

```
using StrFloatMap = map<string, float>;

class Temperature
{
public:

    int cityID_;
    int day_;
    float min_;
    float max_;

    Temperature(int cityID=0, int day=0, float min=0, float max=0);
    Temperature(const Temperature& obj);
    Temperature& operator=(const Temperature& obj);
    StrFloatMap operator()(char scale);
    //Function to return a map {{"min", min_}, {"max", max_},};
    //By the char argument the user can select the temperature in
   Fahrenheit('F'), Celsius('C') or Kelvin('K').
    void printTemp(std::ostream& os, char scale);
```

```
    // Print the maximum and minimum temperature by the selected scale.
};
```

```
// Temperature class test
Temperature temp(3632308, 12, 292.88, 296.65);
cout << temp('C')["min"] << endl;
temp.printTemp(std::cout, 'K');

//The desired output for the code above is:
19.73
**********
Max temperture: 296.65
Min temperture: 292.88
**********
```

(15 POINTS) PROBLEM 4

Create a function called collectTemp to collect data from the temperatures.txt file in order to transform them into objects of the class Temperature and store them in a vector.

temperatures.txt

```
1   cityId: 3632308   day_1{"min": 284.63, "max": 284.63}
2   cityId: 3632308   day_2{"min": 282.23, "max": 289.96}
3   cityId: 3632308   day_3{"min": 282.32, "max": 290.76}
4   cityId: 3632308   day_4{"min": 292.33, "max": 297.63}
5   cityId: 3632308   day_5{"min": 292.22, "max": 298.61}
6   cityId: 3632308   day_6{"min": 291.55, "max": 298.91}
7   cityId: 3632308   day_7{"min": 291.77, "max": 298.15}
8   cityId: 3632308   day_8{"min": 292.01, "max": 297.8}
9   cityId: 3632308   day_9{"min": 292.17, "max": 296.29}
10  cityId: 3632308   day_10{"min": 292.15, "max": 296.46}
11  cityId: 3632308   day_11{"min": 292.71, "max": 296.87}
12  cityId: 3632308   day_12{"min": 292.64, "max": 296.91}
13  cityId: 3632308   day_13{"min": 292.72, "max": 298.47}
```

Figure 0.2: temperatures.txt file

```
void collectTemp(vector<Temperature>& v, ifstream& infile){

};
```

```
// Ready to collect data from the temperatures.txt file.
ifstream inTemp;
inTemp.open("temperatures.txt");
if (!inTemp)
{
    cout << "The␣input␣file␣does␣not␣exist.␣"
            << "Program␣terminates." << endl;
   return 1;
```

```
}

vector<Temperature> cityTemps;
collectTemp(cityTemps,inTemp);

for(Temperature & t : cityTemps ){
    t.printTemp(std::cout, 'F');
}

//The desired output for the code above is:
**********************
Max temperture: 52.664
Min temperture: 52.664
**********************
**********************
Max temperture: 62.258
Min temperture: 48.344
**********************
.
.
.
**********************
Max temperture: 91.13
Min temperture: 69.908
**********************
**********************
Max temperture: 92.966
Min temperture: 67.712
**********************
```

(10 POINTS) PROBLEM 5

Create a class called City with data members and member functions as shown below.

```
class City{

private:
    int cityId_;
    string cityName_;
    Country country_;
    vector<Temperature> temps_;

public:

    City(int id, string name, Country country, vector<Temperature> temps);
    City(const City& obj);
    City& operator=(const City& obj);
    int getCityId() const;
```

```
    string getCityName() const;
    string getCountryName() const;
    vector<Temperature> getTemperatures() const;

};
```

```
// Time to test the class City
cout << "--------␣City␣Class␣--------" << '\n';

vector<Temperature> meridaTemps;
std::copy_if(cityTemps.begin(), cityTemps.end(), std::back_inserter(
    meridaTemps),
                        [](const Temperature& t){return (t.cityID_ ==
    3632308);});



City cy(3632308,"Merida", countries[0], meridaTemps);

cout << cy.getCityId() << endl;
cout << cy.getCityName() << endl;
cout << cy.getCountryName() << endl;
cy.getTemperatures()[0].printTemp(std::cout,'C');
cout << '\n';


//The desired output for the code above is:
3632308
Merida
Venezuela
**********************
Max temperture: 11.48
Min temperture: 11.48
**********************
```

(10 POINTS) PROBLEM 6

Overload the function operator( ) in the City class to get the desired temperature per day and make it possible to choose the scale among Celsius Fahrenheit and kelvin.

```
void  City :: operator()(std::ostream& os, int day, char scale);
```

```
cy(std::cout,1,'C');
cy(std::cout,16,'C');
```

```
//The desired output for the code above is:
--- City: Merida ---
Temperatures on day 1
**********
Max temperture: 11.48
Min temperture: 11.48
**********
--- City: Merida ---
Temperatures on day 16
**********
Max temperture: 23.5
Min temperture: 19.73
**********
```

(10 POINTS) PROBLEM 7

Create a function called extremeTemperature in City class to find the highest temperature of the hottest day or the lowest temperature of the coldest day.

```
void City :: extremeTemperature(char scale, string record)
```

```
cy.extremeTemperature('C', "higher");
cy.extremeTemperature('C', "lower");

//The desired output for the code above is:
The highest temperature of the hottest day in Merida: 25.76
The lowest temperature of the coldest day in Merida: 9.08001
```

(10 POINTS) PROBLEM 8

Let's use the knowledge acquired in the last 4 weeks (algorithms, lambda functions) to select a country from a vector<Country> by its codeISO. Complete the code below.

```
string ISO = "BR";

auto countryItor = find_if(_________, __________, [  ](_______________)
{
    return ____________;
});
```

```
// countryItor is a iterator
cout << *countryItor;
```

```
//The desired output
Country name: Brazil
ISO Code: BR
```

(15 POINTS) PROBLEM 9

Finally, create a function called collectCity to collect data from the cities.txt file, the country vector and the temperature vector to create a vector of cities, cities linked by their countries and temperatures(Hint: Use find_if to select the Country and copy_if to create a Temp vector of temperatures from the same city).

cities.txt

```
1   cityId: 3632308 name: Merida, country: VE
2   cityId: 1261800 name: Nargund, country: IN
3   cityId: 3176738 name: Formia, country: IT
4   cityId: 566854 name: Dedovsk, country: RU
5   cityId: 3985241 name: San Nicolas de los Garza, country: MX
6   cityId: 3457000 name: Mogi Guacu, country: BR
7   cityId: 2135171 name: Port-Vila, country: VU
8   cityId: 2634853 name: Walsall, country: GB
9   cityId: 3520235 name: Rio Verde, country: MX
10  cityId: 4154205 name: Edgewater, country: US
11  cityId: 8199394 name: Ariel, country: IL
```

Figure 0.3: cities.txt file

```
void collectCity(vector<City>& v, const vector<Country>& countries, const
    vector<Temperature>& temps, ifstream& infile){

};
```

```
// Ready to collect data from the cities.txt file.
ifstream inCity;
inCity.open("cities.txt");
if (!inCity)
{
    cout << "The␣input␣file␣does␣not␣exist.␣"
            << "Program␣terminates." << endl;
return 1;
}

vector<City> cities;
collectCity(cities, countries, cityTemps, inCity);

for(City& city : cities){
    for(unsigned day = 1; day <17; day++){
        city(std::cout, day, 'C');
    }
}
```

```
for(City& city : cities){
    city.extremeTemperature('C', "higher");
}

//The desired output
.
.
.
--- City: Merida ---
Temperatures on day 4
**********
Max temperture: 24.48
Min temperture: 19.18
**********
--- City: Merida ---
Temperatures on day 5
**********
Max temperture: 25.46
Min temperture: 19.07
**********
--- City: Merida ---
Temperatures on day 6
**********
.
.
.
--- City: Ariel ---
Temperatures on day 14
**********
Max temperture: 16.65
Min temperture: 10.39
**********
--- City: Ariel ---
Temperatures on day 15
**********
Max temperture: 19.83
Min temperture: 9.45001
**********
--- City: Ariel ---
Temperatures on day 16
**********
Max temperture: 9.45001
Min temperture: 9.45001
**********
The highest temperature of the hottest day in Merida: 25.76
The highest temperature of the hottest day in Nargund: 35.37
The highest temperature of the hottest day in Formia: 17.3
The highest temperature of the hottest day in Dedovsk: 7.92001
The highest temperature of the hottest day in San Nicolas de los Garza:
    32.25
```

```
The highest temperature of the hottest day in Mogi Guacu: 30.31
The highest temperature of the hottest day in Port-Vila: 29.19
The highest temperature of the hottest day in Walsall: 14.93
The highest temperature of the hottest day in Rio Verde: 29.35
The highest temperature of the hottest day in Edgewater: 26.21
The highest temperature of the hottest day in Ariel: 23.76
```