Working C++ Files

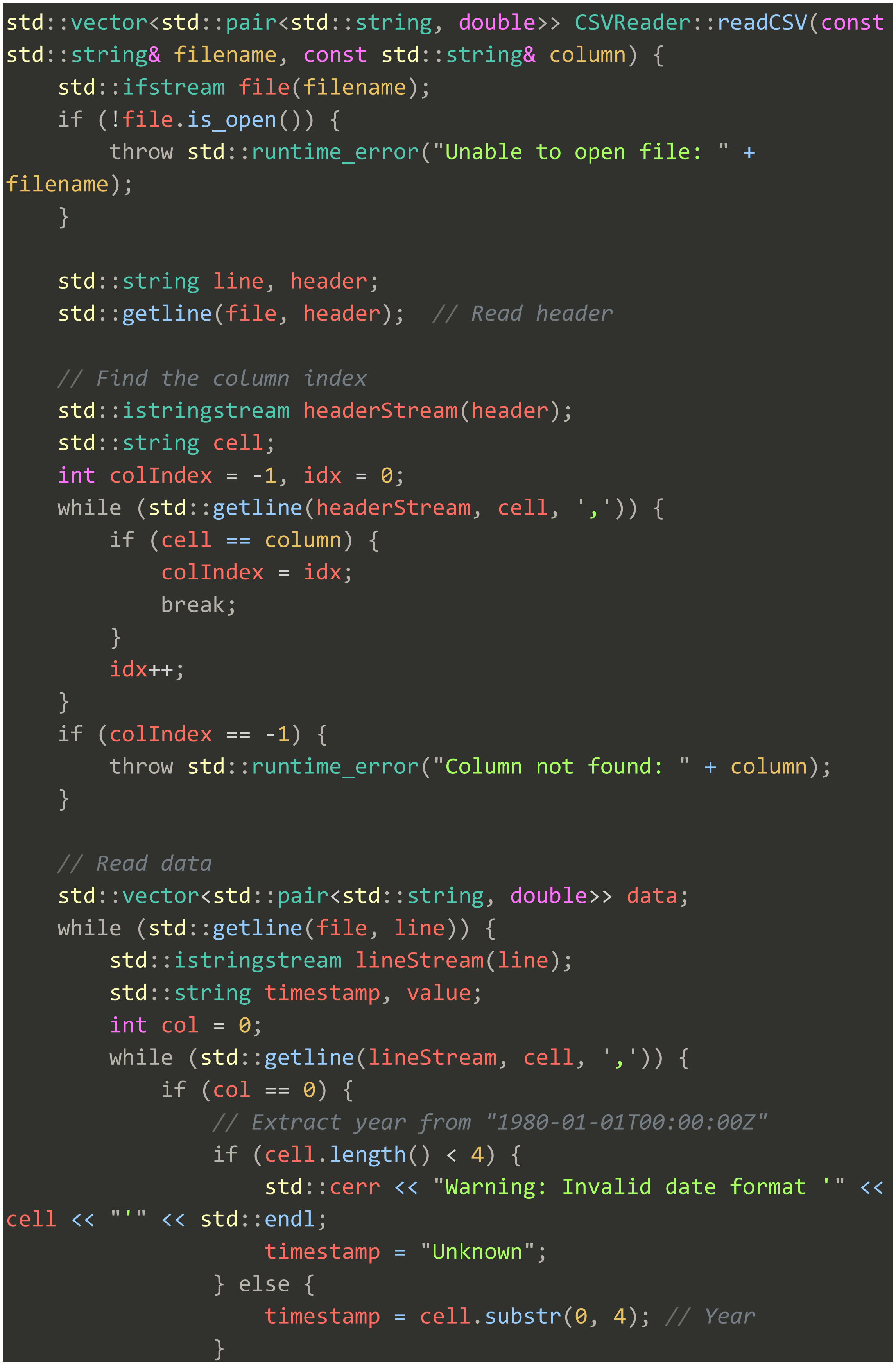
ComputeCandlesticks.cpp

```
// ComputeCandlesticks.cpp
#include "ComputeCandlesticks.h"
#include <map>
#include <vector>
#include <numeric>
#include <algorithm>
#include <iostream>

std::vector<Candlestick> computeCandlesticks(const
std::vector<std::pair<std::string, double>>& entries) {
    std::map<std::string, std::vector<double>> groupedData;

    // Group temperatures by year (YYYY)
    for (const auto& entry : entries) {
        if (entry.first.length() < 4) {
            std::cerr << "Warning: Invalid date format '" <<
entry.first << "'" << std::endl;
            continue;
        }
        std::string year = entry.first.substr(0, 4);  // Extract
YYYY
        groupedData[year].push_back(entry.second);
    }

    std::vector<Candlestick> candlesticks;
    double prevClose = 0.000; // Initialize to 0.000 for the year
1980

    // Compute candlestick data for each group from 1980 to 2019
    for (int year = 1980; year <= 2019; ++year) {
        std::string yearStr = std::to_string(year);

        if (groupedData.find(yearStr) != groupedData.end()) {
            const std::vector<double>& temperatures =
groupedData[yearStr];
            double open = prevClose;
            double close = std::accumulate(temperatures.begin(),
temperatures.end(), 0.0) / temperatures.size();
```

```
            double high = *std::max_element(temperatures.begin(), temperatures.end());
            double low = *std::min_element(temperatures.begin(), temperatures.end());

            candlesticks.emplace_back(yearStr, open, close, high, low);
            prevClose = close;
        } else {
            std::cerr << "Warning: Missing data for year " << yearStr << std::endl;
            candlesticks.emplace_back(yearStr, prevClose, prevClose, prevClose, prevClose);
        }
    }

    // Debug output
    std::cout << "Debug: Computed " << candlesticks.size() << " candlesticks.\n";
    for (const auto& candle : candlesticks) {
        std::cout << "Year: " << candle.date << ", Open: " << candle.open
                  << ", Close: " << candle.close << ", High: " << candle.high
                  << ", Low: " << candle.low << std::endl;
    }

    return candlesticks;
}
```

CSVReader.cpp

```
// CSVReader.cpp
#include "CSVReader.h"

/*Reads temperature data for the specified column (country) from a CSV file, filename Name of the CSV file,
column Name of the temperature column (e.g., "GB_temperature") and Vector of pairs (year, temperature)
*/
```



```cpp
std::vector<std::pair<std::string, double>> CSVReader::readCSV(const
std::string& filename, const std::string& column) {
    std::ifstream file(filename);
    if (!file.is_open()) {
        throw std::runtime_error("Unable to open file: " +
filename);
    }

    std::string line, header;
    std::getline(file, header);  // Read header

    // Find the column index
    std::istringstream headerStream(header);
    std::string cell;
    int colIndex = -1, idx = 0;
    while (std::getline(headerStream, cell, ',')) {
        if (cell == column) {
            colIndex = idx;
            break;
        }
        idx++;
    }
    if (colIndex == -1) {
        throw std::runtime_error("Column not found: " + column);
    }

    // Read data
    std::vector<std::pair<std::string, double>> data;
    while (std::getline(file, line)) {
        std::istringstream lineStream(line);
        std::string timestamp, value;
        int col = 0;
        while (std::getline(lineStream, cell, ',')) {
            if (col == 0) {
                // Extract year from "1980-01-01T00:00:00Z"
                if (cell.length() < 4) {
                    std::cerr << "Warning: Invalid date format '" <<
cell << "'" << std::endl;
                    timestamp = "Unknown";
                } else {
                    timestamp = cell.substr(0, 4); // Year
                }
            } else if (col == colIndex) {
                value = cell;
            }
            col++;
        }
        if (!value.empty() && timestamp != "Unknown") {
            try {
                data.emplace_back(timestamp, std::stod(value));
            } catch (const std::invalid_argument&) {
                std::cerr << "Warning: Invalid temperature value '"
<< value << "' on date " << timestamp << std::endl;
            }
        }
    }
    file.close();

    // Debug output
    std::cout << "Debug: Extracted " << data.size() << " rows of
data from CSV.\n";
    return data;
}
```

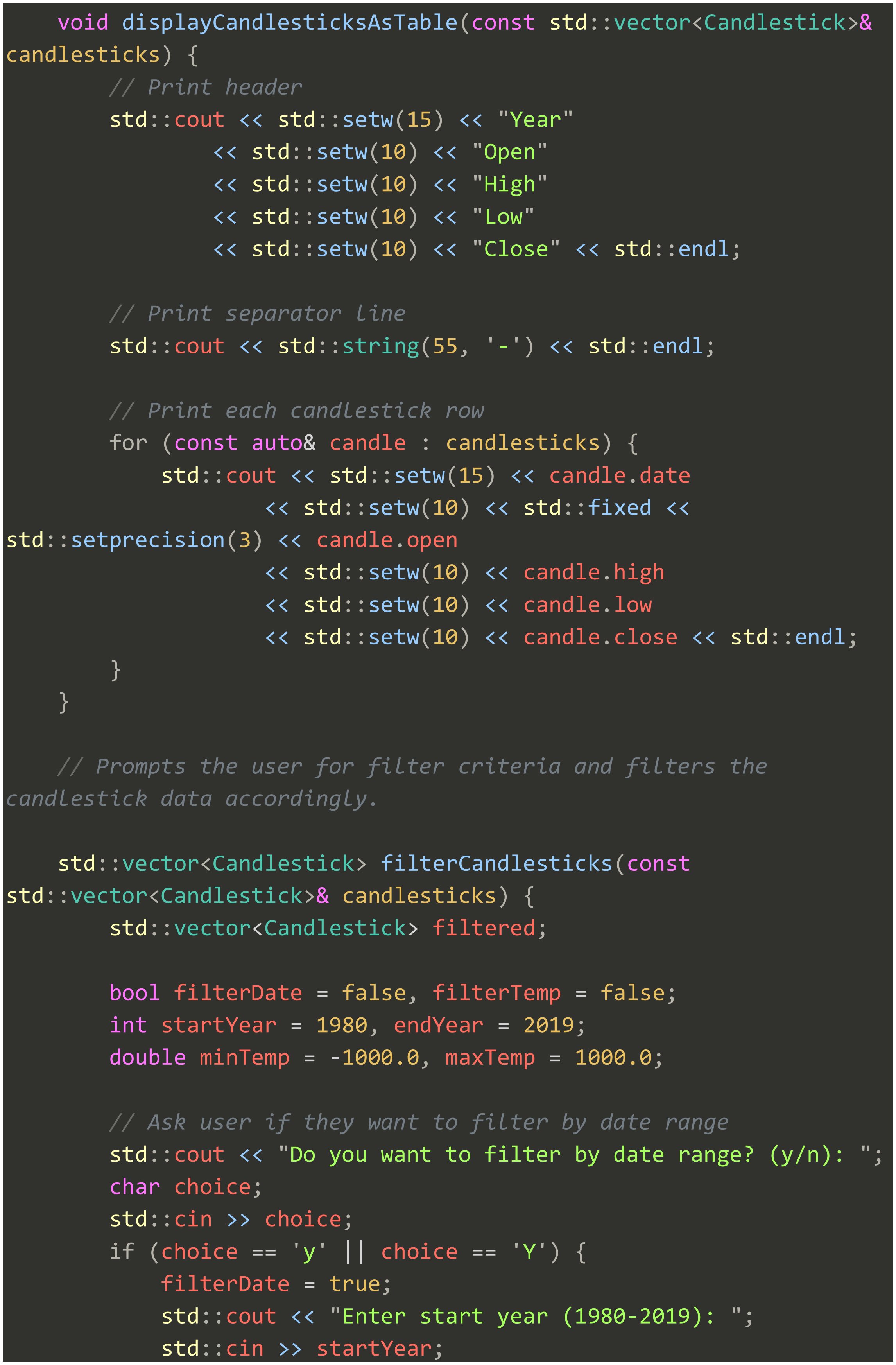
DataFilter.cpp

```
// DataFilter.cpp
#include "DataFilter.h"
#include <algorithm>

//  Filters candlesticks based on a year range.

std::vector<Candlestick> filterByYearRange(const
std::vector<Candlestick>& candlesticks, int startYear, int endYear)
{
    std::vector<Candlestick> filtered;
    for (const auto& candle : candlesticks) {
        int year = std::stoi(candle.date);
        if (year >= startYear && year <= endYear) {
            filtered.push_back(candle);
        }
    }
    return filtered;
}

// Filters candlesticks based on a closing temperature range.

std::vector<Candlestick> filterByClosingTemperatureRange(const
std::vector<Candlestick>& candlesticks, double minTemp, double
maxTemp) {
    std::vector<Candlestick> filtered;
    for (const auto& candle : candlesticks) {
        if (candle.close >= minTemp && candle.close <= maxTemp) {
            filtered.push_back(candle);
        }
    }
    return filtered;
}
```

Main.cpp

```
    // main.cpp
    #include "Candlestick.h"
    #include "CSVReader.h"
    #include "ComputeCandlesticks.h"
    #include "DataFilter.h"
    #include "PlotCandlesticks.h"
    #include "TemperaturePredictor.h"
    #include <iostream>
    #include <vector>
    #include <string>
    #include <fstream>
    #include <sstream>
    #include <map>
    #include <iomanip>
    #include <limits>


    std::vector<std::string> getColumnNames(const std::string&
filename) {
        std::ifstream file(filename);
        std::vector<std::string> columnNames;

        if (file.is_open()) {
            std::string headerLine;
            std::getline(file, headerLine); // Read the first line
            std::stringstream ss(headerLine);
            std::string column;

            while (std::getline(ss, column, ',')) {
                columnNames.push_back(column);
            }
        } else {
            throw std::runtime_error("Unable to open file: " +
filename);
        }

        return columnNames;
    }


    //  Dynamically extracts country columns from the dataset.
    //  Vector of column names from the dataset.
    //   Map of menu index to column name (e.g., "AT_temperature").

    std::map<int, std::string> extractCountryColumns(const
std::vector<std::string>& columnNames) {
        std::map<int, std::string> countryMenu;
        int index = 1;

        for (const auto& column : columnNames) {
            // Only include columns ending with "_temperature"
            if (column.find("_temperature") != std::string::npos) {
                countryMenu[index++] = column;
            }
        }

        if (countryMenu.empty()) {
            throw std::runtime_error("No country temperature columns
found in the CSV file.");
        }

        return countryMenu;
    }

    // Converts a column name into a user-friendly country name.
```

```cpp
    //  Column name from the dataset (e.g., "AT_temperature").
    //  Formatted country name (e.g., "Austria Temperature").

    std::string formatCountryName(const std::string& columnName) {
        std::string countryCode = columnName.substr(0, columnName.find("_"));
        std::string countryName = countryCode; // Default to code if not mapped

        // Example map of country codes to full names (add more if needed)
        static std::map<std::string, std::string> countryNameMap = {
            {"AT", "Austria"},
            {"BE", "Belgium"},
            {"BG", "Bulgaria"},
            {"CH", "Switzerland"},
            {"CZ", "Czech Republic"},
            {"DE", "Germany"},
            {"DK", "Denmark"},
            {"EE", "Estonia"},
            {"ES", "Spain"},
            {"FI", "Finland"},
            {"FR", "France"},
            {"GB", "United Kingdom"},
            {"GR", "Greece"},
            {"HR", "Croatia"},
            {"HU", "Hungary"},
            {"IE", "Ireland"},
            {"IT", "Italy"},
            {"LT", "Lithuania"},
            {"LU", "Luxembourg"},
            {"LV", "Latvia"},
            {"NL", "Netherlands"},
            {"NO", "Norway"},
            {"PL", "Poland"},
            {"PT", "Portugal"},
            {"RO", "Romania"},
            {"SE", "Sweden"},
            {"SI", "Slovenia"},
            {"SK", "Slovakia"}
        };
        if (countryNameMap.find(countryCode) != 
countryNameMap.end()) {
            countryName = countryNameMap[countryCode];
        }

        return countryName + " Temperature";
    }

    std::string selectCountry(const std::map<int, std::string>& 
countryMenu) {
        while (true) {
            std::cout << "\nAvailable Countries:\n";

            for (const auto& it : countryMenu) {
                std::cout << it.first << ". " << 
formatCountryName(it.second) << std::endl;
            }

            std::cout << "Enter the number of the country: ";
            int choice;
            std::cin >> choice;

            if (std::cin.fail()) {
                std::cin.clear(); // Clear the error flags
                std::cin.ignore(std::numeric_limits<std::streamsize>
::max(), '\n'); // Discard invalid input
                std::cout << "Invalid input. Please enter a valid 
number.\n";
                continue;
            }

            if (countryMenu.find(choice) != countryMenu.end()) {
                return countryMenu.at(choice);
            } else {
                std::cout << "Invalid selection. Please try 
again.\n";
            }
        }
    }

    // Displays candlestick data in a tabular format.
```



```
    void displayCandlesticksAsTable(const std::vector<Candlestick>&
candlesticks) {
        // Print header
        std::cout << std::setw(15) << "Year"
                << std::setw(10) << "Open"
                << std::setw(10) << "High"
                << std::setw(10) << "Low"
                << std::setw(10) << "Close" << std::endl;

        // Print separator line
        std::cout << std::string(55, '-') << std::endl;

        // Print each candlestick row
        for (const auto& candle : candlesticks) {
            std::cout << std::setw(15) << candle.date
                    << std::setw(10) << std::fixed <<
std::setprecision(3) << candle.open
                    << std::setw(10) << candle.high
                    << std::setw(10) << candle.low
                    << std::setw(10) << candle.close << std::endl;
        }
    }

    // Prompts the user for filter criteria and filters the
candlestick data accordingly.

    std::vector<Candlestick> filterCandlesticks(const
std::vector<Candlestick>& candlesticks) {
        std::vector<Candlestick> filtered;

        bool filterDate = false, filterTemp = false;
        int startYear = 1980, endYear = 2019;
        double minTemp = -1000.0, maxTemp = 1000.0;

        // Ask user if they want to filter by date range
        std::cout << "Do you want to filter by date range? (y/n): ";
        char choice;
        std::cin >> choice;
        if (choice == 'y' || choice == 'Y') {
            filterDate = true;
            std::cout << "Enter start year (1980-2019): ";
            std::cin >> startYear;
            std::cout << "Enter end year (1980-2019): ";
            std::cin >> endYear;

            // Validate years
            if (startYear < 1980 || startYear > 2019 || endYear <
1980 || endYear > 2019 || startYear > endYear) {
                std::cerr << "Invalid year range. Please ensure 1980
<= start year <= end year <= 2019.\n";
                // Reset to default
                startYear = 1980;
                endYear = 2019;
                filterDate = false;
            }
        }

        // Ask user if they want to filter by closing temperature
range
        std::cout << "Do you want to filter by closing temperature
range? (y/n): ";
        std::cin >> choice;
        if (choice == 'y' || choice == 'Y') {
            filterTemp = true;
            std::cout << "Enter minimum closing temperature: ";
            std::cin >> minTemp;
            std::cout << "Enter maximum closing temperature: ";
            std::cin >> maxTemp;

            // Validate temperatures
            if (minTemp > maxTemp) {
                std::cerr << "Invalid temperature range. Minimum
temperature cannot be greater than maximum temperature.\n";
                // Reset to default
                minTemp = -1000.0;
                maxTemp = 1000.0;
                filterTemp = false;
            }
        }

        // Apply filters using DataFilter functions
        std::vector<Candlestick> tempFiltered = candlesticks;

        if (filterDate) {
            tempFiltered = filterByYearRange(tempFiltered, 
startYear, endYear);
        }

        if (filterTemp) {
            tempFiltered = 
filterByClosingTemperatureRange(tempFiltered, minTemp, maxTemp);
        }

        filtered = tempFiltered;

        // Debug output
        std::cout << "Debug: Filtered " << filtered.size() << " 
candlesticks after applying filters.\n";
        return filtered;
    }

    // Handles the filtering and plotting functionality.

    void filterAndPlot(const std::map<int, std::string>& 
countryMenu, const std::string& filename) {
        try {
            // Select Country
            std::string selectedColumn = selectCountry(countryMenu);
            std::cout << "You selected: " << 
formatCountryName(selectedColumn) << std::endl;

            // Read CSV data for the selected country
            std::vector<std::pair<std::string, double>> data = 
CSVReader::readCSV(filename, selectedColumn);

            // Compute Candlesticks
            std::vector<Candlestick> candlesticks = 
computeCandlesticks(data);

            // Apply Filters
            std::vector<Candlestick> filteredCandlesticks = 
filterCandlesticks(candlesticks);

            if (filteredCandlesticks.empty()) {
                std::cout << "No data matches the specified 
filters.\n";
```

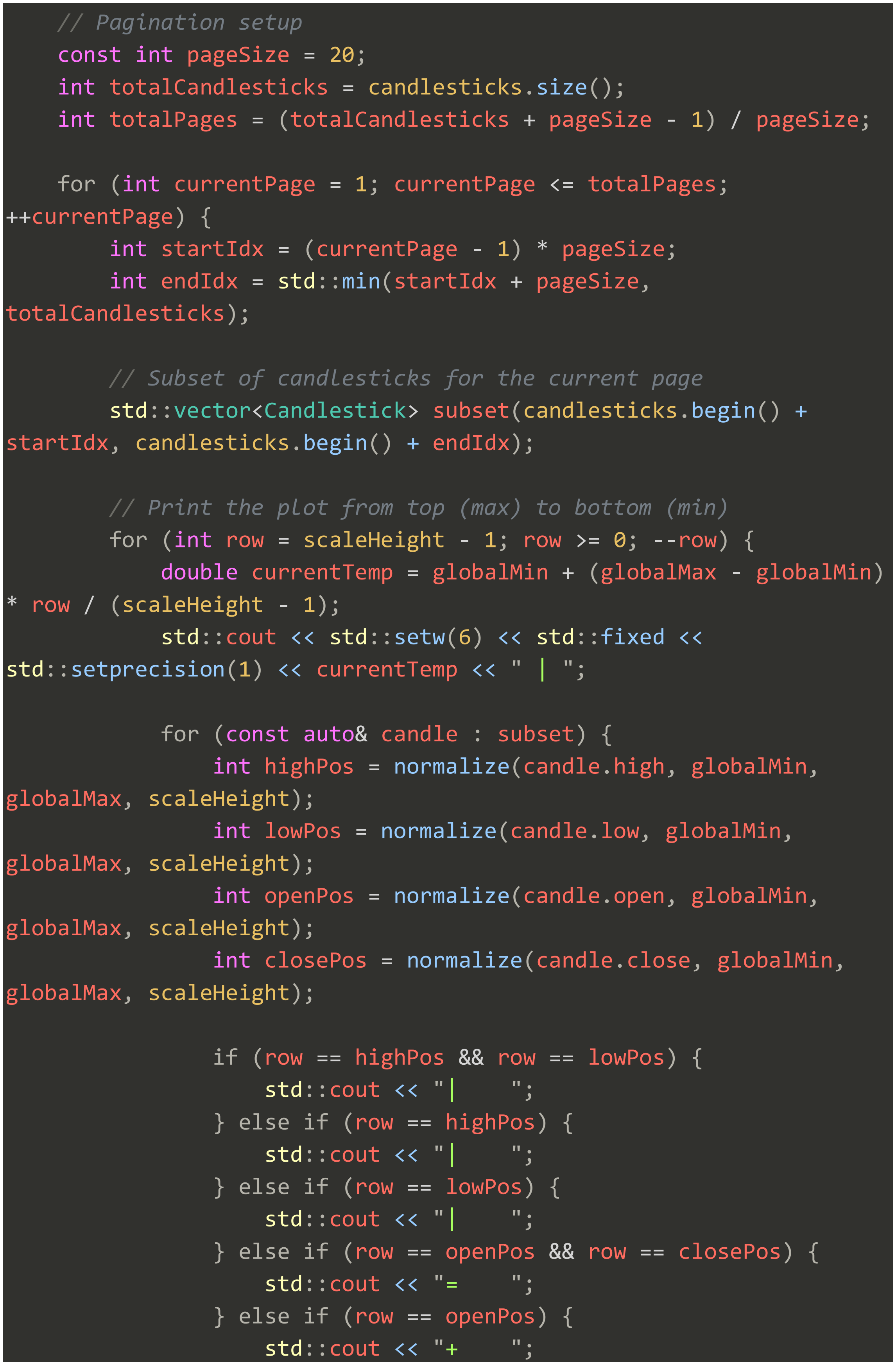
```
                return;
            }

            // Display filtered candlesticks
            std::cout << "\nFiltered Candlestick Data:\n";
            displayCandlesticksAsTable(filteredCandlesticks);

            // Plot filtered candlesticks
            std::cout << "\nPlotting Filtered Candlestick Data:\n";
            plotCandlesticks(filteredCandlesticks, 20);  // Adjust
scaleHeight as needed

        } catch (const std::exception& e) {
            std::cerr << "Error during filtering and plotting: " <<
e.what() << std::endl;
        }
    }

    int main() {
        const std::string filename = "weather_data.csv";
        std::vector<std::string> columnNames;
        std::map<int, std::string> countryMenu;
        std::vector<std::pair<std::string, double>> data;
        std::vector<Candlestick> candlesticks;
        std::string selectedColumn;

        try {
            // Extract column names from the CSV file
            columnNames = getColumnNames(filename);

            // Dynamically extract country columns
            countryMenu = extractCountryColumns(columnNames);

            // Menu Loop
            while (true) {
                // Display Menu
                std::cout << "\nWeather Analysis Menu\n";
                std::cout << "1. Select Country and Display
Table\n";
                std::cout << "2. Plot Candlestick Data\n";
                std::cout << "3. Filter Plot Data\n";
```

```cpp
                std::cout << "4. Predict Temperature Changes\n"; // New option
                std::cout << "5. Exit\n"; // Updated Exit option number
                std::cout << "Enter your choice: ";

                int choice;
                std::cin >> choice;

                // Clear cin fail state if any non-integer is entered
                if (std::cin.fail()) {
                    std::cin.clear(); // clear the error flags
                    std::cin.ignore(std::numeric_limits<std::streamsize>::max(), '\n'); // discard invalid input
                    std::cout << "Invalid input. Please enter a number between 1 and 5.\n";
                    continue;
                }

                switch (choice) {
                    case 1:
                        try {
                            selectedColumn = selectCountry(countryMenu);
                            std::cout << "You selected: " << formatCountryName(selectedColumn) << std::endl;

                            // Read and compute candlesticks for the selected country
                            data = CSVReader::readCSV(filename, selectedColumn);
                            candlesticks = computeCandlesticks(data);

                            // Display computed candlesticks immediately (Tabular Format Only)
                            std::cout << "\nCandlestick Data:\n";
                            displayCandlesticksAsTable(candlesticks);
                        } catch (const std::exception& e) {
                            std::cerr << "Error: " << e.what() <<
std::endl;
                        }
                        break;

                    case 2:
                        if (candlesticks.empty()) {
                            std::cout << "No candlestick data
available. Please select a country first.\n";
                        } else {
                            std::cout << "\nPlotting Candlestick
Data:\n";
                            plotCandlesticks(candlesticks, 20);  //
Adjust scaleHeight as needed
                        }
                        break;

                    case 3:
                        if (candlesticks.empty()) {
                            std::cout << "No candlestick data
available. Please select a country first.\n";
                        } else {
                            filterAndPlot(countryMenu, filename);
                        }
                        break;

                    case 4:
                        if (candlesticks.empty()) {
                            std::cout << "No candlestick data
available. Please select a country first.\n";
                        } else {
                            try {
                                // Prompt user for prediction range
                                int predStartYear, predEndYear;
                                std::cout << "Enter the start year
for prediction (e.g., 2020): ";
                                std::cin >> predStartYear;
                                std::cout << "Enter the end year for
prediction (e.g., 2025): ";
                                std::cin >> predEndYear;

                                if (predStartYear > predEndYear) {
                                    std::cerr << "Invalid range. 
Start year must be less than or equal to end year.\n";
                                    break;
                                }

                                // Initialize TemperaturePredictor 
with historical data
                                TemperaturePredictor 
predictor(candlesticks);

                                // Predict temperatures
                                std::vector<Candlestick> predictions 
= predictor.predictTemperatures(predStartYear, predEndYear);

                                // Display predictions
                                std::cout << "\nPredicted 
Candlestick Data:\n";
                                displayCandlesticksAsTable(predictio
ns);

                                // Plot predictions
                                std::cout << "\nPlotting Predicted 
Candlestick Data:\n";
                                plotCandlesticks(predictions, 20);

                            } catch (const std::exception& e) {
                                std::cerr << "Error during 
prediction: " << e.what() << std::endl;
                            }
                        }
                        break;

                    case 5:
                        std::cout << "Exiting Weather 
Analysis...\n";
                        return 0;

                    default:
                        std::cout << "Invalid choice. Please try 
again.\n";
                        break;
                }
```

```
            }
        } catch (const std::exception& e) {
            std::cerr << "Error: " << e.what() << std::endl;
        }

        return 0;
    }
```

Plotcandlesticks.cpp

```
// PlotCandlesticks.cpp
#include "PlotCandlesticks.h"
#include "Utils.h" // For clamp and normalize
#include <iostream>
#include <iomanip>
#include <cmath>
#include <algorithm>
#include <limits>

//Plots candlestick data in a text-based format with spacing aligned to x-axis labels.

void plotCandlesticks(const std::vector<Candlestick>& candlesticks, int scaleHeight) {
    if (candlesticks.empty()) {
        std::cerr << "No candlestick data to plot." << std::endl;
        return;
    }

    // Determine global min and max temperatures
    double globalMin = candlesticks[0].low;
    double globalMax = candlesticks[0].high;

    for (const auto& candle : candlesticks) {
        globalMin = std::min(globalMin, candle.low);
        globalMax = std::max(globalMax, candle.high);
    }

    // Adjust scaleHeight if necessary
    scaleHeight = std::max(scaleHeight, 10);
```



```
    // Pagination setup
    const int pageSize = 20;
    int totalCandlesticks = candlesticks.size();
    int totalPages = (totalCandlesticks + pageSize - 1) / pageSize;

    for (int currentPage = 1; currentPage <= totalPages;
++currentPage) {
        int startIdx = (currentPage - 1) * pageSize;
        int endIdx = std::min(startIdx + pageSize,
totalCandlesticks);

        // Subset of candlesticks for the current page
        std::vector<Candlestick> subset(candlesticks.begin() +
startIdx, candlesticks.begin() + endIdx);

        // Print the plot from top (max) to bottom (min)
        for (int row = scaleHeight - 1; row >= 0; --row) {
            double currentTemp = globalMin + (globalMax - globalMin)
* row / (scaleHeight - 1);
            std::cout << std::setw(6) << std::fixed <<
std::setprecision(1) << currentTemp << " | ";

            for (const auto& candle : subset) {
                int highPos = normalize(candle.high, globalMin,
globalMax, scaleHeight);
                int lowPos = normalize(candle.low, globalMin,
globalMax, scaleHeight);
                int openPos = normalize(candle.open, globalMin,
globalMax, scaleHeight);
                int closePos = normalize(candle.close, globalMin,
globalMax, scaleHeight);

                if (row == highPos && row == lowPos) {
                    std::cout << "|    ";
                } else if (row == highPos) {
                    std::cout << "|    ";
                } else if (row == lowPos) {
                    std::cout << "|    ";
                } else if (row == openPos && row == closePos) {
                    std::cout << "=    ";
                } else if (row == openPos) {
                    std::cout << "+    ";
                } else if (row == closePos) {
                    std::cout << "-    ";
                } else if (row < highPos && row > lowPos) {
                    std::cout << "|    ";
                } else {
                    std::cout << "     ";  // Add appropriate spacing
                }
            }
            std::cout << std::endl;
        }

        // Print the x-axis separator
        std::cout << "       " << std::string(subset.size() * 5, '-') << std::endl;

        // Print the years below the plot with spacing aligned
        std::cout << "       ";
        for (const auto& candle : subset) {
            std::cout << std::setw(5) << candle.date.substr(0, 4) << " ";
        }
        std::cout << std::endl;

        // If there are more pages, prompt the user to continue
        if (currentPage < totalPages) {
            std::cout << "\nPress Enter to view the next page...";
            std::cin.ignore(std::numeric_limits<std::streamsize>::max(), '\n'); // Clear input buffer
            std::cin.get();    // Wait for Enter
        }
    }
}
```

TemperaturePredictor.cpp

```
// TemperaturePredictor.cpp
#include "TemperaturePredictor.h"
#include <numeric>
#include <cmath>
#include <iostream>
```

```
/**
 * @brief Constructor that initializes the historical data.
 */
TemperaturePredictor::TemperaturePredictor(const
std::vector<Candlestick>& historicalData) : data(historicalData) {}

/**
 * @brief Calculates the slope (m) and intercept (c) for linear
regression.
 */
void TemperaturePredictor::calculateLinearRegression(double& m,
double& c) {
    int n = data.size();
    if (n == 0) {
        throw std::runtime_error("No data available for
prediction.");
    }

    std::vector<double> years;
    std::vector<double> temperatures;

    for (const auto& candle : data) {
        years.push_back(std::stod(candle.date));
        temperatures.push_back(candle.close);
    }

    double sum_x = std::accumulate(years.begin(), years.end(), 0.0);
    double sum_y = std::accumulate(temperatures.begin(),
temperatures.end(), 0.0);
    double sum_xy = 0.0;
    double sum_x2 = 0.0;

    for (int i = 0; i < n; ++i) {
        sum_xy += years[i] * temperatures[i];
        sum_x2 += years[i] * years[i];
    }

    double denominator = n * sum_x2 - sum_x * sum_x;
    if (denominator == 0) {
        throw std::runtime_error("Denominator in linear regression
calculation is zero.");
```

```
    }

    m = (n * sum_xy - sum_x * sum_y) / denominator;
    c = (sum_y * sum_x2 - sum_x * sum_xy) / denominator;
}

/**
 * @brief Predicts temperatures for a given range of years using linear regression.
 */
std::vector<Candlestick> TemperaturePredictor::predictTemperatures(int startYear, int endYear) {
    std::vector<Candlestick> predictions;

    double m, c;
    calculateLinearRegression(m, c);

    for (int year = startYear; year <= endYear; ++year) {
        double predictedClose = m * year + c;
        // For simplicity, set open = close = predictedClose, high = predictedClose + 1, low = predictedClose - 1
        double predictedOpen = predictedClose;
        double predictedHigh = predictedClose + 1.0;
        double predictedLow = predictedClose - 1.0;

        predictions.emplace_back(std::to_string(year), predictedOpen, predictedClose, predictedHigh, predictedLow);
    }

    return predictions;
}
```

Header Files

Candlestick.h

```cpp
// Candlestick.h
#pragma once
#include <string>

class Candlestick {
public:
    std::string date;  // Year (e.g., "1980")
    double open;       // Opening average temperature
    double close;      // Closing average temperature
    double high;       // Highest temperature
    double low;        // Lowest temperature

    // Constructor
    Candlestick(const std::string& d, double o, double c, double h, double l)
        : date(d), open(o), close(c), high(h), low(l) {}
};
```

ComputeCandlesticks.h

```cpp
// ComputeCandlesticks.h
#pragma once
#include "Candlestick.h"
#include <vector>
#include <string>
#include <utility>

//Compute candlestick data for the specified time frame, Vector of pairs (year, temperature) and Vector of Candlestick objects
std::vector<Candlestick> computeCandlesticks(const std::vector<std::pair<std::string, double>>& entries);
```

CSVReader.h

```cpp
// CSVReader.h
#pragma once
#include <fstream>
#include <sstream>
#include <vector>
#include <string>
#include <stdexcept>
#include <iostream> // For debug logs

// CSVReader class to read temperature data from CSV files
class CSVReader {
public:
    static std::vector<std::pair<std::string, double>> readCSV(const
std::string& filename, const std::string& column);
};
```

DataFilter.h

```cpp
// DataFilter.h
#pragma once
#include "Candlestick.h"
#include <vector>
#include <string>

// Filtering by the range of the year from 1980 to 2019
std::vector<Candlestick> filterByYearRange(const
std::vector<Candlestick>& candlesticks, int startYear, int endYear);

// Filtering by the opening and closing temperature
std::vector<Candlestick> filterByClosingTemperatureRange(const
std::vector<Candlestick>& candlesticks, double minTemp, double
maxTemp);
```

PlotCandlesticks.h

```cpp
// PlotCandlesticks.h
#pragma once
#include "Candlestick.h"
```

```
#include <vector>

// Text Based Plot
void plotCandlesticks(const std::vector<Candlestick>& candlesticks, int scaleHeight);
```

TemperaturePredictor.h

```
// TemperaturePredictor.h
#pragma once
#include "Candlestick.h"
#include <vector>
#include <string>
#include <utility>

// TemperaturePredictor class to predict future temperatures based on historical data.
class TemperaturePredictor {
public:
  // Constructor that takes historical candlestick data.
    TemperaturePredictor(const std::vector<Candlestick>& historicalData);
    // Predicts temperatures for a given range of years.
    std::vector<Candlestick> predictTemperatures(int startYear, int endYear);
private:
    std::vector<Candlestick> data;
    //  Calculates the slope (m) and intercept (c) for linear regression.
    void calculateLinearRegression(double& m, double& c);
};
```

Utils.h

```
// Utils.h
#pragma once
#include <cmath>
#include <algorithm>

//Custom implementation of clamp for C++11.
inline int clamp(int value, int minValue, int maxValue) {
    if (value < minValue) return minValue;
    if (value > maxValue) return maxValue;
    return value;
}

//Normalize a value to fit within the scale height.
inline int normalize(double value, double minValue, double maxValue,
int scaleHeight) {
    if (maxValue == minValue) return 0; // Prevent division by zero
    double normalized = (value - minValue) / (maxValue - minValue) *
(scaleHeight - 1);
    return clamp(static_cast<int>(std::round(normalized)), 0,
scaleHeight - 1);
}
```