

CP472: Assignment 2

Total Points = 71

In this programming assignment, you will engage with a dataset named **climate-daily.csv** that contains 5,000 weather records from Kitchener-Waterloo, Ontario downloaded and simplified from [Canadian Centre for Climate Services](#) [1]. These records span weather data from 2010 to 2024. The CSV file includes the following fields: LOCAL_DATE, SPEED_MAX_GUST, TOTAL_PRECIPITATION, MIN_TEMPERATURE, MAX_TEMPERATURE, and MEAN_TEMPERATURE. Your task is to develop a program in Python, Java, and C that will read this dataset, perform various analysis operations, and produce a report. The comparison of implementations across these languages will shed light on their different paradigms and efficiencies in handling data-centric applications.

Tasks:

1. (3*3 = 9 points) Load and Parse CSV Data:

- Implement CSV parsing to read and process the data.
- Handle missing or malformed data by skipping the record or filling in defaults.
- Parse dates and numeric fields correctly, ensuring that they are in the correct format and type for calculations.

2. (3*3 = 9 points) Data Representation:

- For Python, use dictionaries for a flexible representation or create a ClimateData class for each record.
- In Java, create a ClimateRecord class for encapsulating record properties, managing them in an ArrayList.
- Construct a ClimateRecord struct and manipulate a collection of these structs using a dynamic array or linked list.

3. (2*3*3 = 18 points) Analysis:

- Find the month with the highest TOTAL_PRECIPITATION and print both the month and the precipitation.
- Identify the day with the highest SPEED_MAX_GUST, printing both the speed and the corresponding LOCAL_DATE.
- Analyze temperature data to find the day with the largest temperature fluctuation (difference between MAX_TEMPERATURE and MIN_TEMPERATURE).

4. **((5+4)*3 = 27 points) Report Generation:** Output the following neatly formatted reports to the console (ask the user to select which of these reports they want to generate):

- The average SPEED_MAX_GUST, the TOTAL_PRECIPITATION, the MIN_TEMPERATURE, the MAX_TEMPERATURE, and the MEAN_TEMPERATURE for each month. The mean temperature for a month is the average of the daily mean temperatures for that month.
- All weather records between a given start and end date (the user provides the dates). Ensure the dates are in the correct format and within the range of the dataset.

5. **(3+5 = 8 points) Comparative Analysis:**

- Write 1-2 paragraphs on your overall experience of the implementation process in these languages (open ended; write whatever you want).
- Fill the following table:

	Readability	Ease of Debugging	Development Speed	Execution Time for monthly report generation (sec)	Lines of Code
Python					
Java					
C					

The first 3 columns should include the values R1, R2, and R3 which represent the relative rating of languages under that criterion where R1 being the highest and R3 the lowest rating. For example, if you found that your Java implementation took least time, followed by Python, followed by C, then you can rate them R1, R2, and R3, respectively. For the last two columns, you must enter numerical values.

Deliverables

Submit a zip file containing:

- The source code files for Python (.py), Java (.java), and C (.c) programs.
- Include a README file if your code has any dependencies (e.g., 3rd party libraries).
- Include a separate PDF file named "Assignment 2_Report" corresponding to the task 5 above.
- A PDF file named "Assignment 2_Report" for documentation.

Instructions

- You may use any libraries to read csv files but list them in README file.
- Your program should not assume a fixed number of records in the input csv file.
- The Python, Java, and C versions of the program should perform identically in terms of functionality to ensure that the comparative analysis is fair.
- Follow best practices for code readability, such as consistent naming conventions, code formatting, and the use of comments.

References

[1] Canadian Centre for Climate Services. (2024). Daily Climate Data. Station name: Kitchener/Waterloo. Retrieved from <https://climate-change.canada.ca/climate-data/#/daily-climate-data>