BIRZEIT UNIVERSITY

Department of Computer Science

COMP2421 - Data Structures and Algorithms
(Second Semester – Spring 2023/2024)

Project#1 Due Date: April 7th 2024 (by 11:59 PM)

In this project, you will implement an application of Linked Lists: **Radix Sort**.
Your application should be able to build a 2-level hierarchy for the Palestine and sort this hierarchy alphabetically according to the district name from an input file using Radix Sort. This should be done using a **doubly** implementation of the Linked List.

Assume the maximum length of the input string is 50 characters; the input file (i.e. ***districts.txt***) would contain an unspecified number of strings. Each line should contain the district name, the town name, the town population; the pipe symbol separates the strings "|" in each line, example:

```
Hebron | Dura | 100000
Hebron | Halhul | 40000
Jenin | Jaba | 7000
Jenin | Yabad | 31000
Jenin | Jenin | 92000
Gaza|Jabalia|20000
Gaza|Beit Hanoon|50000
```

Example of the Input File

After reading the strings successfully, your application should sort the districts using the Radix Sort algorithm. And sorting the towns based on the population.

The user should be displayed a menu with the options necessary to run the program's functionalities.

The output file (i.e. ***sorted_districts.txt***) should contain one line for the district name followed by the total population in that district, then list the names of towns' and the population in separated lines. Example of printing the sorted data:

```
Gaza District, Population = 70000
Beit Hanoon, 50000
Jabalia, 20000
Hebron District, Population = 140000
Halhul, 40000
Dura, 100000
Jenin District, Population = 130000
Jaba, 7000
Yabad, 31000
Jenin, 92000
```

Example of Output File

Your application should be able to show the following information through a proper menu of the application:

1. Load the input file (Palestinian districts and their town with population).
2. Print the loaded information before sorting (as in the input file format).
3. Sort the districts alphabetically using Radix sort.
4. Sort the towns for each district based on population in ascending order.
5. Print the sorted information.
6. Add a new district to the list of sorted districts (and sort the list)
7. Add a new town to a certain district.
8. Delete a town from a specific district.
9. Delete a complete district; here, you must delete all towns belonging to that district before deleting it.
10. Calculate the population of Palestine, the max and min town population.
11. Print the districts and their total population (without towns details).
12. Change the population of a town, after prompting the user to enter the district name.
13. Save to output file.
14. Exit

The deadline for this assignment will be April 7th, 2024. LATE SUBMISSIONS will not be accepted for any reason. Before the discussion, please ensure your application runs properly on your laptop. Project discussions will be decided later.

Grading policy:

1. Your application should have all functionalities working properly.
2. Your application should contain a menu to allow the user to select which option (s) he would like to run.

Notes and submission instructions:

1. **This is individual work**. It should represent your efforts. It is fine to discuss your work and ask your colleagues, but you are not allowed to copy/paste part of the work of others or give it to anyone else. You are not allowed to post/copy from other websites and/or social media, which will be considered cheating.
2. Any **plagiarized** code will not be marked, resulting in a **zero** grade.
3. You are responsible for the submitted code.
4. **Document format**. Please submit only the code file (**c** file) containing your project's code. Please rename it as follows: "**P1_YourStudentID_FirstNameLastName_SectionNo.c**".
5. **Input/output files names**. Make sure that the input/output files names are the same as in the specifications.
6. Include your full name, student ID, and section number at your file's beginning.
7. Please do not compress the file, only the C-file is needed.
8. You must use C language only.

Good luck!