Lab 10 - Linked Lists

CO 222 Programming Methodology

Department of Computer Engineering, University of Peradeniya

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1 Objective

The objective of this lab is to get hands-on experience with linked lists using C programming. In this lab, you need to implement the exact same program as in Lab 08. However, the implementation should be done with linked lists.

2 Developing a student registration system

Write a program that can be used to handle a student registration system using the following instructions.

1. The system should keep the following data of each student
   (a) Registration Number
   (b) Batch
   (c) First Name
   (d) Last Name
   (e) GPA
2. There should be options to:
   (a) Add new students
   (b) Delete students
   (c) Show the information of a student when his/her registration number is given
   (d) Show information about all the students in the system
3. It is fine to make the student registration system volatile. (The data is lost when the program is stopped. No need to write student data to a file or a database.)
4. Internally the program should use a **linked list-based** implementation to store student data.
5. The UI should be command-line based. (The sample UIs are given in the Appendix (Section 6).)

3 Instructions

- Start by creating the UI.
- Next, create the structure to store a student record and the linked list.
  - ✱ A structure similar to the following can be used,

```
typedef struct _ {
    int batch;
    int regNo;
    char firstName[20];
    char lastName[20];
    float cGPA;
    struct _* next;
} student_t;
```

- Create separate functions for each operation (Add, Delete, and Print) and add them to UI.
- Write answers to the discussion questions in Section 5 and add them as comments in your code.

4 Submission

Submit your code to the Hackerrank Test CO222-2022-Lab 10 before the deadline and run all the test cases before submitting.

Note: The Hackerrank output may differ from the command line outputs of GUI given in Section 6. Hence, running your code on a command prompt is recommended over other IDEs. If you are using different IDEs, you should be able to handle the output differences on your own.

5 Discussion

Try to find answers to the following discussion questions.

1. How much memory (in bytes) is allocated for your Array with 5 data elements inserted? Show your calculation.
2. At what stage of your program, this memory allocation has happened, and when the memory is freed?
3. Explain how deleting values are implemented.
4. Can we add an unlimited amount of student data to this program? If not what is the limitation?
5. What are the pros and cons of linked lists over arrays?
6. Assume you want a similar system to add exactly 1,000 student records at the beginning and after that no additions or deletions. Each record has a unique ID from 0-999. You want to view the student records and modify them. What is the preferred way to implement the system (array-based or linked list-based)? Explain.

6 Appendix

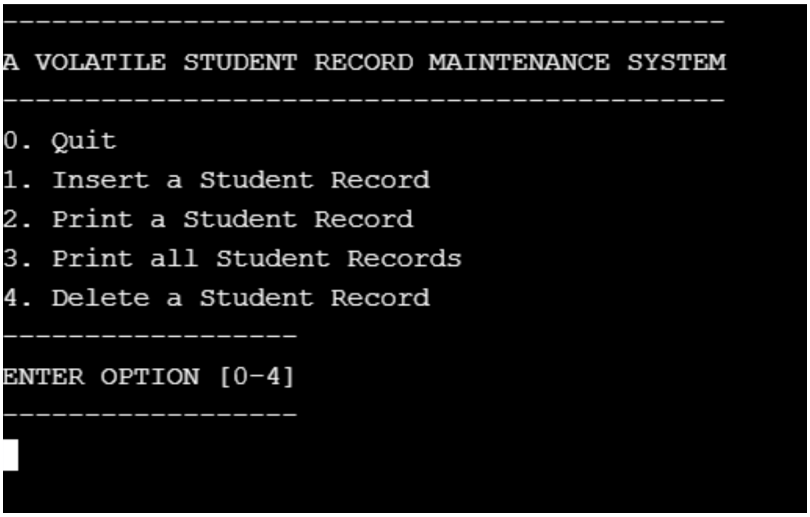

Figure 1: Main UI

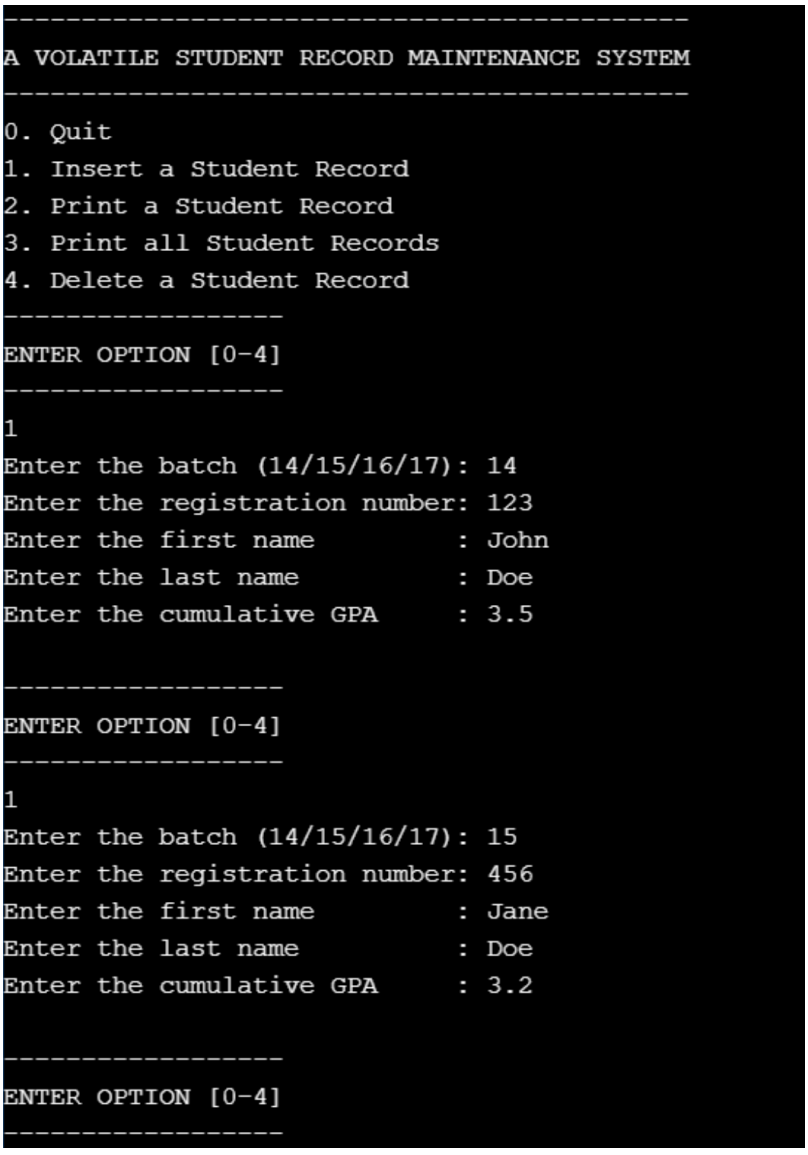

Figure 2: Adding new records

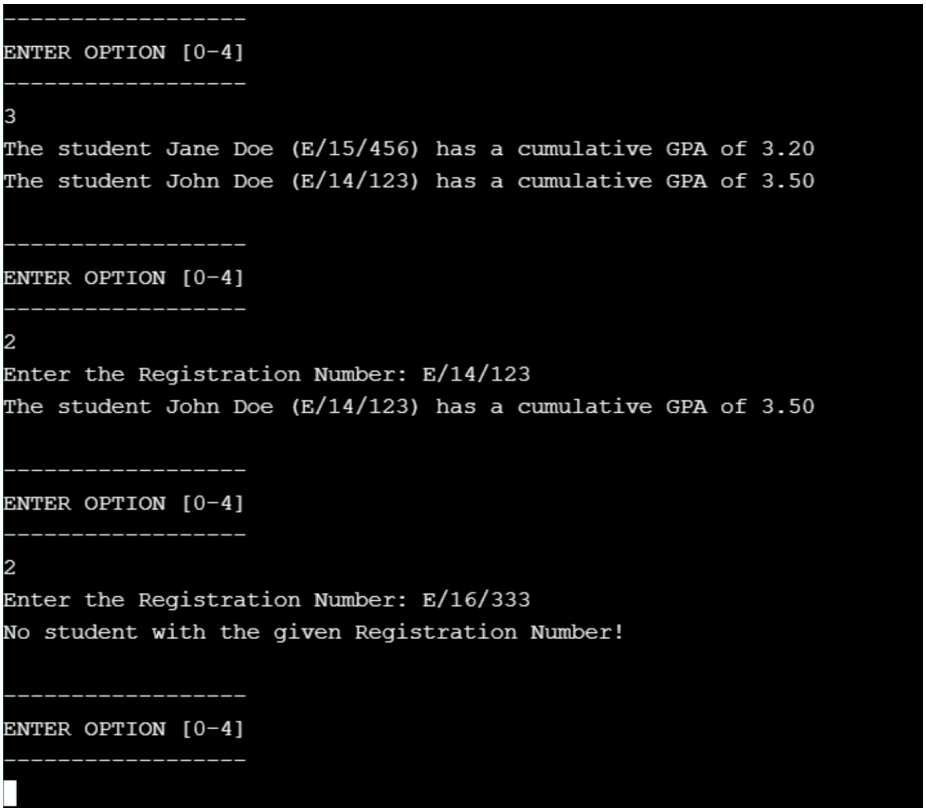

Figure 3: Displaying results

```
------------------
ENTER OPTION [0-4]
------------------
1
Enter the batch (14/15/16/17): 14
Enter the registration number: 123
Enter the first name         : John
Enter the last name          : Doe
Enter the cumulative GPA     : 3.5

------------------
ENTER OPTION [0-4]
------------------
1
Enter the batch (14/15/16/17): 15
Enter the registration number: 456
Enter the first name         : Jane
Enter the last name          : Doe
Enter the cumulative GPA     : 3.2

------------------
ENTER OPTION [0-4]
------------------
3
The student Jane Doe (E/15/456) has a cumulative GPA of 3.20
The student John Doe (E/14/123) has a cumulative GPA of 3.50

------------------
ENTER OPTION [0-4]
------------------
```

Figure 4: Order of print all records

```

------------------
ENTER OPTION [0-4]
------------------
4
Enter the Registration Number: E/14/123
Delete Successful!

------------------
ENTER OPTION [0-4]
------------------
4
Enter the Registration Number: E/14/123
No student with the given Registration Number!

------------------
ENTER OPTION [0-4]
------------------
```

Figure 5: Deleting a record

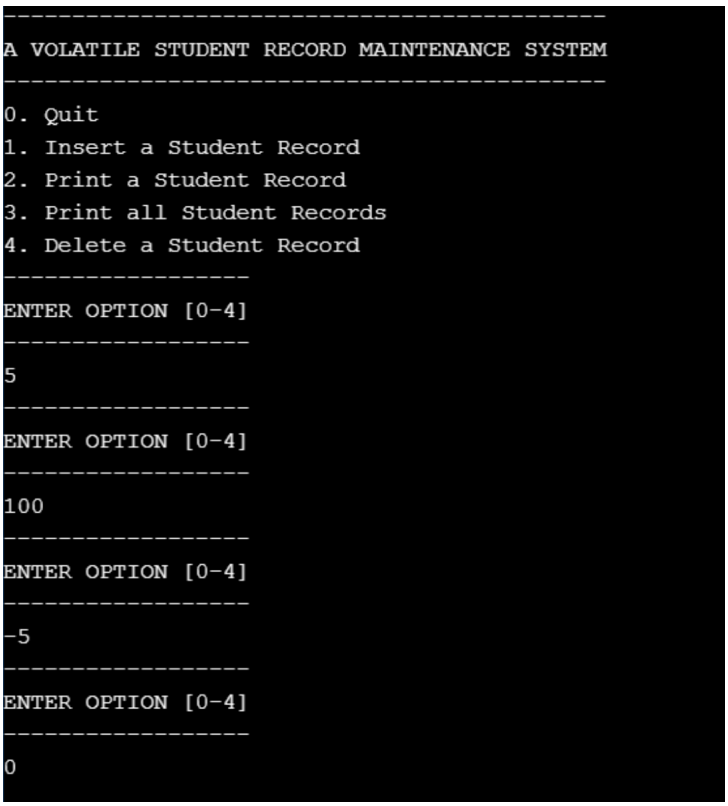

Figure 6: Invalid options