Introduction to C Programming II

Summary: In this homework, you will be implement a simple program that manages a course schedule.

1 Background

In this assignment you will write a program that manages a set of courses a student is taking. This program will introduce new keywords (struct, enum), and the handling of heap memory allocations. Similar to the last assignment, we ask that you do your program development on Linux.

The program will store a collection of courses, giving the user options to add to the collection, or remove from that collection. The collection of courses will be stored as a linked list (using structs as nodes). The problem must support any number of courses in the collection. Courses will be composed of a subject (enum), number, teacher, and number of credits. When a user adds a course, a new node must be created, and when a course is removed, its corresponding node is removed. When the program exits, it will save the courses that have been added to a text file. When it starts, it will check if there is course data to load, and load any existing data.

This document is separated into four sections: Background, Requirements, Compiling a C Program from Terminal, and Submission. You have almost finished reading the Background section already. In Requirements, we will discuss what is expected of you in this homework. In Include Files, we list several files that may provide useful functions for the assignment. Lastly, Submission discusses how your source code should be submitted on Canvas.

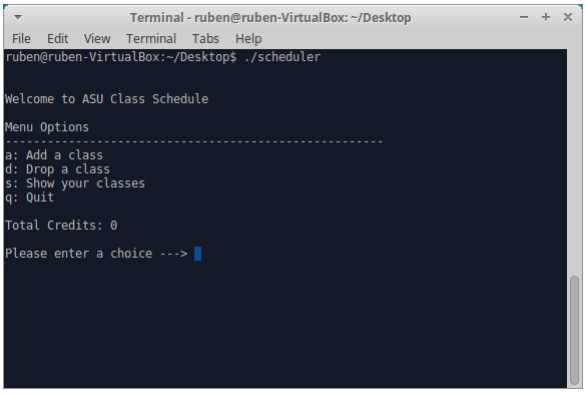
2 Requirements [30 points]

For this assignment you will write a course scheduler program in C. Your program **must**:

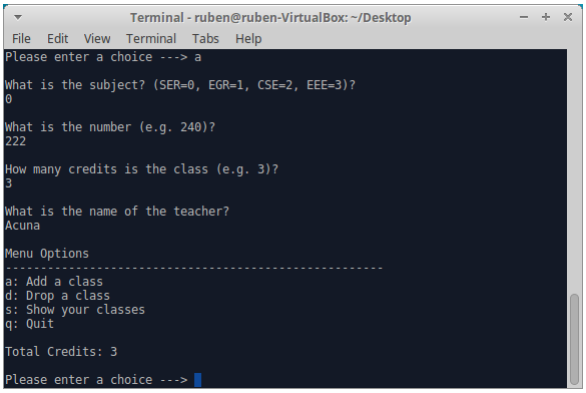
- **Compile on GCC 5.3 or greater under Xubuntu (or another variant of Ubuntu) 20.04.x.**
- Have an enumeration type (called Subject) to represent subjects (SER, EGR, CSE, EEE).
- Have a struct type (called CourseNode) to hold information about a course. Include a subject (see enum type above), a number (int), a teacher (a string of length 1024), and credit hours (int). It should also include the variables necessary to represent a linked list.
- Use a linked list of structs (called course_collection) to store course information. Your program will allow the user to enter any number of courses - this means you must use dynamic memory allocation to store the courses. When an user adds a course, a new node must be created, and when a course is removed, its corresponding node is removed.

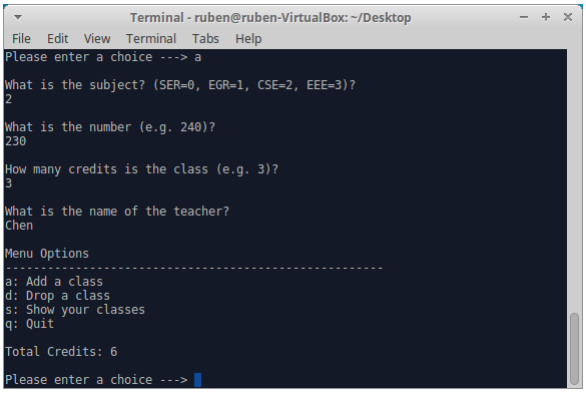
Note: your program may not exactly match the outputs below - screen shots are only provided as samples. Points allocation is:

- Update the main menu to display the total number of credits each time it is shown. [2 points]

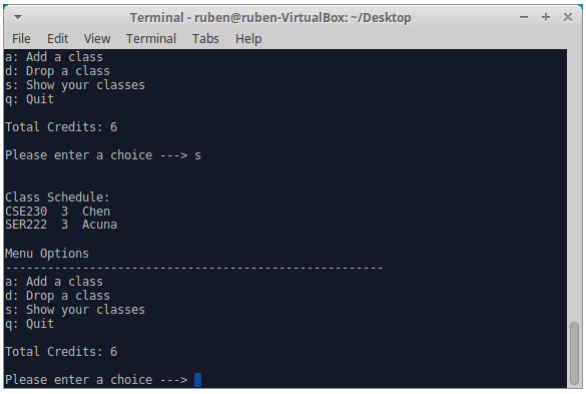


- The program must not leak memory on exit. [4 points]
- Create a void course_insert() function that adds courses to the collection and keeps it sorted. Order by both subject and an course number. For example, all CSE courses would show before SER courses, and SER222 would show before SER334. Populate the elements of the CourseNode as shown below. Do not allow duplicate courses. Two example inserts are shown. Notice that the integer input for different courses is show to the user to help them select (you may number them differently). [8 points]

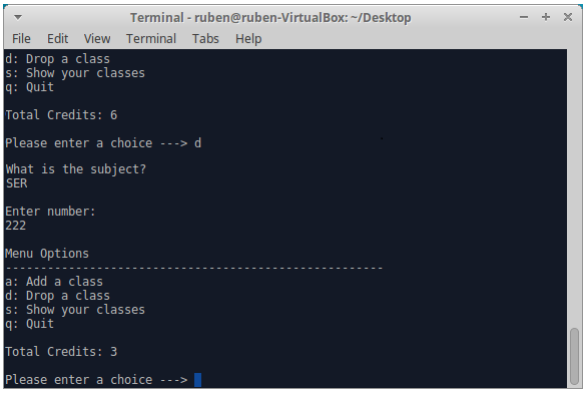


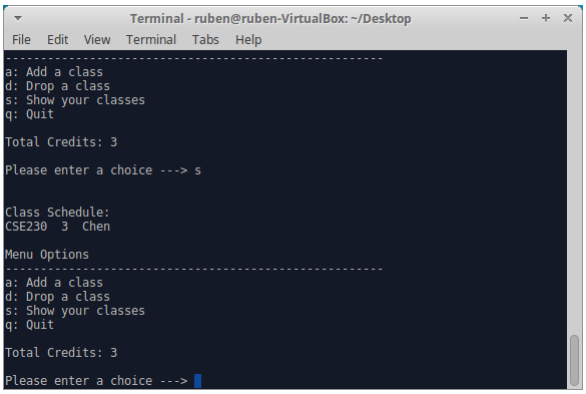


- Create a void schedule_print() function. This function will display the contents of the course_collection list with format Subject Number Credits Teacher as shown. (Hint: Use a switch statement to map from an enumeration to a printf.) [2 points]



- Create a void course_drop() function. This function will prompt the user for a course by its subject and number. It then searches for the course in course_collection and removes it. Dropping a course is only allowed if the course exists in the collection, otherwise an error message will be displayed. [4 points]





- Properly deallocate memory when removing nodes. No memory leaks. [2 points]
- Create a void schedule_load() function that will be called when your program starts. This function should check if a data file exists (plain text, filename up to you), and load any courses that it specifies. Courses should be sorted once the program finishes loading. It may assume that the file is in the format used by your schedule_save() function. If the file does not exist, it should do nothing. [4 points]
- Create a void schedule_save() function that will be called when your program ends. This function saves the contents of the CourseCollection to a plain text file (filename up to you). If the file already exists, you may override it. You should design the format of the data file yourself. [4 points]

3 Include Files

To complete this assignment, you may find the following include files and functions useful:

- *stdio.h*: Defines standard IO features, including file routines.
  - Useful types:
    - *struct FILE* - A structure to represent a file handler.
  - Useful functions:
    - FILE* fopen (const char* filename, const char* mode): the fopen() function opens a file. It takes a filename, and mode, and returns a FILE value representing a file handler. Mode may be "w" for text write, or "r" for text read. If the file cannot be opened, it will return a NULL pointer.
    - char* fgets(char* str, int num, FILE* stream): the fgets() function reads a number of characters into a string variable (or stops early if it sees a new line) from a file handler. Typically used with a fixed size buffer variable.
    - int fprintf(FILE* stream, const char* format, ...): the fprintf() function writes a formatted string into a file. Format section uses the same control sequences as printf.
    - int atoi (const char* str): the atoi() function takes a string and parses it into an integer that it returns.
- *stdlib.h*: Defines memory allocation functions.
- *string.h*: Defines string manipulation functions.
  - char* strcpy(char* dest, const char* src): The strcpy() function copies the string pointed to, by src to dest.
  - size_t strlen(const char* str): The strlen() function computes the length of the string str up to, but not including the terminating null character.

Your solution may not include all of these include files or functions, they are only suggestions. If you want to include any other files, please check with the instructor or TA before doing so. (Somewhat ironically a good documentation site for these methods is: http://www.cplusplus.com/reference/cstdio/.)

4 Submission

The submission for this assignment has one part: a source code submission. The file should be attached to the homework submission link on Canvas.

Writeup: For this assignment, no write up is required.

Source Code: Please name your source file as "LastNameScheduler.c" (e.g. "AcunaScheduler.c").