Final Assignment for the Course "Object-Oriented Programming Using C++"

Using STL, develop three applications to solve the following tasks in console applications with a menu.

# Task 1 (mandatory, maximum 8 points)

In a vector consisting of n integer elements, perform the following operations (via menu commands):

* Count the number of vector elements equal to 0.
* Find the sum of elements located after the minimum element.
* Remove elements that appear less than twice.
* Sort the vector in ascending order of the absolute values of the elements.
* Duplicate the negative elements of the vector.
* Save the vector to a binary file using the output stream.
* Read the vector from a binary file using the input stream.

# Task 2 (for candidates for 10 points)

Using classes and STL algorithms, and lambda expressions, write an application to solve the following task from the practice book by Pavlovskaya T.A. and Shchupak Yu.A. on OOP in C++:  
Write an application for library book accounting. The book information contains: identifier (inventory number), author’s surname and initials, book title, year of publication, and the number of copies of the book in the library. The library information includes the library's address, the surname and initials of the director, and the book collection. Store the library and book data in a text file in CSV format, using ";" as a separator.  
  
File format: the first line contains the library data, with each subsequent line containing data about a book, one book per line. Initial data setup on the first launch should include at least 12 books. Use a menu to implement the following functions:

* Output library and book collection data to the console.
* Add a book by entering data via keyboard, saving the updated collection to the text file.
* Remove books by identifier, saving the updated collection to the text file.
* Modify the number of books by a specific author based on keyboard input, saving the updated collection to the text file.
* Filter books by the year of publication into a separate list, output this list to the console sorted by year without changing the original book collection or data file.
* Filter books by the author into a separate list, output this list to the console sorted by author without changing the original book collection or data file.
* Sort books by the number of copies in descending order, output to the console without changing the data file.
* Sort books by identifier, output to the console without changing the data file.
* Sort books by title, output to the console without changing the data file.

Minimize the use of loops – maximize the use of STL algorithms.

# Task 3 (for candidates for 12 points) – Option 2

You are developing an application for a fitness club that conducts workouts in its own halls under the guidance of trainers or independently by clients. The enterprise may also rent its halls to external trainers. The following information is known about the enterprise from the perspective of the application development:  
There are three categories of users: clients, trainers, and administration (technical staff is ignored 😊). The fitness club has three halls: a gym, an aerobics hall, and a martial arts hall.  
Clients can obtain information about group class schedules, hall occupancy, and individual training with trainers. A client is anyone who has purchased a membership. A client can register for a group workout or a personal session. If fewer than 2 clients have registered, the session is canceled, and the trainer and the registered client are notified.  
Trainers report their desired schedules to the administration: the preferred time and the most suitable hall.  
The administration is responsible for hiring and firing trainers, selling memberships to clients, scheduling trainer sessions, and managing business operations. Additionally, the administrator can generate certain reports using the application (e.g., a report on trainers – the number of sessions for each trainer in a given month).  
Clients and staff members of the fitness club (application users) are characterized by their first name, surname, patronymic, and passport number. Staff members are also characterized by their position (trainer, administrator, janitor, etc.), salary. There is only one administrator, who oversees several trainers.  
Once the schedule is created or a personal training session is assigned, the administrator notifies the trainers and the clients of the personal sessions. The administrator also notifies all fitness club clients about schedule changes.  
A training session is described by the place and time of the session, the trainer, and the list of participants (for individual sessions, there is only one participant in the list).  
For 7 clients, 3 trainers, and 1 administrator, develop and test the following part of the application: assigning trainers to two group sessions and one individual session – at the same time, on the same day, in different halls. One of the group sessions should have only one client registered (for demonstration purposes of session cancellation).  
Use STL and, of course, lambda expressions. Initial data population – from a fixed set.