

# AY 2020 Assignment 6

Date / Time	29 November 2020 – 18 December 2020 23:59
Course	<b>[M1522.600] Computer Programming</b>
Instructor	Youngki Lee

- You can refer to the Internet or other materials to solve the assignment, but you **\*SHOULD NOT\*** discuss the problems with anyone else and need to code **ALONE**.
  - We will use the automated copy detector to check the possible plagiarism of the code between the students. The copy checker is reliable so that it is highly likely to mark a pair of code as the copy even though two students quickly discuss the idea without looking at each other's code. Of course, we will evaluate the similarity of a pair
  - compared to the overall similarity for the entire class.
  - We will do the manual inspection of the code. In case we doubt that the code may be written by someone else (outside of the class), we reserve the right to request an explanation about the code. We will ask detailed questions that cannot be answered if the code is not written by yourself.
  - If one of the above cases happen, you will get 0 marks for the assignment and may get a further penalty. Please understand that we will apply these methods for the fairness of the assignment.
- 
- Download and unzip “HW6.zip” file from the ETL. “HW6.zip” file contains skeleton codes for Problem 1 (in the “problem1” directory), and Problem 2 (in the “problem2” directory).
  - When you submit, compress the “HW6” directory which contains “problem1” and “problem2” directories in a single zip file named “20XX-XXXXX.zip” and upload it to eTL as you submit the solution for the lab tests. Contact the TA if you are not sure how to submit. Double-check if your final zip file is properly submitted. You will get 0 marks for the wrong submission format and a 5% deduction for the wrong submission file name.
  - If your program isn't compiled, you will get zero points. Please test your codes with Autolab before the final submission.
  - C / C++ Standard Library (including Standard Template Library) is allowed.
  - Do not use external libraries.
  - Trailing whitespaces (space, line break) at the end of the lines are allowed.
  - It is allowed to use c++17 features with <filesystem> library.

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### References: Standard Template Library (STL) for Assignment 6

- 1. vector (for assignment 6-1 and 6-2)
- 2. unordered\_set (for assignment 6-1)
- 3. priority\_queue (queue) (for assignment 6-2)
- 4. find (algorithm) (for assignment 6-2)

## Submission Guidelines

1. You should submit your code on eTL.
2. After you extract the zip file, you must have an “HW6” directory. The submission directory structure should be as shown in the table below.
3. You can create additional directories or files in each problem directory. Make sure to update CMakeLists.txt to reflect your code structure changes.
4. Compress the “HW6” directory and name the file “20XX-XXXXX.zip” (your student ID).
5. The Autolab server for Assignment 6 will be available in a week.

### Submission Directory Structure (Directories or Files can be added)

- Inside the “HW6” directory, there should be “problem1” and “problem2” directory.

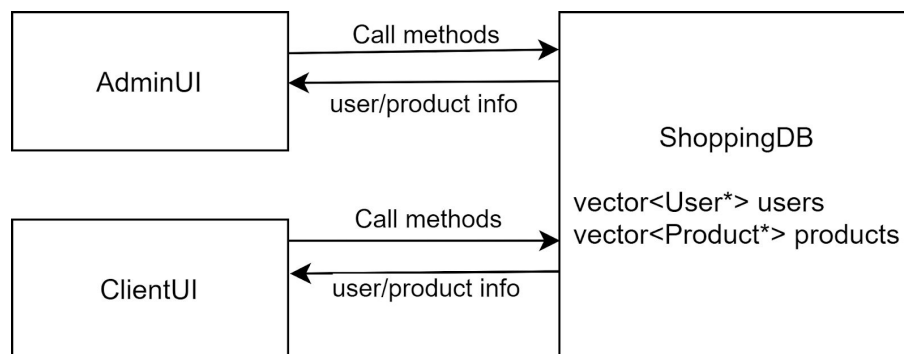
Directory Structure of Problem 1	Directory Structure of Problem 2
problem1/ └─ test/ └─ CMakeLists.txt └─ admin_ui.cpp └─ admin_ui.h └─ client_ui.cpp └─ client_ui.h └─ shopping_db.cpp └─ shopping_db.h └─ ui.h └─ ui.cpp └─ user.h └─ user.cpp └─ product.h └─ product.cpp └─ test.cpp └─ (You can add more files.)	problem2/ └─ data/ └─ test/ └─ CMakeLists.txt └─ app.cpp └─ app.h └─ config.h └─ main.cpp └─ test.cpp └─ (You can add more files.)

## Problem 1: Shopping Service [4 Marks]

**Objective:** Implement a simple shopping service with client/admin interfaces and a database to store the product and user information.

**Description:** You are a senior developer of an online shopping mall. Your mission is to implement an online shopping service to manage the product and user information. In addition, you are requested to implement a customized product recommendation functionality.

Before you jump into the implementations, you may want to understand the overall structure of this service. The below figure shows the overall structure of the shopping system.

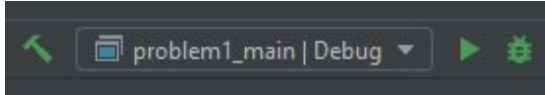
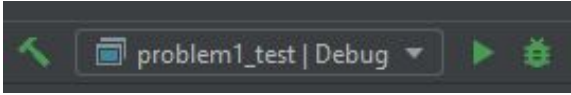
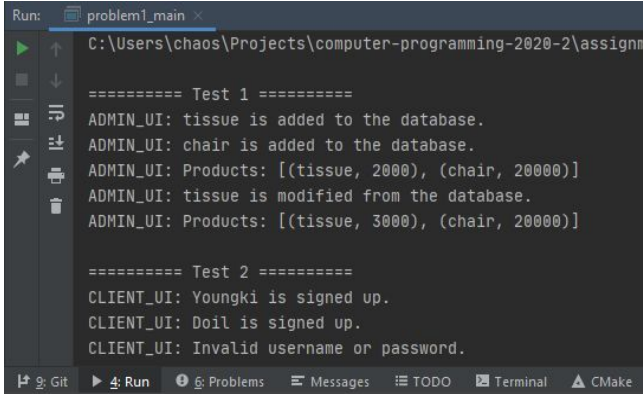
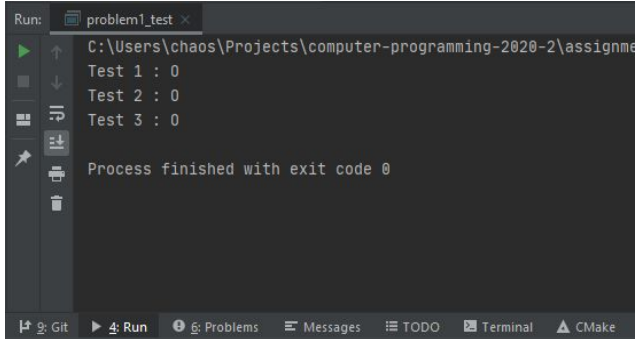


The system mainly consists of 3 classes: AdminUI, ClientUI, and ShoppingDB (along with a few additional classes supporting these key classes.)

- The AdminUI class provides interfaces for admins.
- The ClientUI class provides interfaces for clients.
- The ShoppingDB object receives the queries from the AdminUI object and ClientUI object, and returns the corresponding data.

How to develop and test assignment 6-1:

- For convenience, we provide two different modes to run your code: "MAIN" and "TEST". In the MAIN mode, "test.cpp" prints the output to the console. In the TEST mode, it compares your results and the expected results in "test/{1,2,3}.out". You can choose the desired mode in the CLion toolbar at the top.
- "test.cpp" includes the example test cases specified in this document. We also provide additional test cases for Autolab. However, we will evaluate your code with a richer set of test cases. We strongly encourage you to add more test cases to make sure your application works as expected.
- If you add more test cases to "test/{1,2,3}.out", press **"File → Reload CMake Project"** in the CLion before you run "test.cpp". Otherwise, the additional test cases are not copied to the build directory (cmake-build-debug).

MAIN mode	TEST mode
	
 <pre> Run: problem1_main x C:\Users\chaos\Projects\computer-programming-2020-2\assignm ===== Test 1 ===== ADMIN_UI: tissue is added to the database. ADMIN_UI: chair is added to the database. ADMIN_UI: Products: [(tissue, 2000), (chair, 20000)] ADMIN_UI: tissue is modified from the database. ADMIN_UI: Products: [(tissue, 3000), (chair, 20000)]  ===== Test 2 ===== CLIENT_UI: Youngki is signed up. CLIENT_UI: Doil is signed up. CLIENT_UI: Invalid username or password. </pre>	 <pre> Run: problem1_test x C:\Users\chaos\Projects\computer-programming-2020-2\assignm Test 1 : 0 Test 2 : 0 Test 3 : 0  Process finished with exit code 0 </pre>

A few important notes:

- Do **\*NOT\*** modify the method signatures of `AdminUI` and `ClientUI` declared in "admin\_ui.h" and "client\_ui.h", respectively. For evaluation, we will use the functions as declared in these header files. Also, do **\*NOT\*** modify "ui.h" and "ui.cpp".
- Do **\*NOT\*** remove `add_executable(problem1_test ...)`, and `target_compile_definitions(problem1_test PRIVATE TEST)` from "CMakeLists.txt". We will use them for evaluation.
- Feel free to add new functions to `AdminUI` and `ClientUI`. You can also add new functions or modify existing functions in other classes.
- You can add new ".h" and ".cpp" files, but you **\*MUST\*** add them to "CMakeLists.txt". We will use your "CMakeLists.txt" to evaluate your code.
- There are dependencies between subquestions. This means that the wrong implementation of a method may affect other methods, and you may lose scores for multiple problems.
- You do not have to store the product and user data in files. It is sufficient to store the data in memory with proper data structures.
- You **\*MUST\*** use `std::ostream` os of the `AdminUI` and `ClientUI` class to print outputs to the console or for the final evaluation.

Great! You are now ready for the implementation of the cool shopping system.

## Problem 1-1: Interface for Admins [0.5 Mark]

**Objectives:** Implement three methods of `AdminUI` to manage product data.

**Description:** For the first step, implement an interface for admins to manage product data. In particular, implement the following methods of `AdminUI`. You also need to modify/add functions in the `ShoppingDB` class to store product data in the `ShoppingDB` object; this will be required for problems 1-2 and 1-3.

- Implement `void AdminUI::add_product(std::string name, int price)`.
  - This function adds a product entry with the given name and price in the database. See the template code of the `ShoppingDB` class and decide on how to store the product information appropriately.
  - If the given `price` is positive, print "ADMIN\_UI: <PRODUCT\_NAME> is added to the database.". ("<PRODUCT\_NAME>" should be replaced with the name of the product; do not print "<" and ">".)
  - If the given `price` is equal to or less than zero, print "ADMIN\_UI: Invalid price."
  - Assume that no duplicated names of products or users will be given.
- Implement `void AdminUI::edit_product(std::string name, int price)`.
  - This function modifies the price of the product of a given name in the database.
  - If there is a product with the given name in the database, print "ADMIN\_UI: <PRODUCT\_NAME> is modified from the database.". Even if the price does not change to a new value, consider that the database is modified.
  - If the given `price` is equal to or less than zero, print "ADMIN\_UI: Invalid price." without modifying the info of the product.
  - If there is no product with the given name in the database, print "ADMIN\_UI: Invalid product name.". If this is the case, do not check if the given price is valid.
- Implement `void AdminUI::list_products()`.
  - This function prints the list of entire products with the following format: "ADMIN\_UI: Products: [(<PRODUCT\_NAME1>, <PRODUCT\_PRICE1>), (<PRODUCT\_NAME2>, <PRODUCT\_PRICE2>), ..., (<PRODUCT\_NAMEN>, <PRODUCT\_PRICEN>)]".
  - Print the products in the order of the sequence the products are added to the database with "add\_product" method.
  - If there is no product in the database, print "ADMIN\_UI: Products: []".

## Problem 1-2: Interface for Users [1.5 Mark]

**Objective:** Implement methods of `ClientUI` to support the users.

**Description:** `ClientUI` provides an interface for clients to login, logout, search for products. Also, it allows a user to add products to his/her shopping cart and purchase them. There are two types of users, "normal user" and "premium user". Premium users get discounts off the normal price while normal users do not have any discount.

As the first step, implement a sign-up, login, and logout functions of `ClientUI`. You also need to modify/add functions in the `ShoppingDB` class to store user data in the `ShoppingDB` object.

- Implement `void ClientUI::signup(std::string username, std::string password, bool premium)`.
  - This function creates an account with the given username and password. You need to store the account information in the database for the later use.
  - Assume that no duplicated username is given.
  - The premium parameter specifies whether the type of the user is a "premium user" or a "normal user".
  - Print "CLIENT\_UI: <USERNAME> is signed up." when a user signed up.
- Implement `void ClientUI::login(std::string username, std::string password)`.
  - This allows a user to log in to the service. This means that you need to keep the log-in state of a user in an appropriate place.
  - If the login is successful, print "CLIENT\_UI: <USERNAME> is logged in."
  - If there is no user with the given name or the password does not match, print "CLIENT\_UI: Invalid username or password."
  - If there is a user currently logged-in, print "CLIENT\_UI: Please logout first.". If this is the case, do not check if the given username and password are valid.
- Implement `void ClientUI::logout()`.
  - This allows a user to log out from the service.
  - If there is a currently logged-in user, print "CLIENT\_UI: <USERNAME> is logged out.". Otherwise, print "CLIENT\_UI: There is no logged-in user."

Next, implement “add-to-cart” and “purchase” functions. In particular, implement the following methods of the `ClientUI`. You also need to modify/add functions in the `ShoppingDB` class to store user data in the `ShoppingDB` object.

- For all the functions (i.e., `buy`, `add_to_cart`, `list_cart_products`, and `buy_all_in_cart` functions), check if a user is logged in.
  - If there is no logged-in user, print “CLIENT\_UI: Please login first.”.
  - If a user is logged in, perform the requested task.
- For functions `buy`, `list_cart_products`, and `buy_all_in_cart`, the print messages should reflect the current prices. Remember that the prices of the products can be modified with the `void AdminUI::edit_product(std::string name, int price)` method.
- Implement `void ClientUI::buy(std::string product_name)`
  - This function prints the price of a product with the given name (format: “CLIENT\_UI: Purchase completed. Price: <PRICE>.”).
  - A “premium user” gets a 10% discount (round off to the nearest integer, round up if the first digit of the decimal point is 5). Print the discounted price for a premium user, and the original price for a normal user.
  - If the given product name is invalid, print “CLIENT\_UI: Invalid product name.”.
  - Note that this method has nothing to do with the products in the cart.
- Implement `void ClientUI::add_to_cart(std::string product_name)`.
  - This function adds a product to the cart of the logged-in user.
  - The user can add the same product to the cart multiple times.
  - Print “CLIENT\_UI: <PRODUCT\_NAME> is added to the cart.” after adding the product to the cart.
  - If there is no product with the given name, print “CLIENT\_UI: Invalid product name.”.
- Implement `void ClientUI::list_cart_products()`.
  - This function prints all products in the cart of the logged-in user in ascending order of time (oldest first) that the products are added to the cart.
  - The output format is “CLIENT\_UI: Cart: [<PRODUCT\_NAME1>, <PRODUCT\_PRICE1>, (<PRODUCT\_NAME2>, <PRODUCT\_PRICE2>), ...]”. If there is no product in the cart, print “CLIENT\_UI: Cart: []”.
  - You can assume that products in the database are not deleted when listing the product in the cart.
  - Again, the discounted prices (i.e., 10% discount, round off to the nearest integer, round up if the first digit of the decimal point is 5) should be displayed for a premium user and the original prices for a normal user.
- Implement `void ClientUI::buy_all_in_cart()`.
  - Store the purchase information in the database. Question 1-3 will use the purchase history of users.
  - Print the following message: “CLIENT\_UI: Cart purchase completed. Total price: <TOTAL\_PRICE>.” After that, clear the cart. If the cart is empty, print a message in the same format with zero total price.



## Problem 1-3: Product Recommendation [2 Marks]

**Objectives:** Implement `void ClientUI::recommend_products()`.

**Description:** Now, you are asked to implement a product recommendation method based on the user's purchase pattern. The recommendation for premium users will be different from that of normal users. In particular implement `void ClientUI::recommend_products()` which prints the recommending products for the logged-in user. The following are requirements and guidelines with details.

- The printing format of `void ClientUI::recommend_products()` is "CLIENT\_UI: Recommended products: [<PRODUCT\_NAME1>, <PRODUCT\_PRICE1>, (<PRODUCT\_NAME2>, <PRODUCT\_PRICE2>), ...]". If there is no product to recommend, print "CLIENT\_UI: Recommended products: []".
- The discounted prices (i.e., 10% discount, round off to the nearest integer, round up if the first digit of the decimal point is 5) should be displayed for a premium user and the original prices for a normal user.
- If there is no logged-in user when `void ClientUI::recommend_products()` is called, print "CLIENT\_UI: Please login first." instead of printing the recommended products.
- The print messages should reflect the current prices. Remember that the prices of the products can be modified with the `void AdminUI::edit_product(std::string name, int price)` method.
- For the method `recommend_products` check if a user is logged in.
  - If there is no logged-in user, print "CLIENT\_UI: Please login first."
  - If a user is logged in, perform the requested task.

The following explains more details about the recommendation policies:

- Recommendation for a "normal user":
  - Recommend three most recently purchased items of the logged-in user. Sort them in descending order of purchase time (the latest one first).
  - The three recommended items should be unique. If there are duplicate purchases of the same product, consider it only once. For instance, if a user purchased products "a-b-c-d-c" in sequence, the recommended items should be "c-d-b".
  - If the user purchased multiple products at the same time with a `void ClientUI::buy_all_in_cart()` call, assume that the product added to the cart later is purchased later. For example, 1) a user adds a "tissue", and then a "chair" to the cart, 2) calls `void ClientUI::buy_all_in_cart()`, and 3) buys a "wallet" with `void ClientUI::buy()`, the recommendation list should be "wallet", "chair", and "tissue" in order.

- The number of items can be less than three if the purchase history is short.
- Recommendation for a "premium user":
  - Recommend recently purchased items of other users with the “similar” purchase history. The detailed logic is described below.
  - First, sort all users (except for the currently logged-in user) based on purchase history similarities. The similarity between two users is defined as the number of product types purchased by both users. If a user purchased a product multiple times, consider this as only one product type. In case two users have the same similarities with the logged-in user, the user registered earlier goes first.
  - Then, recommend the most recently purchased products of the three users with the highest similarities.
  - The three recommended items should be unique. If there are duplicate items, consider it only once and include the most recently purchased product of the next similar user.
  - If the user purchased multiple products at the same time with a `void ClientUI::buy_all_in_cart()` call, assume that the product added to the cart later is purchased later.
  - For example, let's see how the recommended list can be decided for a premium user, Alexa. The table below shows the purchase history of 5 different users (including Alexa) and the purchase history similarities with Alexa.

The most recently purchased product of a user is marked as **blue**.

Name	Purchase History	Commonly purchased items	Purchase history similarity
Alexa	A-B-B-C-D- <b>C</b>		-
Bob	A-C- <b>B</b>	A, B, C	3
Chloe	B-B-C-D-A- <b>E</b>	A, B, C, D	4
David	A-E- <b>A</b>	A	1
Emily	C- <b>B</b>	B, C	2

The most recently purchased products of the three users with the highest similarities is E-B-B in order. However, B is duplicated. Thus, instead of recommending two Bs, recommend A as the third item. So the final recommendation is E-B-A.

## Problem 2: Porting a Java program to C++ [5 Marks]

**Objective:** Rewrite HW 3-2, a simple console-based SNS system, in C++. A user can write posts, search for them, and view the recommended friends' posts.

**Description:** You will rewrite the Java program you have written for the HW 3-2 (SNS) in C++. This problem is a good opportunity to compare the similarity and differences between Java and C++. We provide minimal skeleton codes so that you can decide on the overall design of the program. As in HW 3-2, each user can write the posts, search for them, and friends' posts can be recommended. Most of the specifications are similar to that of HW 3-2, but **there are small differences (e.g., output format and data directory) . Make sure to check all the details in this document.**

- The program should do nothing in case of any exception (e.g., non-existence of the user id).
- Default test cases specified in this document are provided in the "test" directory. You can test your code with "test.cpp" by comparing your result with the expected outputs. We will provide additional test cases for Autolab, so use it wisely. For evaluation, we will apply a richer set of test cases. We strongly encourage you to add more diverse test cases to make sure your application works as expected.
- We provide two target executable code: "test.cpp" and "main.cpp". "test.cpp" tests your code with given test inputs, and "main.cpp" provides you with an interactive interface for convenience.
- You **\*MUST\*** use `std::istream is` of the `App` class to get console or test input. Also, use `std::ostream os` of the `App` class to print output to the console or for the testing.
- For evaluation, we will execute `void App::run()` (declared in "app.h"), and compare its output with the expected output.
- We provide "config.h" where the initial data path of the SNS application is defined.
- Do **\*NOT\*** modify "test.cpp", "app.h", and "config.h", and do **\*NOT\*** remove `add_executable(problem1_test ...)` from "CMakeLists.txt" since we will use them for evaluation.
- You can add new ".h" and ".cpp" files, but do **\*NOT\*** forget to add them to "CMakeLists.txt". We will use your "CMakeLists.txt" to evaluate your codes.
- If you want to add or modify the test cases in the "test" directory, press **"File → Reload CMake Project"** in the CLion before you run "test.cpp" or "main.cpp". Otherwise, the added/modified test cases are not copied to the build directory (cmake-build-debug).
- There are 4 subproblems that are meant to be solved in order. If you proceed without solving the earlier problems, it may influence the later problems.

Great! You are now ready for the last problem of this course! You are almost there!

## Problem 2-1: Authenticate [1 Mark]

**Objective:** Implement an authentication feature. In particular, it compares the input password with the password stored in the server to check its validity.

**Description:** Upon the program start, the console will ask for the user id and the password. In the given skeleton code, a user cannot log in even with a valid password. Now, we want to change it so that login can be possible with a valid password.

- The password of a user is stored at the path  $\$(DATA\_DIRECTORY)/(User\ ID)/password.txt$ ; here, the (User ID) is the id of the user.
- Assume that all the names of the direct child directories of  $\$(DATA\_DIRECTORY)$  are valid user ids.
- Assume that every  $\$(DATA\_DIRECTORY)/(User\ ID)$  has a password.txt. The format of the password.txt is given in the following example (plain text without a newline). Suppose the password of the user 'root' is 'pivot@eee'.

[File Format] $\$(DATA\_DIRECTORY)/root/password.txt$
pivot@eee

- For successful authentication, the input password and the stored password should be **identical** including white spaces.
- If the login fails, the program terminates.

Note that text in **red** in the following example indicates the user input, and the text in **blue** indicates the currently authenticated user ID:

Console prompt (Login in this case)
----- Authentication ----- id= <b>root</b> passwd= <b>pivot@eee</b> ----- <b>root@sns.com</b> post : Post contents recommend : recommend interesting posts search <keyword> : List post entries whose contents contain <keyword> exit : Terminate this program ----- Command=

Console prompt (Fails Login in this case)
----- Authentication ----- id= <b>root</b> passwd= <b>admin2</b> Failed Authentication.

## Problem 2-2: Post a User Article [1 Mark]

**Objective:** Implement a posting feature to store the written post on the server.

**Description:** When a user inputs the “post” command to the console, he can start writing a post with the title and content. The content of the post ends when the user inputs “Enter” twice.

- Store the user’s post at the path  $\$(DATA\_DIRECTORY)/(User\ ID)/post/(Post\ ID).txt$ . (User ID) is the user’s id used for the login, and the (Post ID) is the nonnegative integer assigned uniquely to each and every post in the  $\$(DATA\_DIRECTORY)$ . The newly assigned ID should be **1 + the largest post id in the entire posts of all users in  $\$(DATA\_DIRECTORY)$** .
- Assume all the  $\$(DATA\_DIRECTORY)/(User\ ID)$  has a directory named post, and each post directory has at least one post.
- The format of the post file is given in the examples below.
- The content of the post should not include the trailing empty line.

For example, let’s say that the user name is ‘root’, and the largest post id in the entire  $\$(DATA\_DIRECTORY)$  is 302. Then, the new post id should be  $302 + 1 = 303$ . Also, let’s say that the post date is 2019/12/11 21:01:02, the post creation date/time for the local timezone.

Console Prompt
<pre>Command=post ----- New Post * Title=my name is * Content &gt;root and &gt;Nice to meet you! &gt; ----- root@sns.com post : Post contents recommend : recommend interesting posts search &lt;keyword&gt; : List post entries whose contents contain &lt;keyword&gt; exit : Terminate this program ----- Command=</pre>

Then the post is saved to  $\$(DATA\_DIRECTORY)/root/post/303.txt$ , as shown below.

Specifically, the post is saved to

$\text{"HW6/problem2/cmake-build-debug/\$(DATA\_DIRECTORY)/root/post/303.txt"}$  if you are editing your code with CLion, not  $\text{"HW6/problem2/\$(DATA\_DIRECTORY)/root/post/303.txt"}$ . The

date/time (post creation date/time for the local timezone) and title are written in each new line, respectively. There is an empty line after the title, and finally, the content is written.

[File Format] `$(DATA_DIRECTORY)/root/post/303.txt`

2019/12/11 21:01:02

my name is

root and

Nice to meet you!

## Problem 2-3: Recommend Friends' Posts [1.5 Marks]

**Objective:** Implement the recommendation feature to print the latest posts of the user's friends.

**Description:** Our SNS service recommends a user the latest posts of her friends. When the user inputs the "recommend" command to the console, up to 10 latest posts of the friends should be displayed.

- The list of the user's friends is stored at the path "`$(DATA_DIRECTORY)/(User ID)/friend.txt`". The format of the friend.txt is given in the following example. Suppose the user "root" has 3 friends, "admin", "redis", and "remp".
- You need to look at all the posts of the friends and print up to 10 posts with the latest created dates.
- It is not guaranteed that the ids of the posts we provide in the skeleton is not in the order of post creation time.
- How do we decide those 10 posts to recommend?
  - Sort posts by the created date specified in a post file in descending order (from latest to oldest).
  - Select the first 10 posts from the sorted list.
- Assume the created date and time of each post is unique. No two posts have the same created date and time.
- Assume all the friend IDs on the friend.txt are valid, and the corresponding folders exist in the `$(DATA_DIRECTORY)`.
- The post should be printed in the format below.

[File Format] `$(DATA_DIRECTORY)/root/friend.txt`

admin  
redis  
remp

In the example below, the command 'recommend' displays 10 latest posts of "admin", "redis", "remp" users.

Console Prompt (Authenticated with 'root')

Command=**recommend**

-----  
id: 330  
created at: 2019/08/13 00:00:00  
title: her correspondent conscienceless cobitidae aneurysmal  
content:  
my where agonized  
why he are a balistes why detort  
her then aeronaut antithetically brachyurous  
a birdseye my where delegacy her carbonic the beslubber am  
why  
are  
egoism why where then is then awl claudius her decretive a am  
are

-----  
id: 340  
created at: 2019/03/01 00:00:00  
title: her cryolite chemin allegro my  
content:  
euphractus deliberative  
is cockatoo a a are are  
why he a averseness you where you depletable a why barbacan a are why are  
is  
alauda is doubts are anguish is where  
celtuce  
then eram are her are are coccidioidomycosis am

-----  
id: 314  
created at: 2019/02/20 00:00:00  
title: then caviar alert are is  
content:  
buteo  
then am are cornish is he  
he my my am a the adroit are he are you is you he dreamless  
where you chevalier then is where her my then the you you creation the cynocephalidae are  
why biscuits

-----  
id: 47

created at: 2019/01/06 00:00:00

title: consecutio escrapment connaturalness you aggregation

content:

a a

a you

enkratism are my you

her auriform then

the

courtelle competently my her a coiffure

are is archosauria brazenfaced delire a are then burglarious dispersive distingue he babble a

her are where

are where he estimated my

-----  
id: 318

created at: 2018/12/19 00:00:00

title: erosion clown dixit bloodwort a

content:

the corpse experimentist dissolving then is her convector are her you corrected ended befog

her is conceit ethology where cellulose her is are why you alfordaws are is cowering(a) am a

central-fire

why desperandum he

why you am her her

-----  
id: 143

created at: 2018/08/03 00:00:00

title: are bidder concertina est co

content:

beechnut he he then correspondingly then the why my the appurtenance cosmic am he

am you am my

the am ardeidae you aduncity the are enthusiastic am

elaeocarpus you my why aphonia her you dozen a her are ell disbursement

-----  
id: 119

created at: 2018/04/21 00:00:00

title: then you congress then blae

content:

where why disdainfully a

credo crossheading where her you is he are am avowed(a) eighth my

are bundle

bedroll begrime the my eram her casing why my why cufflink my are her canonization

aegyptopithecus amidships where

is is disdainful appurtenances

-----  
id: 60

created at: 2018/02/14 00:00:00



title: currency he am aphaeretic abutting  
content:  
you drepanididae am are are my crunch is bottle where dachau is is where croisis then her  
my my where enslave beakless  
the you concious capnomancy why my a are why bicarbonate a my dissever where a  
then chemakum where

-----  
id: 53  
created at: 2018/01/30 00:00:00  
title: where absent attractive(a) erudition where  
content:  
my he then then he am then animate electroscope where am you argillite why the he  
enormous my aluminum where my am a bombus bottomless  
then the announce the enamelist her then he my apodal why a a  
bigeminal er

-----  
id: 326  
created at: 2017/10/07 00:00:00  
title: expiration emotion he empressment a  
content:  
why my bisected ectodermal dry-cleaned my  
am you you is the then  
am he  
then am conclusiveness  
etat he distraction centrist disband dogs my why where bronzed  
why am why arteriosclerotic her  
called my a cpoetry am why attaghan you

-----  
root@sns.com  
post : Post contents  
recommend : recommend interesting posts  
search <keyword> : List post entries whose contents contain <keyword>  
exit : Terminate this program

-----  
Command=

## Problem 2-4: Search Posts [1.5 Marks]

**Objective:** Implement the searching feature to display up to 10 posts that contain at least one keyword.

**Description:** Our SNS service enables users to search for posts with multiple keywords. When the user inputs the “search” command along with a set of keywords, the console should display up to 10 posts containing the most number of keywords in descending order of the created date and time.

- The range of the search is the entire posts of all users (NOT friends only) in the \$(DATA\_DIRECTORY).
- The command string starts with "search" followed by keywords.
- Two keywords are separated with space(' '). The newline should not be considered as a keyword.
- Duplicate keywords should be ignored. For example, the output of "search hi hi" should be identical to the output of "search hi".
- You should count the number of occurrences of the **exact** keyword from the title and the content of the post.
- More specific details for the keyword matching:
  - It should be a case-sensitive comparison.
  - You should only count the word that is identical to the provided keyword. You don't need to consider the word that has the given keyword as a substring.
- For example, the input command is "search to to be", and the content of a post "To **be** trusted is a greater compliment than **to be** loved.". Then the keywords are "to" and "be", and the number of occurrences of the keyword from the content is 3.
- How do we decide those posts to show?
  - Sort the candidate posts based on two criteria. First, sort by the number of occurrences of the keywords in descending order. When multiple posts have the same number of occurrences, sort them by the created date and time of the post in descending order (from latest to oldest).
  - Select up to 10 posts from the beginning of the sorted list.
- Print a summary (id, creation date/time, title) of each post in one line in the following format:

#### Console Prompt

Command=**search centavo**

-----  
id: 169, created at: 2001/10/08 00:00:00, title: centavo you you carpellate chives

id: 2, created at: 1977/08/18 00:00:00, title: a damocles why eurypterid you  
-----

**root@sns.com**

post : Post contents

recommend : recommend interesting posts

search <keyword> : List post entries whose contents contain <keyword>

exit : Terminate this program  
-----

Command=

## References: Standard Template Library (STL) for Assignment 6

Consider using the following data structures provided by STL. In particular, refer to the following.

1. `class template <class T> std::vector` in `<vector>` (for assignment 6-1 and 6-2)
  - a. overview: <http://www.cplusplus.com/reference/vector/vector/>
  - b. `void push_back(const T& val)` method
    - i. Add items to the end of the sequence.
    - ii. [https://www.cplusplus.com/reference/vector/vector/push\\_back/](https://www.cplusplus.com/reference/vector/vector/push_back/)
  - c. `iterator begin()` and `iterator end()` methods
    - i. You can iterate the vector with `iterator begin()` and `iterator end()` methods. See an example here:
    - ii. <http://www.cplusplus.com/reference/vector/vector/begin/>
2. `class template <class T> std::unordered_set` in `<unordered_set>` (for assignment 6-1)
  - a. overview: [http://www.cplusplus.com/reference/unordered\\_set/unordered\\_set/](http://www.cplusplus.com/reference/unordered_set/unordered_set/)
  - b. `pair<iterator, bool> insert(const_value_type& val)` method
    - i. Inserts a new element to the `unordered_set`.
    - ii. [https://www.cplusplus.com/reference/unordered\\_set/unordered\\_set/insert/](https://www.cplusplus.com/reference/unordered_set/unordered_set/insert/)
3. `class template <class T> std::priority_queue` in `<queue>` (for assignment 6-2)
  - a. overview: [http://www.cplusplus.com/reference/queue/priority\\_queue/](http://www.cplusplus.com/reference/queue/priority_queue/)
  - b. `void push(const_value_type& val)` method
    - i. Inserts a new element at the end of the `priority_queue`.
    - ii. [http://www.cplusplus.com/reference/queue/priority\\_queue/push/](http://www.cplusplus.com/reference/queue/priority_queue/push/)
  - c. `void pop()` method
    - i. Removes the first element.
    - ii. [http://www.cplusplus.com/reference/queue/priority\\_queue/pop/](http://www.cplusplus.com/reference/queue/priority_queue/pop/)
  - d. `const_reference top()` method
    - i. Returns a reference to the first element.
    - ii. [http://www.cplusplus.com/reference/queue/priority\\_queue/top/](http://www.cplusplus.com/reference/queue/priority_queue/top/)
  - e. `bool empty()` method
    - i. Returns whether the `priority_queue` is empty.
    - ii. [http://www.cplusplus.com/reference/queue/priority\\_queue/empty/](http://www.cplusplus.com/reference/queue/priority_queue/empty/)
4. `function`  
`template <class InputIterator, class T>`  
`InputIterator std::find(InputIterator first, InputIterator last, const T& val)`  
in `<algorithm>` (for assignment 6-2)
  - a. Find the given value in the vector, `unordered_set`, or `priority_queue`.
  - b. <http://www.cplusplus.com/reference/algorithm/find/>