Project Specification - Major Practical

Introduction

Our project is about library systems that we use in real life, such as logging system, borrow-return material (book, e-book and DVD) system and managing library material system for staff. The library system allows the current users (public, staff) log in, log out, borrow materials, return materials and change password. It also allows a new user to make a new account. There are more specific behaviours that the staff is able to access, such as check history and add materials.

Design Description

Assessment Concepts

Memory allocation from stack and the heap

- **Arrays :** we are using a dynamic array for storing the books(DVDs) that the user have borrowed.
- **Vectors :** we are using a vector for storing all the materials(ebooks, books, dvds) and user(public, staff) lists
- **Strings :** material names, author names and user names
- **Objects :** Ebook, book, DVD, public, staff

User Input and Output

- **I/O of different data types :** Command-line.
    - A person enters a number to choose log in types(user, staff or new user) - console displays the possible options that user or staff can select.
    - The user is asked to enter a behaviour number to borrow materials(ebook, book or dvd), return materials or change password - the program displays corresponding outputs.
    - The staff is asked to input a number to choose the opitions of borrowing materials, returning materials, changing password, checking history or adding material – the program prints out the corresponding outputs.

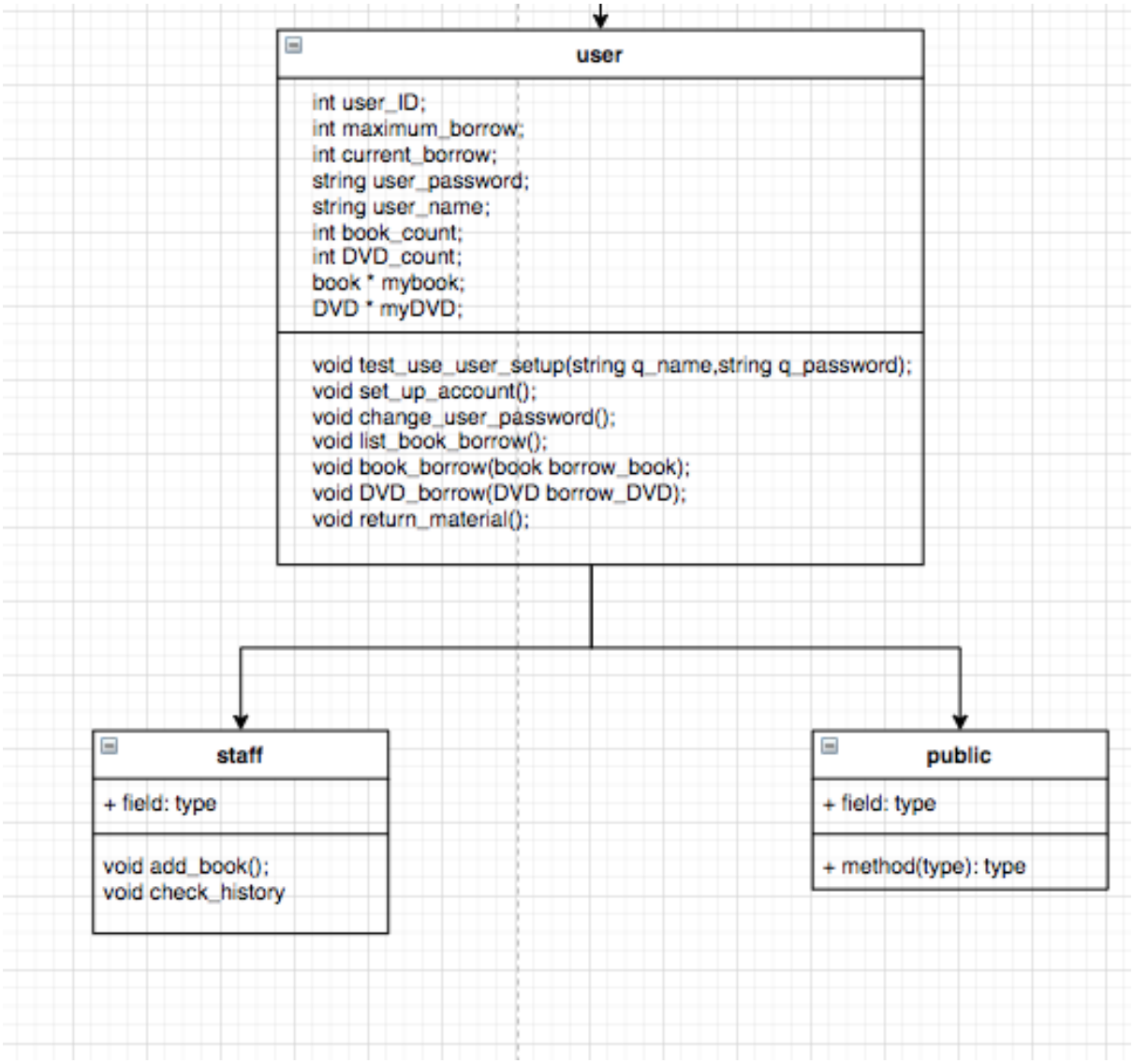
Object-oriented programming and design

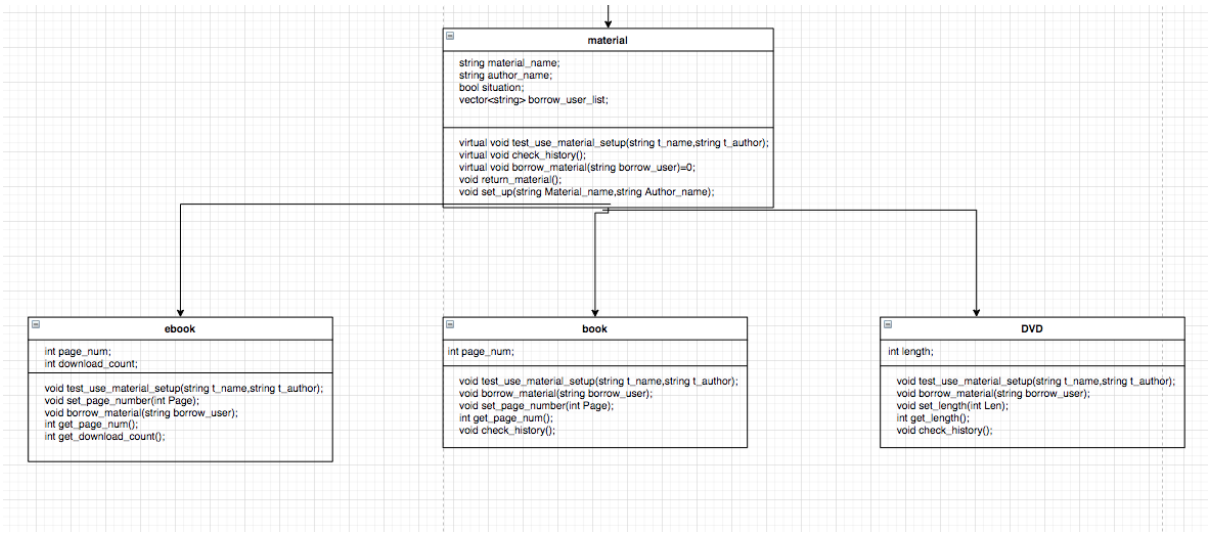
- **Inheritance:**
  - material -parent class / Ebook, book and DVD – child classes
    - There are different types of materials such as Ebook, book and DVD.
    - Each child class (Ebook, book, DVD) inherits from the parent class(material)
    - Each child class has few different behaviours to other child class
  - user(staff and public)
    - There are two types of users such as staff and public
    - Both child classes inherit from parent class(user)
    - Each class has few different behaviours (the staff user can access more library system)

- **Polymorphism:**
  - test_use_material_setup(string t_name, string t_author) function
    - Child classes(Ebook, book and DVD) have the same function for quick setting up the objects but each child class has different implementations
  - check_history() function
    - Child classes(Ebook, book and DVD) have the same function check_history() but the outcomes are different. The check history for book(DVD) prints out the list of people who borrowed the book(DVD) and the check history for ebook prints out the number of ebooks that people have downloaded

- **Abstract classes:**
  - borrow_material(string borrow_user) = 0;
    - Every child class has the function called borrow_material to borrow the material, which has different outcomes.
    - According to ebook function(borrow_material), we are going to count out how many ebooks the user has downloaded. However, the borrow_material function for book and DVD shows the situation of availability of borrowing the book and DVD.
  - add_new_material() = 0;
    - Parent class does not declare the add_new_material function details but every child class (ebook, book, dvd) defines different function details.
    - The add_new_material function for Ebook and book asks user for entering material's name, author's name and page numbers but the add_new_material function for DVD save the information about material's name, author's name and length.

Class Diagram





Class Descriptions

material:

the superclass of all material in the library.(include book, ebook and DVD), contain attribute :

material name
author_name
situation (of available to borrow or not)
vector<string> borrow_user_list (record the name of user who borrow this material)

ebook:

child class of material, one of the material type. contain extra attribute:

download_count (count the time user download this book instead of borrow)
page_num (pages record)

book:

child class of material, one of the material type. contain extra attribute:

page_num

DVD:

child class of material, one of the material type. contain extra attribute:

length (time length of CD);

user:

the superclass of staff. contain attribute

user_ID;
maximum borrow (limit number of book can borrow)
current borrow (count of recent book borrow)
user_password
user_name
book_count & DVD count (use to calculate the user borrow and check it hit the limit.)
mybook, myDVD (array for storing material that user have borrowed)

User Interface

The users (public, staff) is going to input the numbers to choose one of the options using the command-line.

The options that the users can select is like:

What would you like to do today?
1: Borrow material
2: Return material
3. Change current password
4. Check history (only for staff)
5. Add material (only for staff)
6. Delete material (only for staff)

Testing Plan

We are going to compile all the codes through our makefile and for the accuracy, we are going to check our codes through various testing cases, such as unit testing, input/ouput testing, integration testing, boundary testing, automated testing and regression testing.

Unit Testing

We have separate class function files and corresponding test files to check if the individual files can be implemented. When each individual class is tested successfully, we test the main file to see if all files are well compiled and run completely.

- *test_choose_material: material.o choose_material.cpp choose_material_test.cpp*
  g++ material.o choose_material.cpp choose_material_test.cpp -o test_choose_material $(FLAGS)

- *test_log_in: user.o log_in.cpp log_in_test.cpp material.o choose_material.cpp*
  g++ user.o log_in.cpp log_in_test.cpp material.o choose_material.cpp -o test_log_in $(FLAGS)

- *user_unit_testing : material.o user.o user_unit_testing.cpp choose_material.cpp*
  g++ material.o user.o user_unit_testing.cpp choose_material.cpp -o user_unit_testing $(FLAGS)

- *material_unit_testing : material.o user.o material_unit_testing.cpp choose_material.cpp*
  g++ material.o user.o material_unit_testing.cpp choose_material.cpp -o material_unit_testing $(FLAGS)

Input/output testing

Through the input/output testing, we check if the output is equal to the expected output. we have several separate input and expected output files to go through every possible result.

inout_test:

./test < input01.txt | diff - output01.txt
./test < input02.txt | diff - output02.txt
./test < input03.txt | diff - output03.txt
./test < input04.txt | diff - output04.txt
./test < input05.txt | diff - output05.txt
./test < input06.txt | diff - output06.txt
./test < input07.txt | diff - output07.txt
./test < input08.txt | diff - output08.txt
./test < input_user.txt | diff - output_user.txt
./test < input_newuser.txt | diff - output_newuser.txt
./test < input_staff.txt | diff - output_staff.txt
./test < input.txt | diff - output.txt

	input file	functions(input)	output file	expected output
1	input01.txt	user log in quit the system	output01.txt	log in type ID, password initial screen
2	input02.txt	new user log in quit the system	output02.txt	log in type set up ID, name, password log in ID, password initial screen
3	input03.txt	user log in borrow material(book) return material quit the system	output03.txt	log in type log in ID, password options material list borrow(material name, author, page number) return type initial screen
4	input04.txt	user log in change password quit the system	output04.txt	log in type log in ID, password options new password options initial screen
5	input05.txt	user log in	output05.txt	log in type log in ID, password

		borrow material(DVD) check current borrow list quit the system		options borrow(material list) current borrow list initial screen
6	input06.txt	staff log in add material(ebook) add material(book) add material(DVD) quit the system	output06.txt	log in type staff ID, password options add material(name, autor, page number) (ebook, book, DVD) initial screen
7	input07.txt	staff log in borrow material check borrow list return material quit the system	output07.txt	log in type staff ID, password options (borrow)material lists material name, author, page number borrow list return initial screen
8	input08.txt	staff log in change password quit the system	output08.txt	log in type staff ID, password options new password initial screen
9	input_user.txt	every function about user	output_user.txt	every possibility about user
10	input_newuser.txt	every function about new user	output_newuser.txt	every possibility about new user
11	input_staff.txt	every function about staff	output_staff.txt	every possibility about staff
12	input.txt	every function	output.txt	every result

Integration testing

We have a main.cpp file, which integrates all functions together that we have tested in separate test files so far. Through the main file, we do integration testing to see if all files are well compiled and run completely.

- *All: main.cpp material.o user.o log_in.cpp choose_material.cpp user_behavior.cpp list_of_materials.cpp tests*

g++ main.cpp material.cpp user.cpp log_in.cpp choose_material.cpp list_of_materials.cpp user_behavior.cpp -o test $(FLAGS)

- *test_user_setup : material.o user.o user_setup_test.cpp choose_material.cpp*
  g++ material.cpp user.cpp user_setup_test.cpp choose_material.cpp -o test_user_setup $(FLAGS)
- *test_user_borrow_return_test : material.o user.o user_borrow_return_test.cpp choose_material.cpp*
  g++ user.cpp material.cpp user_borrow_return_test.cpp choose_material.cpp -o test_user_borrow_return_test $(FLAGS)
- *test_material : material.o material_test.cpp*
  g++ material.cpp material_test.cpp -o test_material $(FLAGS)
- *test_material_borrow_return_checkhistory : material.o material_borrow_return_checkhistory_test.cpp*
  g++ material.cpp material_borrow_return_checkhistory_test.cpp -o test_material_borrow_return_checkhistory $(FLAGS)
- *test_user_staff : material.o user.o choose_material.cpp user_staff_test.cpp*
  g++ material.cpp user.cpp choose_material.cpp user_staff_test.cpp -o test_user_staff $(FLAGS)

Boundary Testing

We check not only the boundary of every possible range but also upper and lower limits of the range of inputting data which should be accepted in the system. We also test invalid data that the program should not accept.

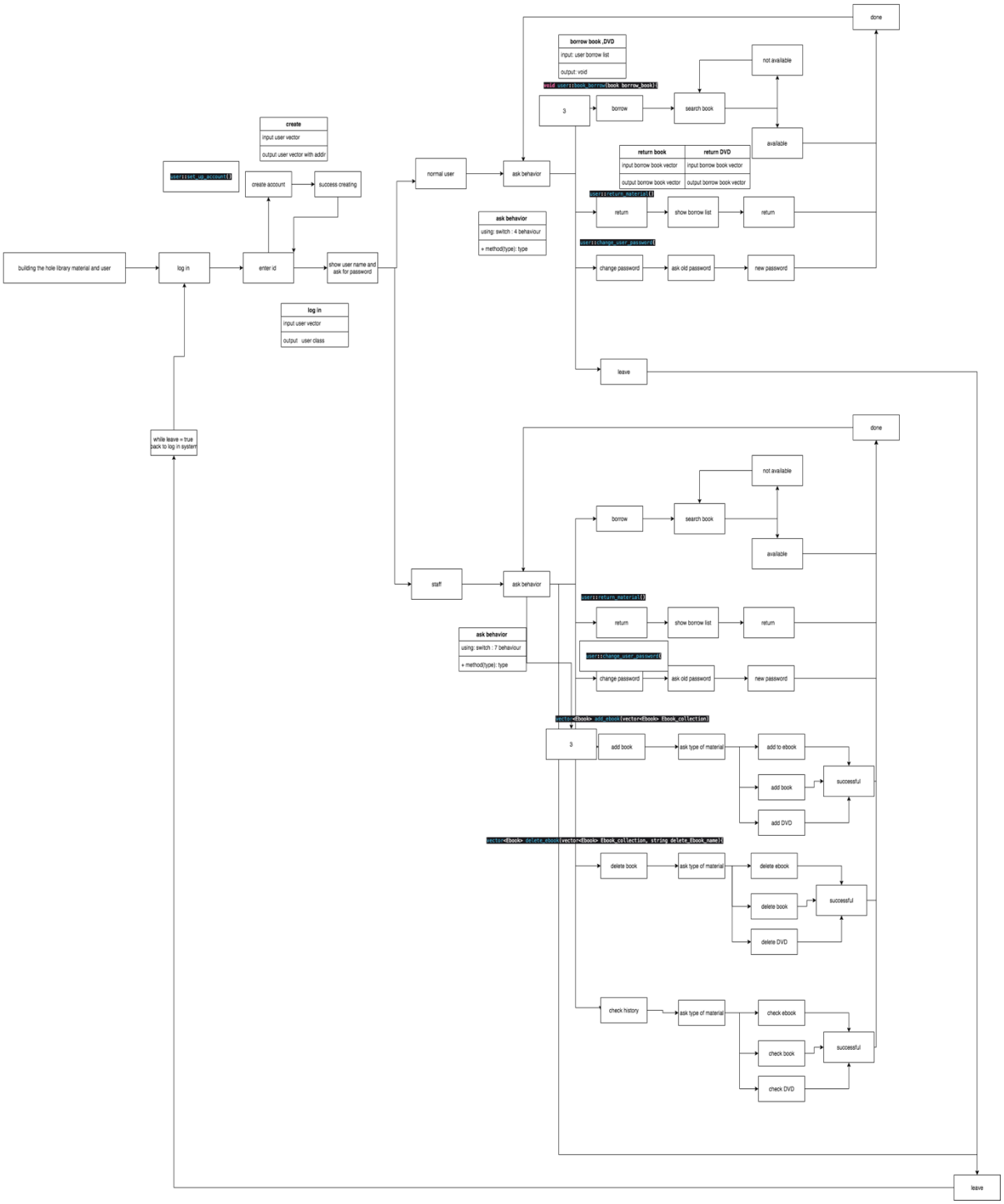
1. while(user_choose<1 || user_choose>4)
➔ let the users know that they are out of the range they can choose and ask them to enter the number again
2. when the user input the wrong ID and the wrong password
➔ inform them of wrong valid number and ask them to enter valid number again
3. when the user enters the material code that is out of the range
➔ let them know they input wrong number and ask them re-enter valid number
4. when the staff adds material and enters the number (less than 1 and greater than 3)
➔ going back to the previous screen so that they can choose the number again

Automated Testing

We have a makefile to check every file automatically and through the input/output testing, we do automated check of comparing the actual outcomes with the predicted outcomes.

Regression Testing

Whenever we changed the code or added the code, we checked if the code changes affected existing code and the program still performs after a change.


done
borrow book ,DVD
input: user borrow list
output: void
not available
void user::book_borrow(book borrow_book)
3
borrow
search book
available
create
input user vector
output user vector with addr
return book
input borrow book vector
output borrow book vector
return DVD
input borrow book vector
output borrow book vector
user::set_up_account()
create account
success creating
normal user
ask behavior
user::return_material()
return
show borrow list
return
ask behavior
using: switch : 4 behaviour
+ method(type): type
user::change_user_password()
change password
ask old password
new password
building the hole library material and user
log in
enter id
show user name and ask for password
leave
log in
input user vector
output user class
while leave = true back to log in system
done
not available
borrow
search book
available
staff
ask behavior
user::return_material()
return
show borrow list
return
ask behavior
using: switch : 7 behaviour
+ method(type): type
user::change_user_password()
change password
ask old password
new password
vector<Ebook> add_ebook(vector<Ebook> Ebook_collection)
3
add book
ask type of material
add to ebook
add book
add DVD
successful
vector<Ebook> delete_ebook(vector<Ebook> Ebook_collection, string delete_Ebook_name)
delete book
ask type of material
delete ebook
delete book
delete DVD
successful
check history
ask type of material
check ebook
check book
check DVD
successful
leave

Schedule Plan

Stretch Goals

Our goal is to make a diagram to check if we satisfy all the rubrics and write down the pseudo codes for every class and functions. When we satisfy the requirements, we are going to expand our idea.

week 8	- Write down the diagram - *Waitong* - Make a group and create SVN – *Hyun Ji* - make our plan – Waitong, Hyun Ji
break	- organise the group works – *Waitong, Hyun Ji* - separate the classes and write some codes - *Waitong* - write down separate codes(class, function) - *Waitong* ✓ material.h / material.cpp ✓ user.h / user.cpp ✓ add_material_function_list.cpp - write down separate corresponding test files– *Waitong*, *Hyun Ji* ✓ add_material_test.cpp ✓ borrow_return_DVD_test.cpp ✓ borrow_return_book_test.cpp
week 9	- write down project plan – *Waitong, Hyun Ji* - write down separate codes(class, function) - *Waitong* ✓ log-in.cpp ✓ add_material_function_list.cpp ✓ user_behaviour.cpp - write down separate corresponding test files and check if the individual files are run properly – *Waitong*, *Hyun Ji* ✓ material_test.cpp ✓ user_borrow_return_test.cpp ✓ user_setup_test.cpp ✓ log_in_test.cpp - write makefile - Waitong - testing
week 10	- edit project plan – *Hyun Ji* - write down separate codes(class, function) - *Waitong* ✓ choose_material.cpp - write down separate corresponding test files– *Waitong*, *Hyun Ji* ✓ material_borrow_return_checkhistory_test.cpp ✓ user_staff_test.cpp ✓ choose_material_test.cpp - write down the main file combining all the codes – *Waitong* ✓ main.cpp - correcting the codes and debug – *Waitong, Hyun Ji* - write makefile – *Waitong, Hyun Ji*

week 11	- correcting the codes and debug – *Waitong* - fixing some problems that we made in week 10 –*Hyun Ji* - testing final main file – *Waitong, Hyun Ji* - write makefile – *Waitong, Hyun Ji* - write down specific testing files - *Waitong, Hyun Ji*