1. Architecture:

   -Used CORBA and Java IDL between servers and clients, and TCP between servers.

   Used data structure to represent book and ID.

2. Test Scenarios:

   Starts three servers and let MCGM1000, CONU5000, MCGU6000 and MONU7000 log in. Three libraries initially keep some books shown as follow:

   ```
   CON6231, Distributed System Design, 4
   CON6421, Compiler Design, 2
   CON6521, Advanced Database Technology and Applications, 10
   CON6651, Algorithm Design Techniques, 7

   MCG6231, Distributed System Design, 2
   MCG6521, Advanced Database Technology and Applications, 3

   MON6231, Distributed System Design, 5
   MON6521, Advanced Database Technology and Applications, 1
   MON6651, Algorithm Design Techniques, 4
   ```

   2.1 Test login

   -Invalid manager or user ID try to log in to the system.

   -Logins of the manager and three users.

   2.2 Test adding function of managers.

   -MCGM1000 adds a book with invalid ID. (CON6231, Distributed System Design, 2).

   -MCGM1000 adds 5 of MCG6521.

   -MCGM1000 adds a new book (MCG6651, Algorithm Design Techniques) with quantity of 3.

   2.3 Test list function of managers.

   MCGM1000 lists all books in the library.

   2.4 Test find function of users

   MCGU6000 finds "Distributed System Design".

   2.5 Test borrow function and waiting list feature of users.

   MCGU6000 borrows MCG6231 for 10 days.

   CONU5000 borrows MCG6231 for 10 days.

   MONU7000 borrows MCG6231 but adds in the waiting list.

   2.6 Test return function of users.

   MCGU6000 returns MCG6231.

   MONU7000 returns MCG6231.

   CONU5000 returns MCG6231.

MCGU6000 returns MCG6231 but fails.

MCGU6000 borrows MCG0000 but fails.

2.7 Test remove function of managers

MCGM1000 removes 1 of MCG6231.

MCGM1000 removes all of MCG6651.

MCGM1000 removes an invalid book MCG0000 but fails.

2.8 Test a manager adding quantity of a book which holds a waiting list.

MCGU6000 borrows MCG6231 for 10 days.

CONU5000 borrows MCG6231 but adds in the waiting list.

MONU7000 borrows MCG6231 but adds in the waiting list.

MONU7000 returns MCG6231 but fails.

CONU5000 returns MCG6231 but fails.

MCGM1000 adds 3 of MCG6231.

CONU5000 returns MCG6231.

MONU7000 returns MCG6231.

MCGM1000 lists all books.

2.9 Test the manager removes invalid number of book.

MCGM1000 removes 4 of MCG6231 but fails.

2.10   Test the manager removes all of a book that some of it have been borrowed.

MCGU6000 borrows MCG6231.

MONU7000 borrows MCG6231.

MONU7000 returns MCG6231.

MCGM1000 removes all of MCG6231.

MCGU6000 returns MCG6231 but fails

2.11   Test a user tries to borrow an invalid book.

MCGU6000 borrows MCG6231 but fails.

2.12   Test exchange book

MCGU6000 borrows MCG6521.

MCGU6000 exchanges MCG6521 for CON6421.

MCGM1000 removes 8 of MCG6521 and its quantity is 0 now.

MCGU6000 exchange CON6421 for MCG6521 but fails.

MCGM1000 adds 1 of MCG6521.

MCGU6000 exchange CON6421 for MCG6521.

MCGM1000 removes all of MCG6521.

MCGU6000 exchanges MCG6521 for CON6231 but fails.

2.13   Test logout

CONU5000 logs out from the system.
MCGU6000 logs out from the system.
MONU7000 logs out from the system.
MCGM1000 logs out from the system.

3. Difficulties in the assignment
   I think the most important and difficult part is setting CORBA running
   environment and start it. I spent a lot of time to make it work.