COMP6231 Assignment 1

Distributed Appointment Management System using Java RMI

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1. Overview

The Distributed Appointment Management System (DAMS) is a distributed system for health care; It is used by an admin of the hospitals who manages the information about the medical appointments and patients to book or cancel a medical appointment across three different hospitals Montreal (MTL), Sherbrooke (SHE), and Quebec (QUE) within a system.

Hospital admins and patients are uniquely identified by the admin id (e.g., MTLA0000) and patient id (QUEP2981) respectively. There are 3 types of appointment types for which slots can be created by the admin: Physician, Surgeon, Dental. There are three-time slots are available for each appointment type in a day. Each appointment type is a combination of city, appointment slot, and date.

Each server maintains its database using the HashMap. Client and Server are communicating using the Java RMI connection. While inter-server communication is done by the UDP communication. Each server maintains a log file for all the operations performed by the server. Also, for each patient and admin client log file is maintained.

To make the system more robust, inter-server communication is done using the thread. Since there are multiple users are accessing the server concurrently, the proper synchronization of data is implemented in the code. All the user inputs are case insensitive.

A. Tools

- Java IDE Eclipse
- Java JDK version 11

2. Create & Run System in Eclipse

To create a Distributed system there are 4 steps.

a. Create a Server Interface (HospitalServerInterface.java) by extending Remote interface
b. Implement a Server Interface (MTLHospitalServer.java, QUEHospitalServer.java, SHEHospitalServer.java) by extending UnicastRemoteObject class
c. Create a Server application (MontrealServer.java, QuebecServer.java, SherbrookeServer.java)
d. Create a client application (AdminClient.java, PatientClient.java)

Run command of Server files

```
java MontrealServer
java SherbrookeServer
java QuebecServer
```

Run command of AdminClient.java file

```
java AdminClient <AdminId>
```

Run command of PatientClient.java file

```
java PatientClient <PatientId>
```

Order to run the system

- Start Montreal, Sherbrooke, and Quebec server in any order
- Start either AdminClient or PatientClient based on requirements.

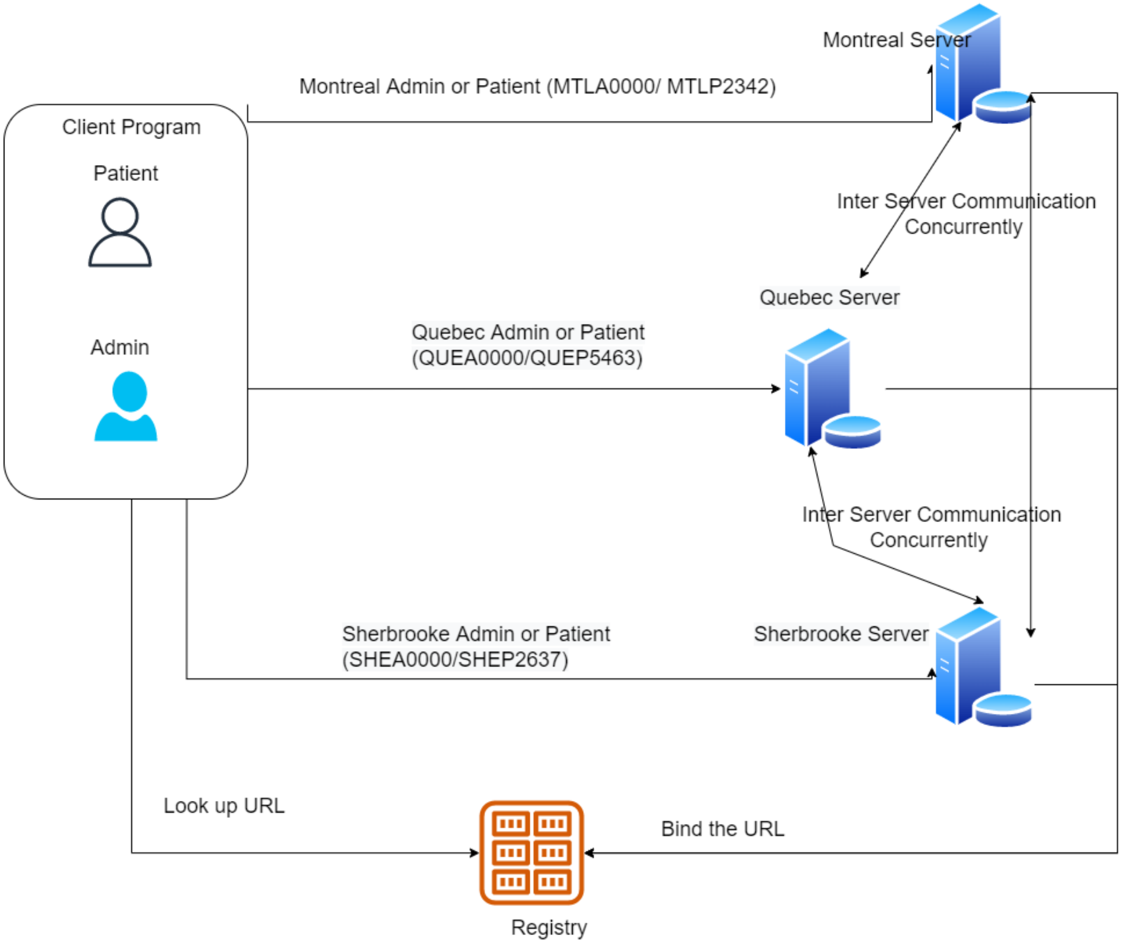
3. Architecture

There are three different servers MTL, QUE, and SHE. When all these servers are started, all the servers start their own UDP servers for communicating with the patient-client and server client. These servers are running all the time to listen to requests from clients.

Depending on the client ID of the patient or admin, the client system will connect you to the respective server, and then after, based on the type of client either patient or admin, the client system will give you an option to perform several options.

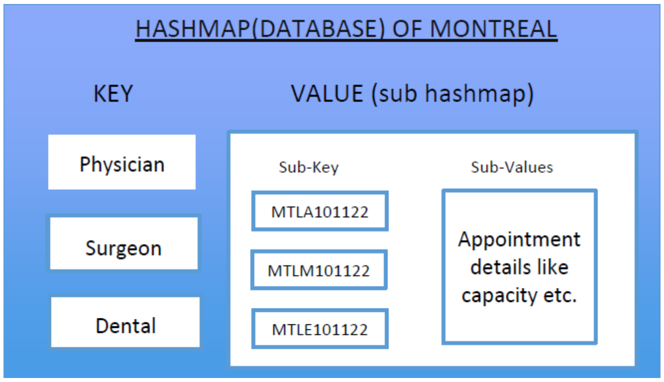
A client only communicates with their corresponding server. But there are multiple options (list appointment availability, book appointment, get schedule appointment of a patient) which have required to communicate with the other servers. This communication is done by the UDP socket communication. The client-server makes a UDP request to other servers concurrently and it will get the response from the other servers, and it is returned to the client.

A. Architecture Diagram

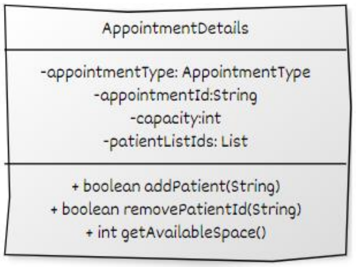

Montreal Server
Montreal Admin or Patient (MTLA0000/ MTLP2342)
Client Program
Patient
Admin
Inter Server Communication Concurrently
Quebec Server
Quebec Admin or Patient (QUEA0000/QUEP5463)
Inter Server Communication Concurrently
Sherbrooke Admin or Patient (SHEA0000/SHEP2637)
Sherbrooke Server
Look up URL
Bind the URL
Registry

4. Features

A. Server Database: each server has its own database, and it is implemented using HashMap.

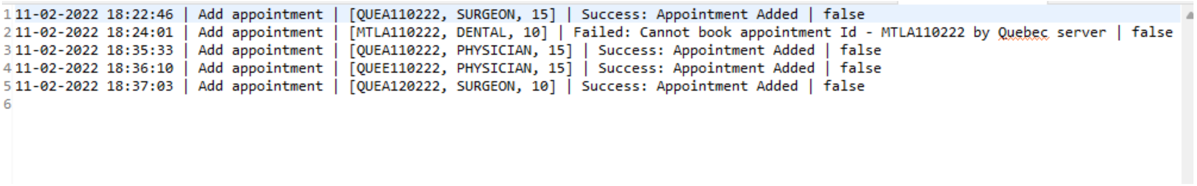


B. Appointment Details are maintained by AppointmentDetails class object which has details of type of appointment, appointment id, capacity and list of patient id who has booked the slot.


AppointmentDetails
-appointmentType: AppointmentType
-appointmentId:String
-capacity:int
-patientListIds: List
+ boolean addPatient(String)
+ boolean removePatientId(String)
+ int getAvailableSpace()

C. Log has been implemented to track all the activities on each server as well as for each admin and patient who use the system.

Format of the log:
Request Date Time | Request Type | Request Parameters | Server Response | Status of Completion



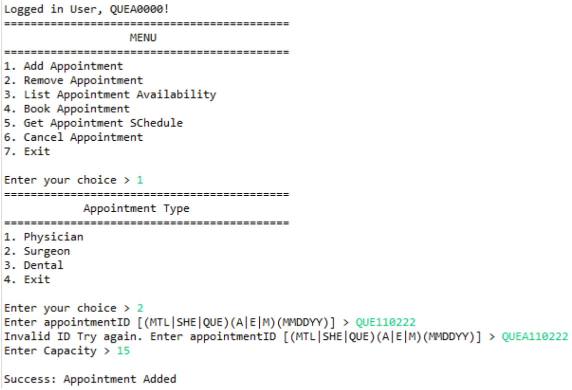
```
11-02-2022 18:22:46 | Add appointment | [QUEA110222, SURGEON, 15] | Success: Appointment Added | false
11-02-2022 18:24:01 | Add appointment | [MTLA110222, DENTAL, 10] | Failed: Cannot book appointment Id - MTLA110222 by Quebec server | false
11-02-2022 18:35:33 | Add appointment | [QUEA110222, PHYSICIAN, 15] | Success: Appointment Added | false
11-02-2022 18:36:10 | Add appointment | [QUEE110222, PHYSICIAN, 15] | Success: Appointment Added | false
11-02-2022 18:37:03 | Add appointment | [QUEA120222, SURGEON, 10] | Success: Appointment Added | false
```

5. Test Case

Already Added Test Data

Server Name	Appointment Type	Appointment ID	Patient List
Montreal	Physician	MTLA030222	**MTLP2345, QUEP5465**
		MTLE030222	**MTLP1245, MTLP2463, MTLP9875**
		MTLM010222	**MTLP2345, MTLP9875, MTLP3246**
	Dental	**MTLM030222**	**MTLP2345, MTLP3246**
		MTLE030222	**MTLP2345**
		MTLA010222	**MTLP3246, MTLP1245, MTLP2463, MTLP5465**
		MTLA020222	**MTLP2345, MTLP5465**
	Surgeon	**MTLA030222**	**MTLP1245, MTLP2463**
		MTLM030222	**MTLP3246, MTLP9875**
Quebec	**Physician**	**QUEA040222**	**MTLP2345, QUEP5465**
	Dental	**QUEA010222**	**QUEP5465**
		QUEA020222	**QUEP5465**
Sherbrooke	**Physician**	**SHEE080222**	**MTLP2345, SHEP5565, SHEP2475**
	Dental	**SHEA050222**	**SHEP5565, SHEP2475**
	Surgeon	**SHEE070222**	**MTLP2345, SHEP5565, SHEP2475**

A. Add appointment

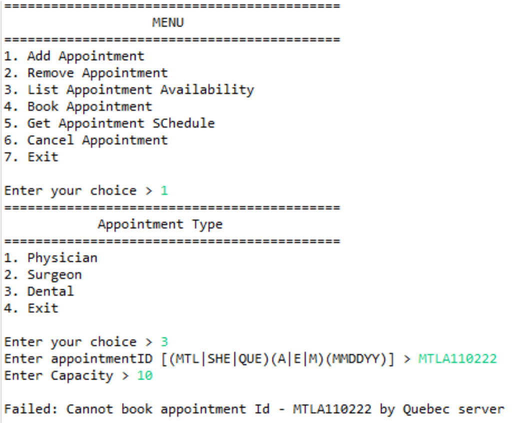


```
Logged in User, QUEA0000!
============================================
                   MENU
============================================
1. Add Appointment
2. Remove Appointment
3. List Appointment Availability
4. Book Appointment
5. Get Appointment SChedule
6. Cancel Appointment
7. Exit

Enter your choice > 1
============================================
            Appointment Type
============================================
1. Physician
2. Surgeon
3. Dental
4. Exit

Enter your choice > 2
Enter appointmentID [(MTL|SHE|QUE)(A|E|M)(MMDDYY)] > QUE110222
Invalid ID Try again. Enter appointmentID [(MTL|SHE|QUE)(A|E|M)(MMDDYY)] > QUEA110222
Enter Capacity > 15

Success: Appointment Added
```

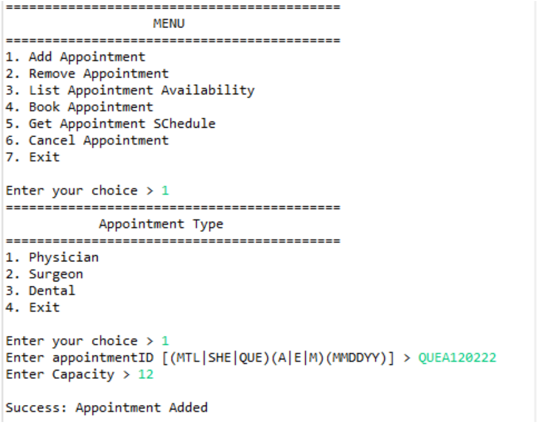


```
============================================
                   MENU
============================================
1. Add Appointment
2. Remove Appointment
3. List Appointment Availability
4. Book Appointment
5. Get Appointment SChedule
6. Cancel Appointment
7. Exit

Enter your choice > 1
============================================
            Appointment Type
============================================
1. Physician
2. Surgeon
3. Dental
4. Exit

Enter your choice > 3
Enter appointmentID [(MTL|SHE|QUE)(A|E|M)(MMDDYY)] > MTLA110222
Enter Capacity > 10

Failed: Cannot book appointment Id - MTLA110222 by Quebec server
```



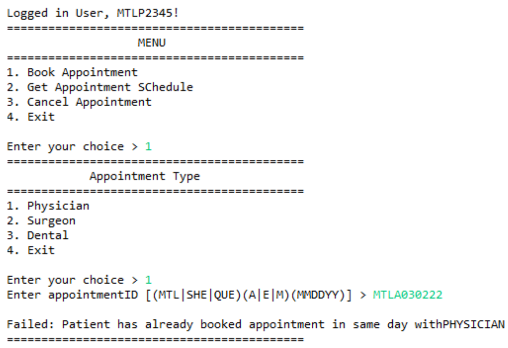
```
============================================
                   MENU
============================================
1. Add Appointment
2. Remove Appointment
3. List Appointment Availability
4. Book Appointment
5. Get Appointment SChedule
6. Cancel Appointment
7. Exit

Enter your choice > 1
============================================
            Appointment Type
============================================
1. Physician
2. Surgeon
3. Dental
4. Exit

Enter your choice > 1
Enter appointmentID [(MTL|SHE|QUE)(A|E|M)(MMDDYY)] > QUEA120222
Enter Capacity > 12

Success: Appointment Added
```

B. Book appointment

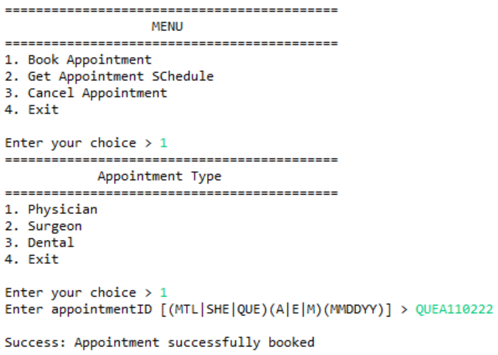


```
Logged in User, MTLP2345!
===========================================
                   MENU
===========================================
1. Book Appointment
2. Get Appointment SChedule
3. Cancel Appointment
4. Exit

Enter your choice > 1
===========================================
            Appointment Type
===========================================
1. Physician
2. Surgeon
3. Dental
4. Exit

Enter your choice > 1
Enter appointmentID [(MTL|SHE|QUE)(A|E|M)(MMDDYY)] > MTLA030222

Failed: Patient has already booked appointment in same day withPHYSICIAN
===========================================
```

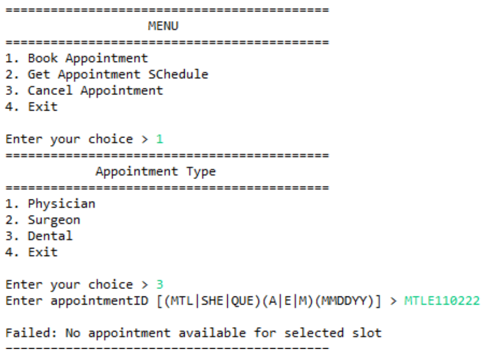


```
===========================================
                   MENU
===========================================
1. Book Appointment
2. Get Appointment SChedule
3. Cancel Appointment
4. Exit

Enter your choice > 1
===========================================
            Appointment Type
===========================================
1. Physician
2. Surgeon
3. Dental
4. Exit

Enter your choice > 1
Enter appointmentID [(MTL|SHE|QUE)(A|E|M)(MMDDYY)] > QUEA110222

Success: Appointment successfully booked
```

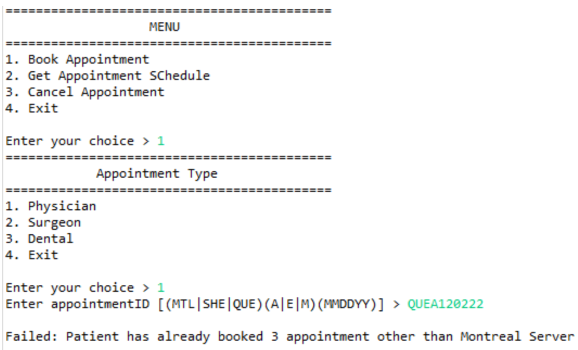


```
===========================================
                   MENU
===========================================
1. Book Appointment
2. Get Appointment SChedule
3. Cancel Appointment
4. Exit

Enter your choice > 1
===========================================
            Appointment Type
===========================================
1. Physician
2. Surgeon
3. Dental
4. Exit

Enter your choice > 3
Enter appointmentID [(MTL|SHE|QUE)(A|E|M)(MMDDYY)] > MTLE110222

Failed: No appointment available for selected slot
-------------------------------------------
```



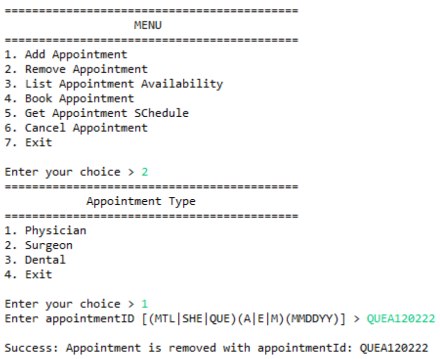
```
===========================================
                   MENU
===========================================
1. Book Appointment
2. Get Appointment SChedule
3. Cancel Appointment
4. Exit

Enter your choice > 1
===========================================
            Appointment Type
===========================================
1. Physician
2. Surgeon
3. Dental
4. Exit

Enter your choice > 1
Enter appointmentID [(MTL|SHE|QUE)(A|E|M)(MMDDYY)] > QUEA120222

Failed: Patient has already booked 3 appointment other than Montreal Server
```

C. Remove appointment

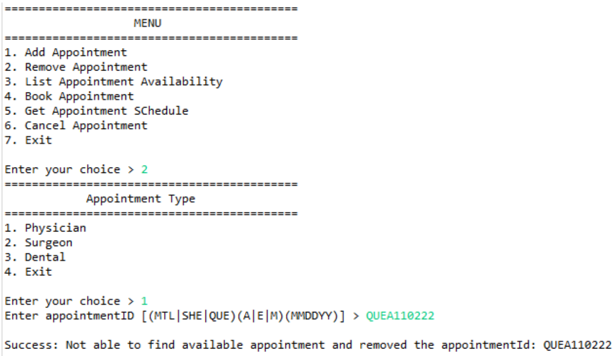


```
===========================================
                   MENU
===========================================
1. Add Appointment
2. Remove Appointment
3. List Appointment Availability
4. Book Appointment
5. Get Appointment SChedule
6. Cancel Appointment
7. Exit

Enter your choice > 2
===========================================
            Appointment Type
===========================================
1. Physician
2. Surgeon
3. Dental
4. Exit

Enter your choice > 1
Enter appointmentID [(MTL|SHE|QUE)(A|E|M)(MMDDYY)] > QUEA120222

Success: Appointment is removed with appointmentId: QUEA120222
```

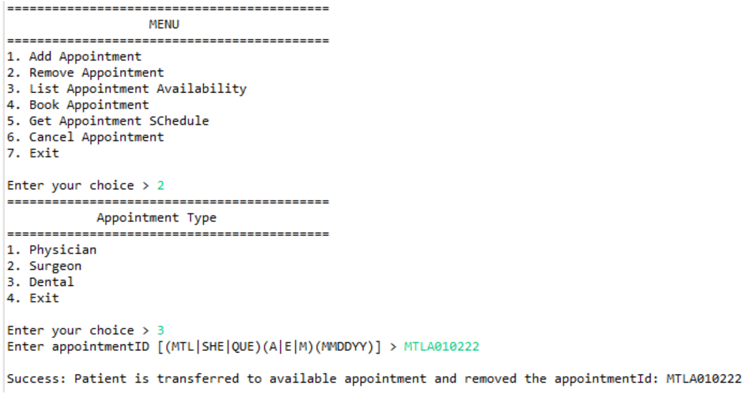


```
===========================================
                   MENU
===========================================
1. Add Appointment
2. Remove Appointment
3. List Appointment Availability
4. Book Appointment
5. Get Appointment SChedule
6. Cancel Appointment
7. Exit

Enter your choice > 2
===========================================
            Appointment Type
===========================================
1. Physician
2. Surgeon
3. Dental
4. Exit

Enter your choice > 1
Enter appointmentID [(MTL|SHE|QUE)(A|E|M)(MMDDYY)] > QUEA110222

Success: Not able to find available appointment and removed the appointmentId: QUEA110222
```



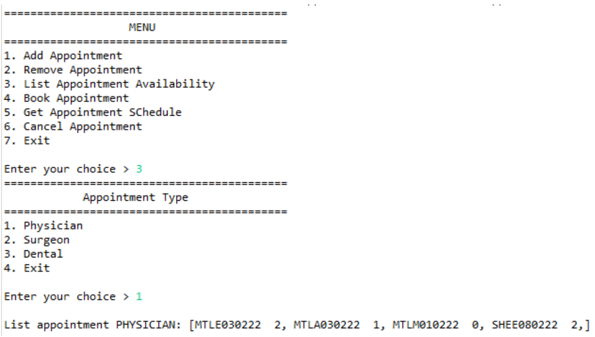
```
===========================================
                   MENU
===========================================
1. Add Appointment
2. Remove Appointment
3. List Appointment Availability
4. Book Appointment
5. Get Appointment SChedule
6. Cancel Appointment
7. Exit

Enter your choice > 2
===========================================
            Appointment Type
===========================================
1. Physician
2. Surgeon
3. Dental
4. Exit

Enter your choice > 3
Enter appointmentID [(MTL|SHE|QUE)(A|E|M)(MMDDYY)] > MTLA010222

Success: Patient is transferred to available appointment and removed the appointmentId: MTLA010222
```

D. List Appointment

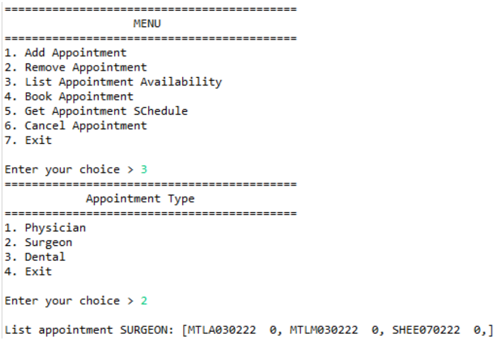


```
============================================
                   MENU
============================================
1. Add Appointment
2. Remove Appointment
3. List Appointment Availability
4. Book Appointment
5. Get Appointment SChedule
6. Cancel Appointment
7. Exit

Enter your choice > 3
============================================
            Appointment Type
============================================
1. Physician
2. Surgeon
3. Dental
4. Exit

Enter your choice > 1

List appointment PHYSICIAN: [MTLE030222  2, MTLA030222  1, MTLM010222  0, SHEE080222  2,]
```



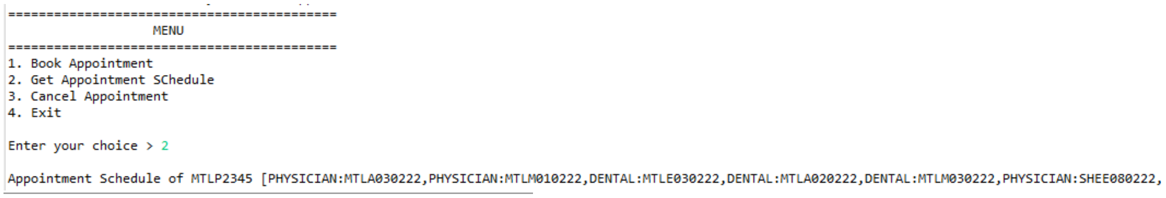
```
============================================
                   MENU
============================================
1. Add Appointment
2. Remove Appointment
3. List Appointment Availability
4. Book Appointment
5. Get Appointment SChedule
6. Cancel Appointment
7. Exit

Enter your choice > 3
============================================
            Appointment Type
============================================
1. Physician
2. Surgeon
3. Dental
4. Exit

Enter your choice > 2

List appointment SURGEON: [MTLA030222  0, MTLM030222  0, SHEE070222  0,]
```

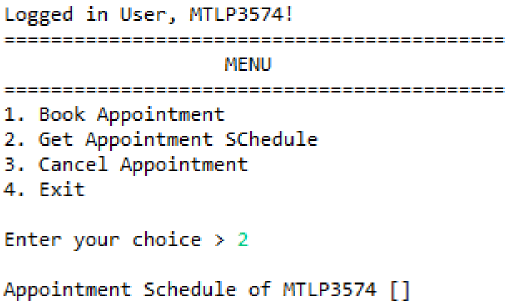
E. Get appointment Schedule



```
============================================
                   MENU
============================================
1. Book Appointment
2. Get Appointment SChedule
3. Cancel Appointment
4. Exit

Enter your choice > 2

Appointment Schedule of MTLP2345 [PHYSICIAN:MTLA030222,PHYSICIAN:MTLM010222,DENTAL:MTLE030222,DENTAL:MTLA020222,DENTAL:MTLM030222,PHYSICIAN:SHEE080222,
```

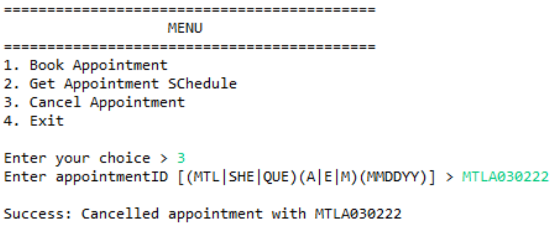


```
Logged in User, MTLP3574!
============================================
                   MENU
============================================
1. Book Appointment
2. Get Appointment SChedule
3. Cancel Appointment
4. Exit

Enter your choice > 2

Appointment Schedule of MTLP3574 []
```

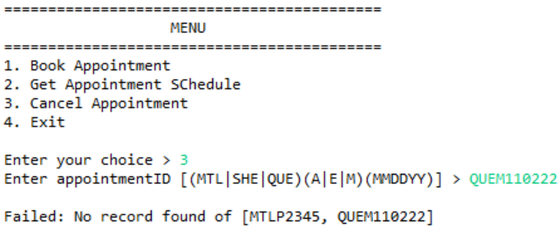
F. Cancel Appointment



```
============================================
                   MENU
============================================
1. Book Appointment
2. Get Appointment SChedule
3. Cancel Appointment
4. Exit

Enter your choice > 3
Enter appointmentID [(MTL|SHE|QUE)(A|E|M)(MMDDYY)] > MTLA030222

Success: Cancelled appointment with MTLA030222
```



```
============================================
                   MENU
============================================
1. Book Appointment
2. Get Appointment SChedule
3. Cancel Appointment
4. Exit

Enter your choice > 3
Enter appointmentID [(MTL|SHE|QUE)(A|E|M)(MMDDYY)] > QUEM110222

Failed: No record found of [MTLP2345, QUEM110222]
```

6. References

A. https://www.javatpoint.com/RMI
B. https://www.baeldung.com/udp-in-java
C. https://www.w3schools.com/java/java_threads.asp