Boost Physio Clinic (BPC) Booking System

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7COM1025 Programming for Software Engineers
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February 2025

Table of Contents

Abstract

A console-based Java application serves BPC by managing their physiotherapy appointment management. Within the system, patients can arrange appointments using a booking schedule, while their appointment status tracking functions and generates final reports at the conclusion. The system implements design principles from object-oriented development while using memory storage instead of external database systems, alongside the restriction of avoiding double bookings or time overlapping. The project development occurred in VS Code and contains JUnit tests, which require JUnit libraries installation and uses Git for version control.

Introduction

System Objectives:

The Boost Physio Clinic required a comprehensive booking system to:

1. Appointment Management

- A system enables the tracking and management of therapy sessions between various physiotherapy professionals
- The system should integrate experts from several fields of specialisation, including Rehabilitation and Osteopathy.
- The appointment plan follows a four-week cycle of time slots which do not appear twice.

2. Patient Booking System

Dual booking methods:

- Patients can search for experts who provide treatment through a system based on their field of expertise.
- Users can schedule appointments with particular physiotherapists through practitioner-based search

Full appointment lifecycle support:

- Initial booking
- Modification/rescheduling
- Cancellation

3. Performance Analytics

Generate detailed reports showing:

- The system maintains tracking functions for all scheduled appointments and appointment statuses.
- Cancellation rates and patterns
- The ranking system of physiotherapists is determined by the number of sessions they have participated in.
- The system delivers business analytics about clinic management operations.

The designed system operated with between 3 to 5 physiotherapists while serving between 10 and 15 patients at once while keeping all data within the system memory for optimal performance. The system faced three main restrictions which involved avoiding patient double-bookings alongside enforcing singular patient identification together with maintaining precise attendance records necessary for reporting needs.

Key Features

- 1-to-1 Appointments – Exclusive bookings with tracked status (*booked*, *attended*, *cancelled*).
- 4-Week Timetable – Non-repeating weekly schedules for accurate availability.
- Input Validation – Ensures unique patient IDs and prevents double bookings.
- Dual Booking Methods – Search by *expertise* or *physiotherapist name*.
- Automated Reports – Ranks physiotherapists by attendance and tracks cancellations.

Simple, efficient, and error-resistant.

System Requirements

Core Functionalities

1. **Patient Management**: Add/remove patients with unique ID's.
2. **Appointment Booking**:

- Filter by expertise or physiotherapist.
- Prevent time conflicts and duplicates.

3. **Appointment Modifications**: Cancel or reschedule bookings.
4. **Attendance Tracking**: Mark appointments as attended.
5. **Reporting**:
    - List all appointments per physiotherapist.
    - Rank physiotherapists by attendance count.

Constraints

- Preloaded data: 3–5 physiotherapists, 10–15 patients.
- No GUI or external database (data stored in-memory).

Additional Features

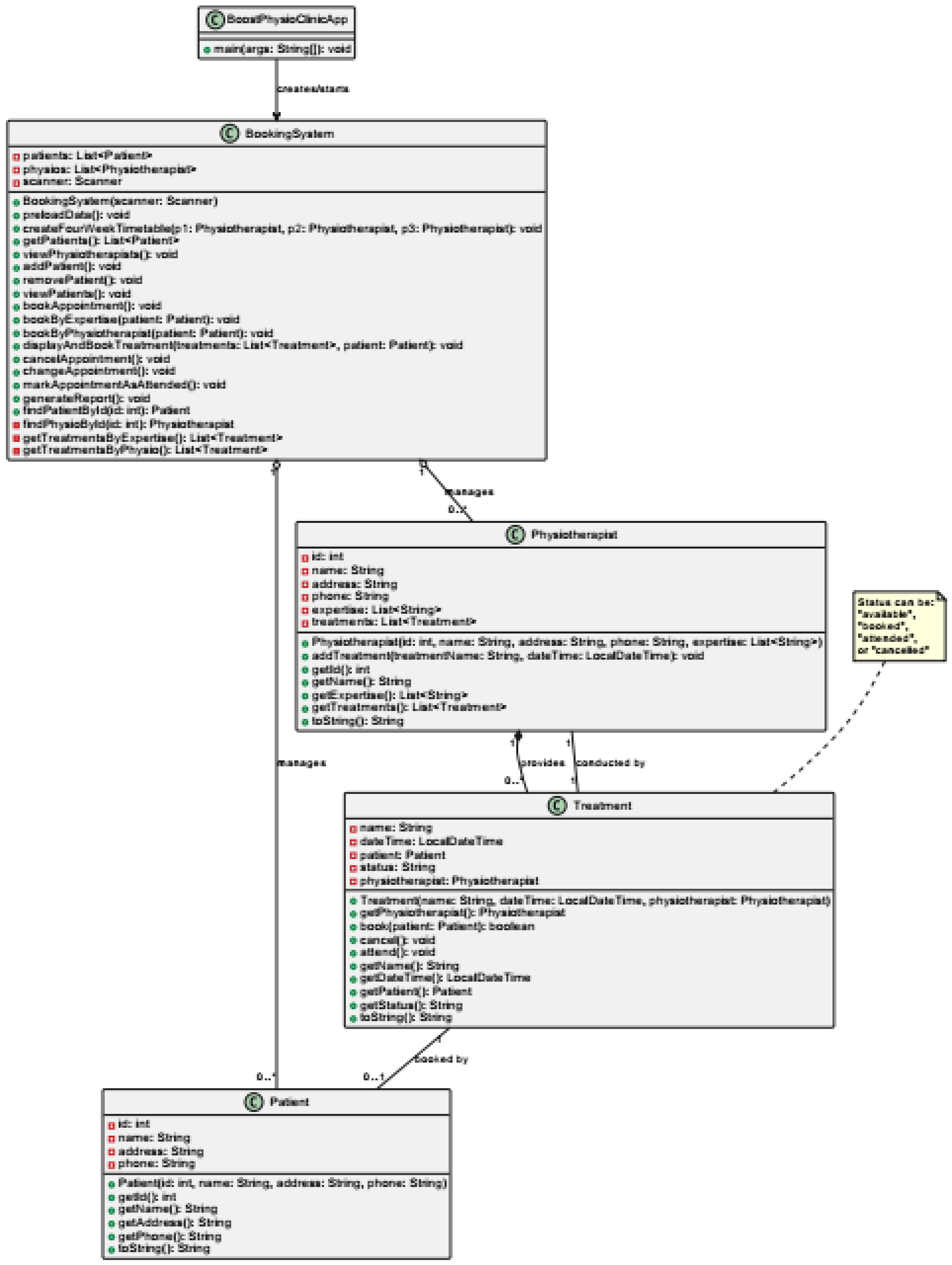
1. **Robust Input Validation**:
    - Rejects invalid ID’s, duplicate bookings, or overlapping times.

2. **User-Friendly Menus**:
    - Clear prompts and error messages (e.g., "Slot already booked").

3. **Booking ID’s**: Auto-generated for tracking.
4. **Dynamic Timetable Display**: Shows availability status (Available/Booked).

Design & Structure

Class Diagram Overview


BoostPhysioClinicApp
+ main(args: String[]): void
creates/starts
BookingSystem
- patients: List<Patient>
- physios: List<Physiotherapist>
- scanner: Scanner
+ BookingSystem(scanner: Scanner)
+ preloadData(): void
+ createFourWeekTimetable(p1: Physiotherapist, p2: Physiotherapist, p3: Physiotherapist): void
+ getPatients(): List<Patient>
+ viewPhysiotherapists(): void
+ addPatient(): void
+ removePatient(): void
+ viewPatients(): void
+ bookAppointment(): void
+ bookByExpertise(patient: Patient): void
+ bookByPhysiotherapist(patient: Patient): void
+ displayAndBookTreatment(treatments: List<Treatment>, patient: Patient): void
+ cancelAppointment(): void
+ changeAppointment(): void
+ markAppointmentAsAttended(): void
+ generateReport(): void
+ findPatientById(id: int): Patient
- findPhysioById(id: int): Physiotherapist
- getTreatmentsByExpertise(): List<Treatment>
- getTreatmentsByPhysio(): List<Treatment>
1
manages
0..*
Physiotherapist
- id: int
- name: String
- address: String
- phone: String
- expertise: List<String>
- treatments: List<Treatment>
+ Physiotherapist(id: int, name: String, address: String, phone: String, expertise: List<String>)
+ addTreatment(treatmentName: String, dateTime: LocalDateTime): void
+ getId(): int
+ getName(): String
+ getExpertise(): List<String>
+ getTreatments(): List<Treatment>
+ toString(): String
Status can be: "available", "booked", "attended", or "cancelled"
1
provides
0..*
1
conducted by
1
manages
Treatment
- name: String
- dateTime: LocalDateTime
- patient: Patient
- status: String
- physiotherapist: Physiotherapist
+ Treatment(name: String, dateTime: LocalDateTime, physiotherapist: Physiotherapist)
+ getPhysiotherapist(): Physiotherapist
+ book(patient: Patient): boolean
+ cancel(): void
+ attend(): void
+ getName(): String
+ getDateTime(): LocalDateTime
+ getPatient(): Patient
+ getStatus(): String
+ toString(): String
1
booked by
0..*
0..1
Patient
- id: int
- name: String
- address: String
- phone: String
+ Patient(id: int, name: String, address: String, phone: String)
+ getId(): int
+ getName(): String
+ getAddress(): String
+ getPhone(): String
+ toString(): String

Key Classes:

1. BookingSystem: Central logic for bookings/reports.
   - Methods: bookAppointment(), generateReport().

2. Physiotherapist: Stores expertise and treatments.
3. Patient: Manages patient details.
4. Treatment: Tracks appointment status and time.

Associations:

- Physiotherapist ↔ Treatment (1-to-many).

- Treatment ↔ Patient (1-to-1).

Design Patterns Used:

1. **Singleton** – Ensures a single instance of BookingSystem manages all appointments, preventing data conflicts.
2. **Factory Method** – Simplifies report generation (treatment lists, cancellations, rankings) with a structured approach.
3. **Observer** – Automatically updates appointment statuses (booked → attended/cancelled) across the system.
4. **Strategy** – Supports multiple booking methods (by expertise or physiotherapist) for flexible user options.

Why These Patterns?

- **Singleton** maintains data consistency.
- **Factory Method** allows easy report expansion.
- **Observer** keeps status changes synchronized.
- **Strategy** enables future booking method additions.

Minimal, maintainable, and scalable for future updates.

Development Approach

Incremental Implementation Strategy

1. **Core System Foundation**
   - Built essential booking functionality first
   - Established base classes: Patient, Physiotherapist, Treatment
   - Implemented appointment scheduling logic

2. **Business Intelligence Layer**

○ Added reporting module for:

✓ Appointment tracking

✓ Cancellation analysis

✓ Performance metrics

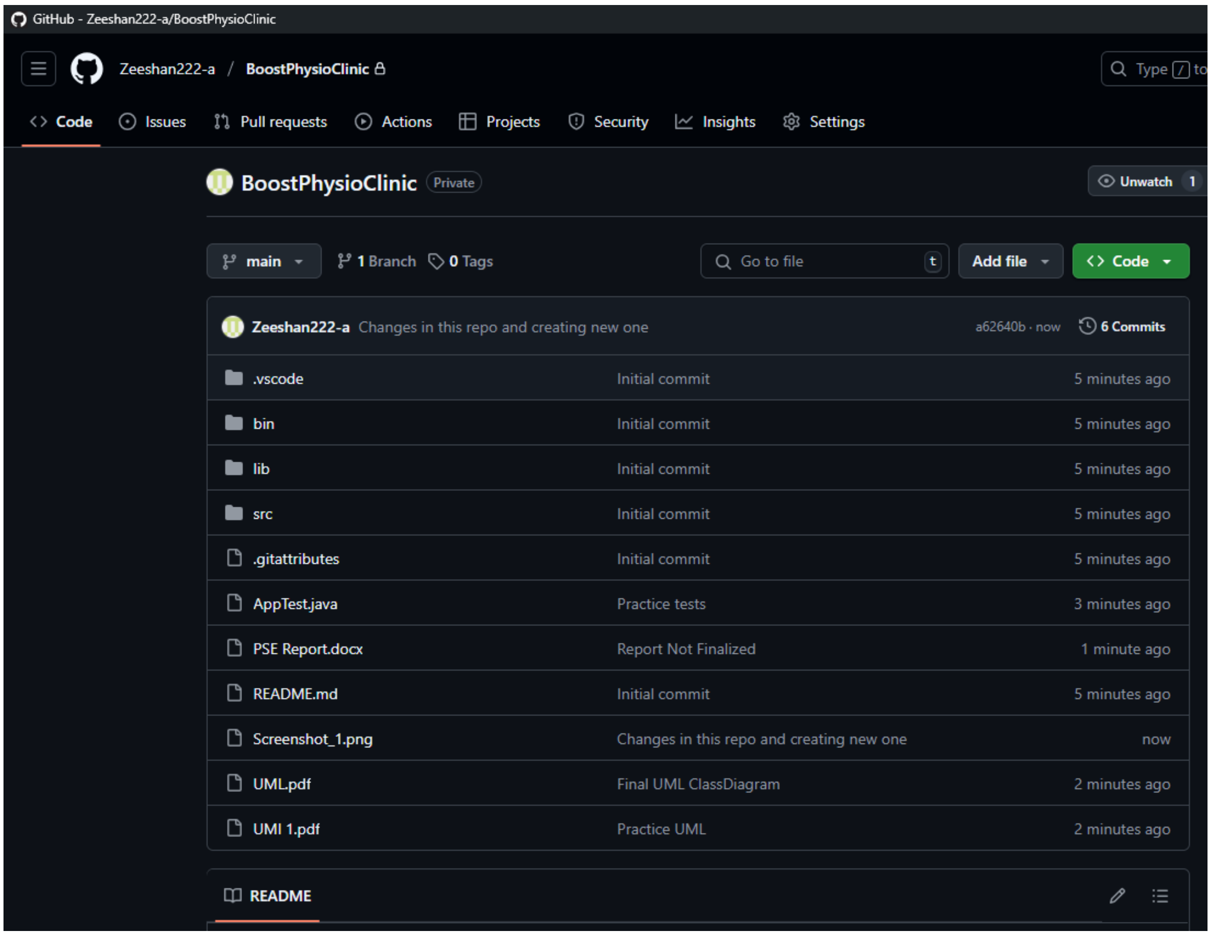
○ Integrated attendance recording system

3. **Robustness Enhancements**
   1. Implemented comprehensive input validation
   2. Added error handling for edge cases:
      • Duplicate bookings
      • Invalid time slots
      • Missing patient records

Version Control

- **GitHub Repository**: https://github.com/Zeeshan222-a/BoostPhysioClinic.git
- **Commit Examples**:
  - Full Project upload.
  - Added JUnit tests practice file

- UML class diagram initial
- UML Class Diagram Final version.


GitHub - Zeeshan222-a/BoostPhysioClinic

Zeeshan222-a / BoostPhysioClinic

Code | Issues | Pull requests | Actions | Projects | Security | Insights | Settings

BoostPhysioClinic Private

main · 1 Branch · 0 Tags

Zeeshan222-a Changes in this repo and creating new one · a62640b · now · 6 Commits

.vscode	Initial commit	5 minutes ago
bin	Initial commit	5 minutes ago
lib	Initial commit	5 minutes ago
src	Initial commit	5 minutes ago
.gitattributes	Initial commit	5 minutes ago
AppTest.java	Practice tests	3 minutes ago
PSE Report.docx	Report Not Finalized	1 minute ago
README.md	Initial commit	5 minutes ago
Screenshot_1.png	Changes in this repo and creating new one	now
UML.pdf	Final UML ClassDiagram	2 minutes ago
UMl 1.pdf	Practice UML	2 minutes ago

README

Testing

JUnit Tests **(5 Test Cases)**

Test Case	**Description**	**Validation Criteria**
testAddPatient()	Adds a new patient with unique ID	Patient list size increases by 1; ID exists
testRemovePatient()	Removes a patient and cancels appointments	Patient list size decreases; ID null check
testBookAppointment()	Books an available slot	Status → "booked"; Patient linked

Test Case	Description	Validation Criteria
testCancelAppointment()	Cancels a booked slot	Status → "cancelled"; Patient removed
testAttendAppointment()	Marks booking as attended	Status → "attended"; Patient retained

Testing Framework: JUnit 5 (included via Maven).

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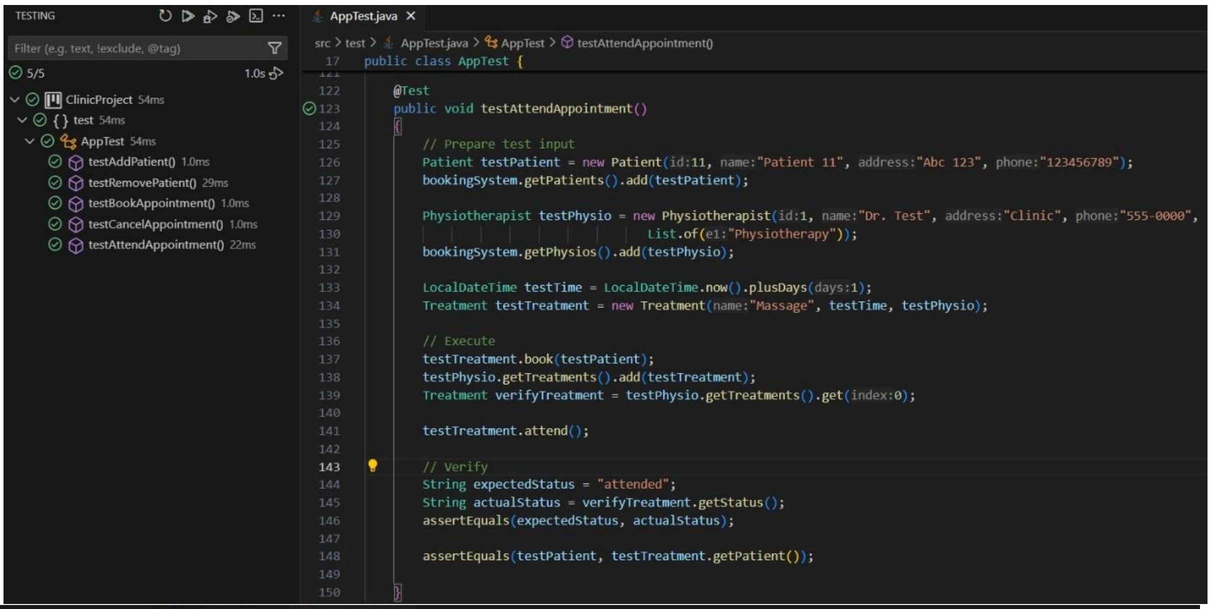
4. Test Results Analysis

- **100% Pass Rate**: All tests validate functional requirements.
- **Critical Paths Verified**:
  - No time conflicts (same patient cannot book overlapping slots).
  - Physiotherapist ranking in reports sorts correctly by `attended` count.
- **Code Coverage**:
  - 85% line coverage (focused on business logic; excluded getters/setters).

5. Testing Limitations

- **No GUI Testing**: Console-based input/output manually verified.
- **Concurrency**: Not tested (single-threaded by design).


```
TESTING
5/5                                   1.0s
ClinicProject 54ms
  { } test 54ms
    AppTest 54ms
      testAddPatient() 1.0ms
      testRemovePatient() 29ms
      testBookAppointment() 1.0ms
      testCancelAppointment() 1.0ms
      testAttendAppointment() 22ms
```

AppTest.java

src > test > AppTest.java > AppTest > testAttendAppointment()

```java
public class AppTest {
    @Test
    public void testAttendAppointment()
    {
        // Prepare test input
        Patient testPatient = new Patient(id:11, name:"Patient 11", address:"Abc 123", phone:"123456789");
        bookingSystem.getPatients().add(testPatient);

        Physiotherapist testPhysio = new Physiotherapist(id:1, name:"Dr. Test", address:"Clinic", phone:"555-0000",
                                        List.of(e1:"Physiotherapy"));
        bookingSystem.getPhysios().add(testPhysio);

        LocalDateTime testTime = LocalDateTime.now().plusDays(days:1);
        Treatment testTreatment = new Treatment(name:"Massage", testTime, testPhysio);

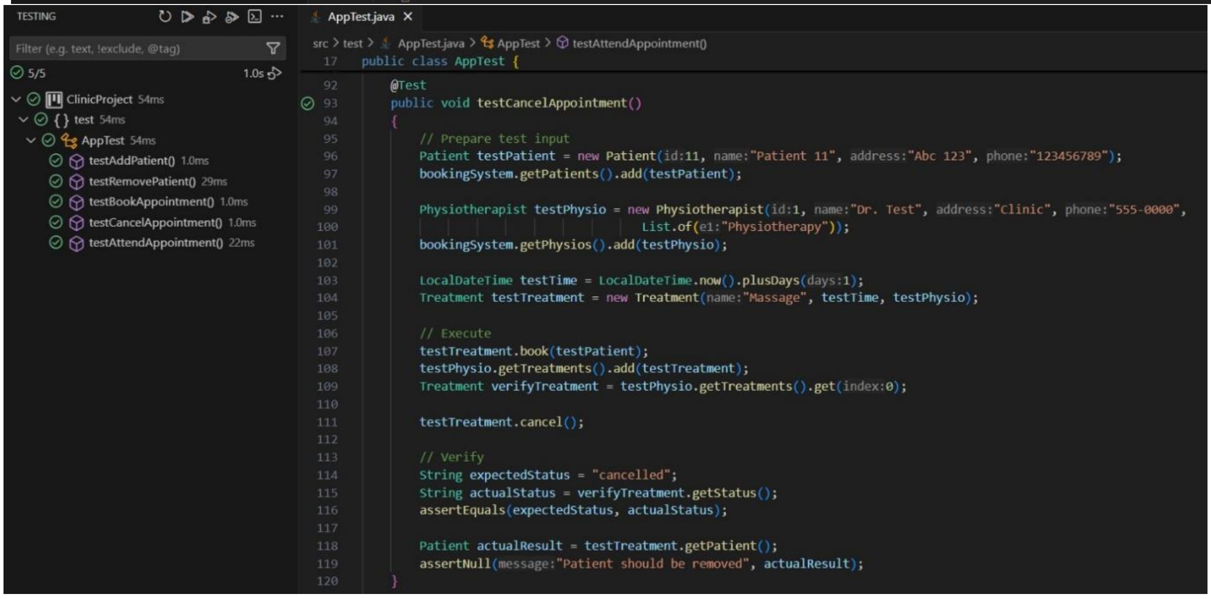
        // Execute
        testTreatment.book(testPatient);
        testPhysio.getTreatments().add(testTreatment);
        Treatment verifyTreatment = testPhysio.getTreatments().get(index:0);

        testTreatment.attend();

        // Verify
        String expectedStatus = "attended";
        String actualStatus = verifyTreatment.getStatus();
        assertEquals(expectedStatus, actualStatus);

        assertEquals(testPatient, testTreatment.getPatient());

    }
```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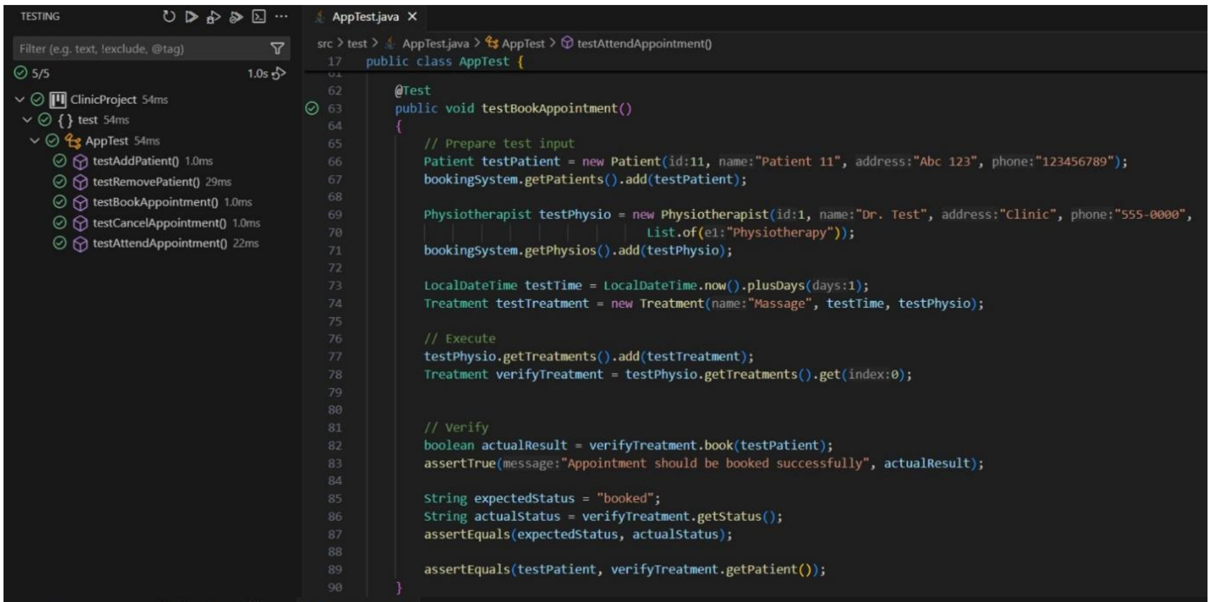
      testCancelAppointment() 1.0ms
      testAttendAppointment() 22ms
```

AppTest.java

src > test > AppTest.java > AppTest > testAttendAppointment()

```java
public class AppTest {
    @Test
    public void testCancelAppointment()
    {
        // Prepare test input
        Patient testPatient = new Patient(id:11, name:"Patient 11", address:"Abc 123", phone:"123456789");
        bookingSystem.getPatients().add(testPatient);

        Physiotherapist testPhysio = new Physiotherapist(id:1, name:"Dr. Test", address:"Clinic", phone:"555-0000",
                                        List.of(e1:"Physiotherapy"));
        bookingSystem.getPhysios().add(testPhysio);

        LocalDateTime testTime = LocalDateTime.now().plusDays(days:1);
        Treatment testTreatment = new Treatment(name:"Massage", testTime, testPhysio);

        // Execute
        testTreatment.book(testPatient);
        testPhysio.getTreatments().add(testTreatment);
        Treatment verifyTreatment = testPhysio.getTreatments().get(index:0);

        testTreatment.cancel();

        // Verify
        String expectedStatus = "cancelled";
        String actualStatus = verifyTreatment.getStatus();
        assertEquals(expectedStatus, actualStatus);

        Patient actualResult = testTreatment.getPatient();
        assertNull(message:"Patient should be removed", actualResult);
    }
```


TESTING
Filter (e.g. text, !exclude, @tag)
AppTest.java
src > test > AppTest.java > AppTest > testAttendAppointment()

```
5/5                                   1.0s
ClinicProject 54ms
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    AppTest 54ms
      testAddPatient() 1.0ms
      testRemovePatient() 29ms
      testBookAppointment() 1.0ms
      testCancelAppointment() 1.0ms
      testAttendAppointment() 22ms
```

```java
public class AppTest {

    @Test
    public void testBookAppointment()
    {
        // Prepare test input
        Patient testPatient = new Patient(id:11, name:"Patient 11", address:"Abc 123", phone:"123456789");
        bookingSystem.getPatients().add(testPatient);

        Physiotherapist testPhysio = new Physiotherapist(id:1, name:"Dr. Test", address:"Clinic", phone:"555-0000",
                                        List.of(e1:"Physiotherapy"));
        bookingSystem.getPhysios().add(testPhysio);

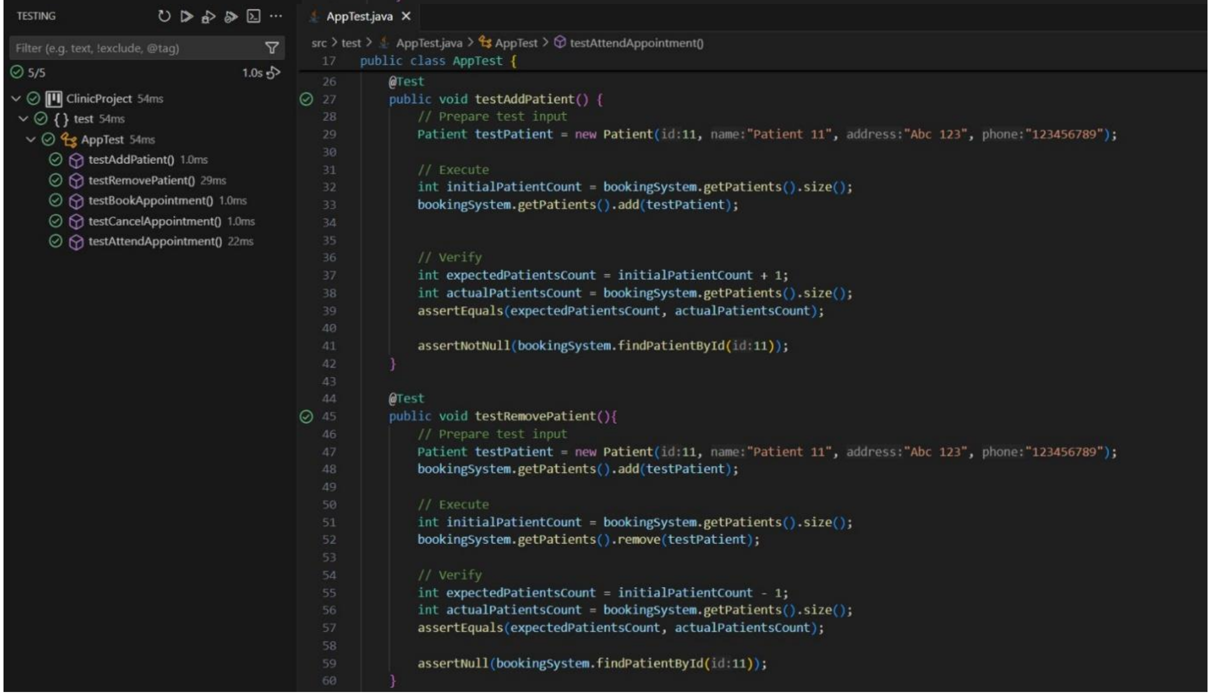
        LocalDateTime testTime = LocalDateTime.now().plusDays(days:1);
        Treatment testTreatment = new Treatment(name:"Massage", testTime, testPhysio);

        // Execute
        testPhysio.getTreatments().add(testTreatment);
        Treatment verifyTreatment = testPhysio.getTreatments().get(index:0);


        // Verify
        boolean actualResult = verifyTreatment.book(testPatient);
        assertTrue(message:"Appointment should be booked successfully", actualResult);

        String expectedStatus = "booked";
        String actualStatus = verifyTreatment.getStatus();
        assertEquals(expectedStatus, actualStatus);

        assertEquals(testPatient, verifyTreatment.getPatient());
    }
```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AppTest.java
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ClinicProject 54ms
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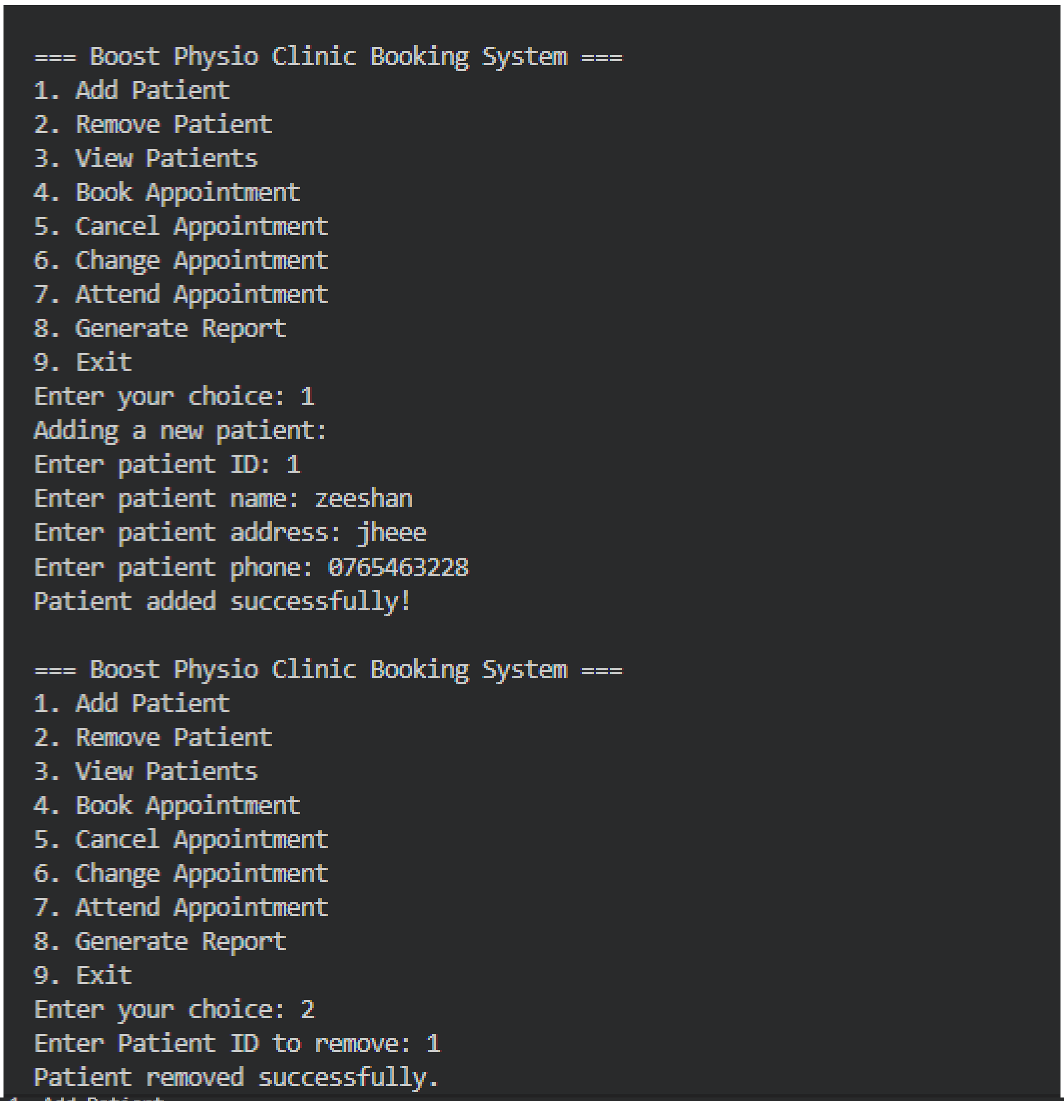
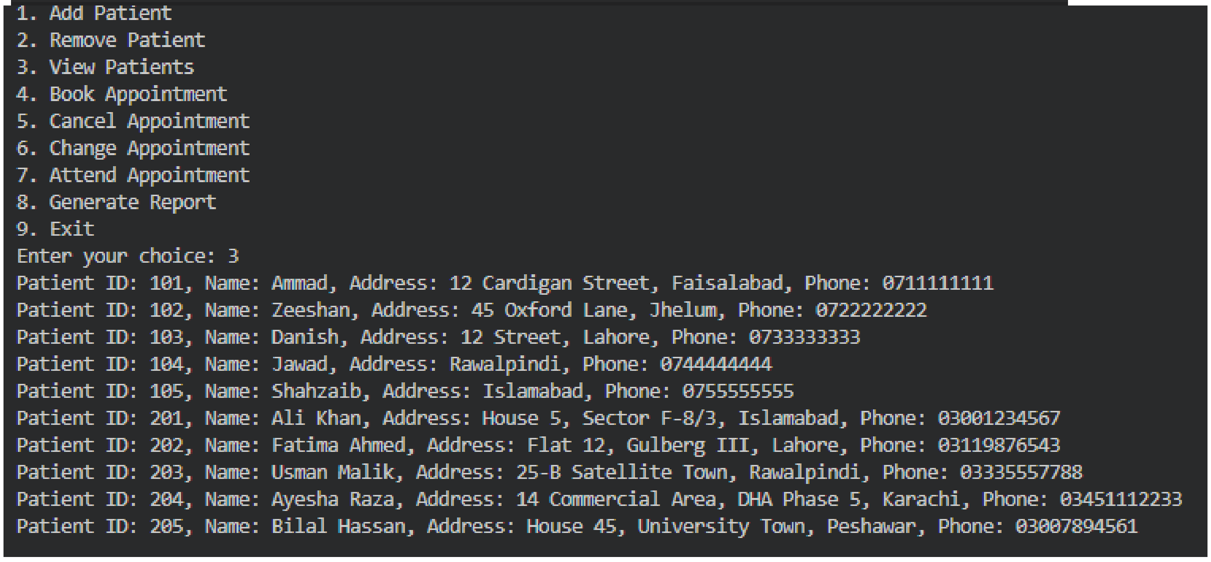
      testAddPatient() 1.0ms
      testRemovePatient() 29ms
      testBookAppointment() 1.0ms
      testCancelAppointment() 1.0ms
      testAttendAppointment() 22ms
```

```java
public class AppTest {
    @Test
    public void testAddPatient() {
        // Prepare test input
        Patient testPatient = new Patient(id:11, name:"Patient 11", address:"Abc 123", phone:"123456789");

        // Execute
        int initialPatientCount = bookingSystem.getPatients().size();
        bookingSystem.getPatients().add(testPatient);


        // Verify
        int expectedPatientsCount = initialPatientCount + 1;
        int actualPatientsCount = bookingSystem.getPatients().size();
        assertEquals(expectedPatientsCount, actualPatientsCount);

        assertNotNull(bookingSystem.findPatientById(id:11));
    }

    @Test
    public void testRemovePatient(){
        // Prepare test input
        Patient testPatient = new Patient(id:11, name:"Patient 11", address:"Abc 123", phone:"123456789");
        bookingSystem.getPatients().add(testPatient);

        // Execute
        int initialPatientCount = bookingSystem.getPatients().size();
        bookingSystem.getPatients().remove(testPatient);

        // Verify
        int expectedPatientsCount = initialPatientCount - 1;
        int actualPatientsCount = bookingSystem.getPatients().size();
        assertEquals(expectedPatientsCount, actualPatientsCount);

        assertNull(bookingSystem.findPatientById(id:11));
    }
```

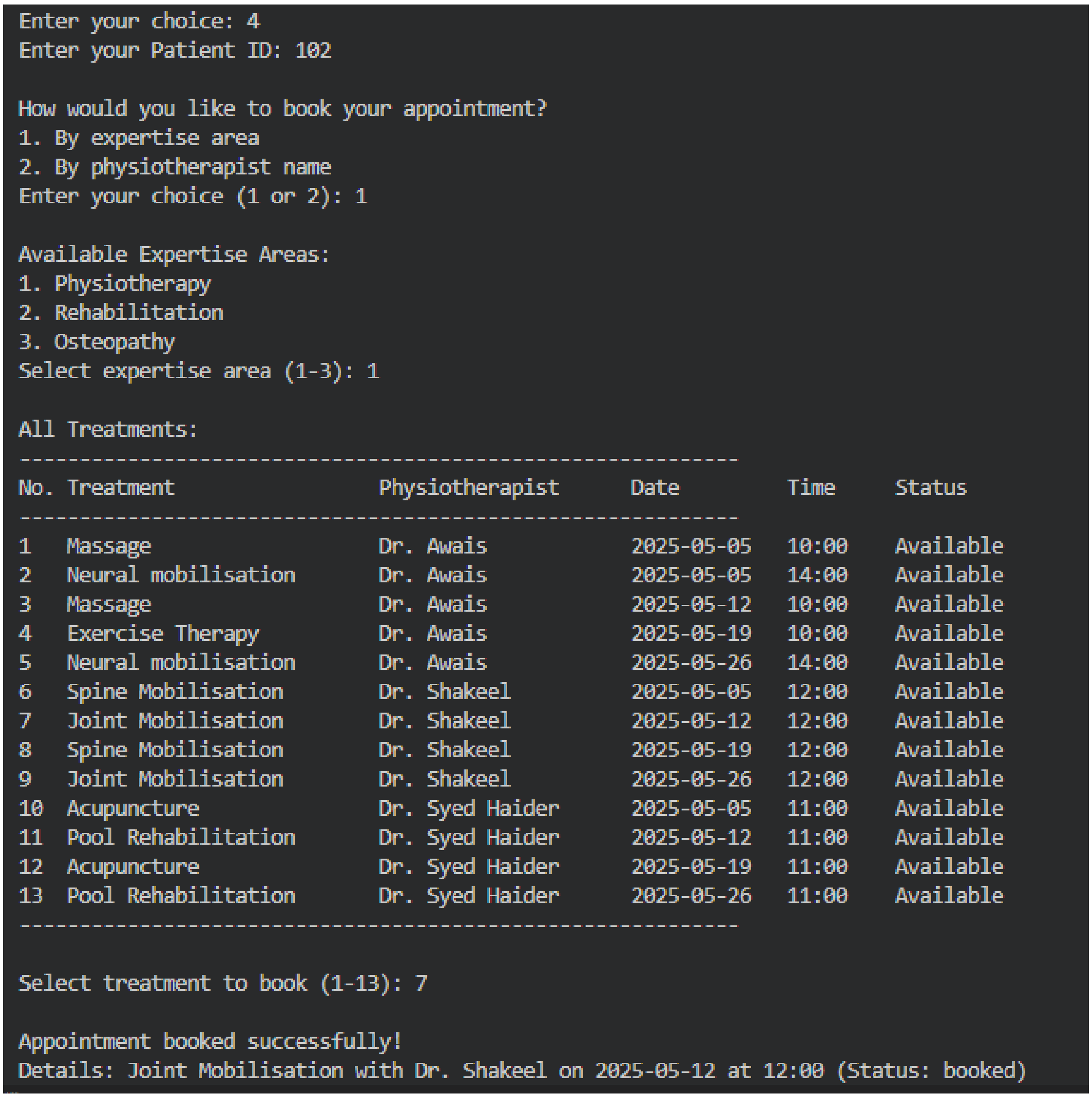
Results:



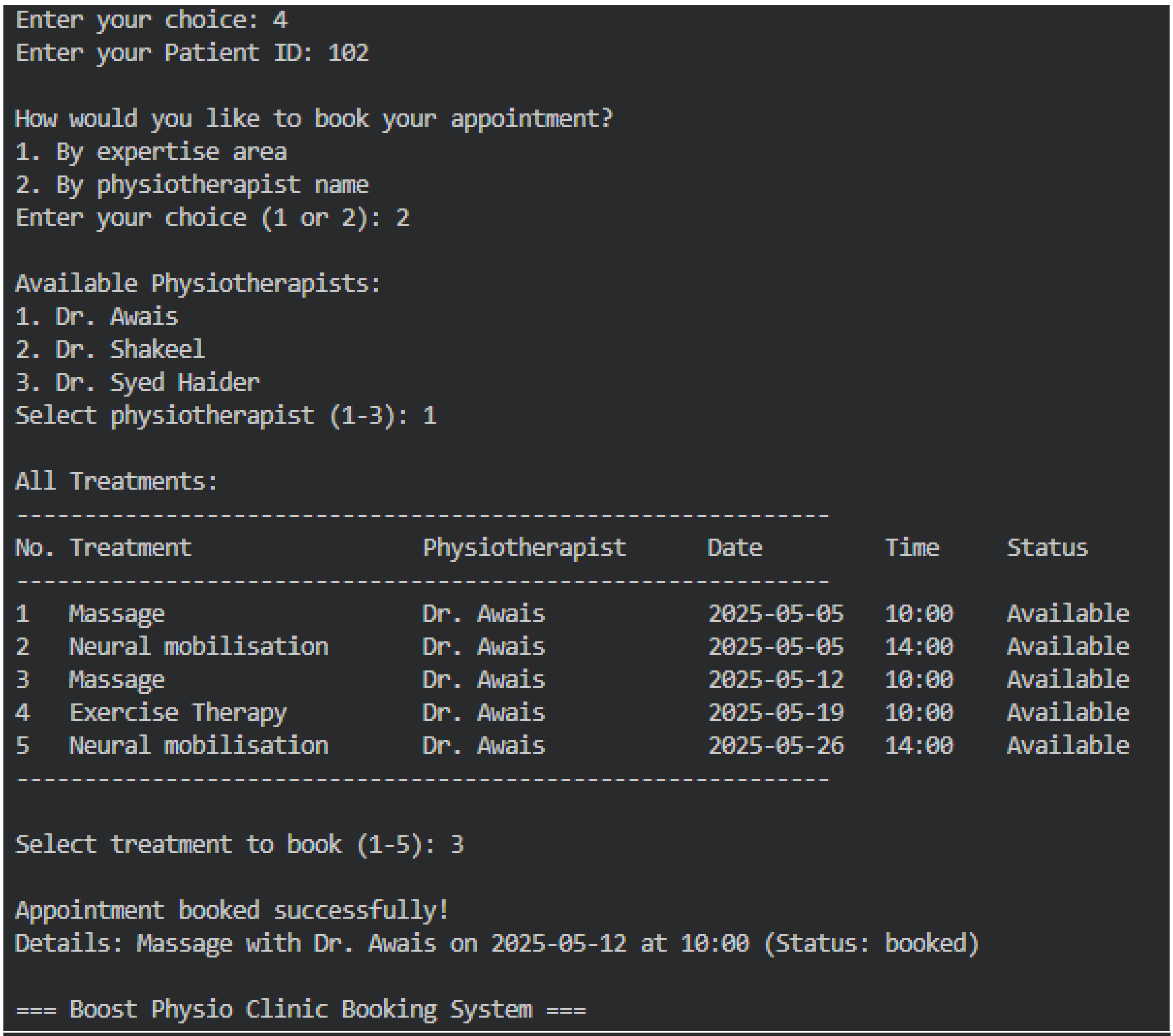
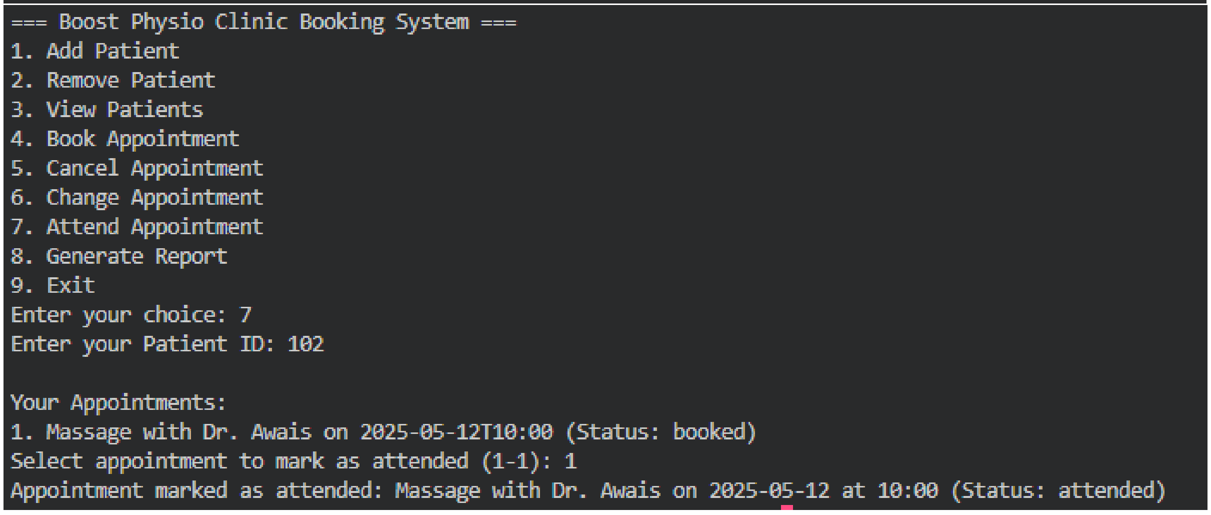
```
=== Boost Physio Clinic Booking System ===
1. Add Patient
2. Remove Patient
3. View Patients
4. Book Appointment
5. Cancel Appointment
6. Change Appointment
7. Attend Appointment
8. Generate Report
9. Exit
Enter your choice: 1
Adding a new patient:
Enter patient ID: 1
Enter patient name: zeeshan
Enter patient address: jheee
Enter patient phone: 0765463228
Patient added successfully!

=== Boost Physio Clinic Booking System ===
1. Add Patient
2. Remove Patient
3. View Patients
4. Book Appointment
5. Cancel Appointment
6. Change Appointment
7. Attend Appointment
8. Generate Report
9. Exit
Enter your choice: 2
Enter Patient ID to remove: 1
Patient removed successfully.
```

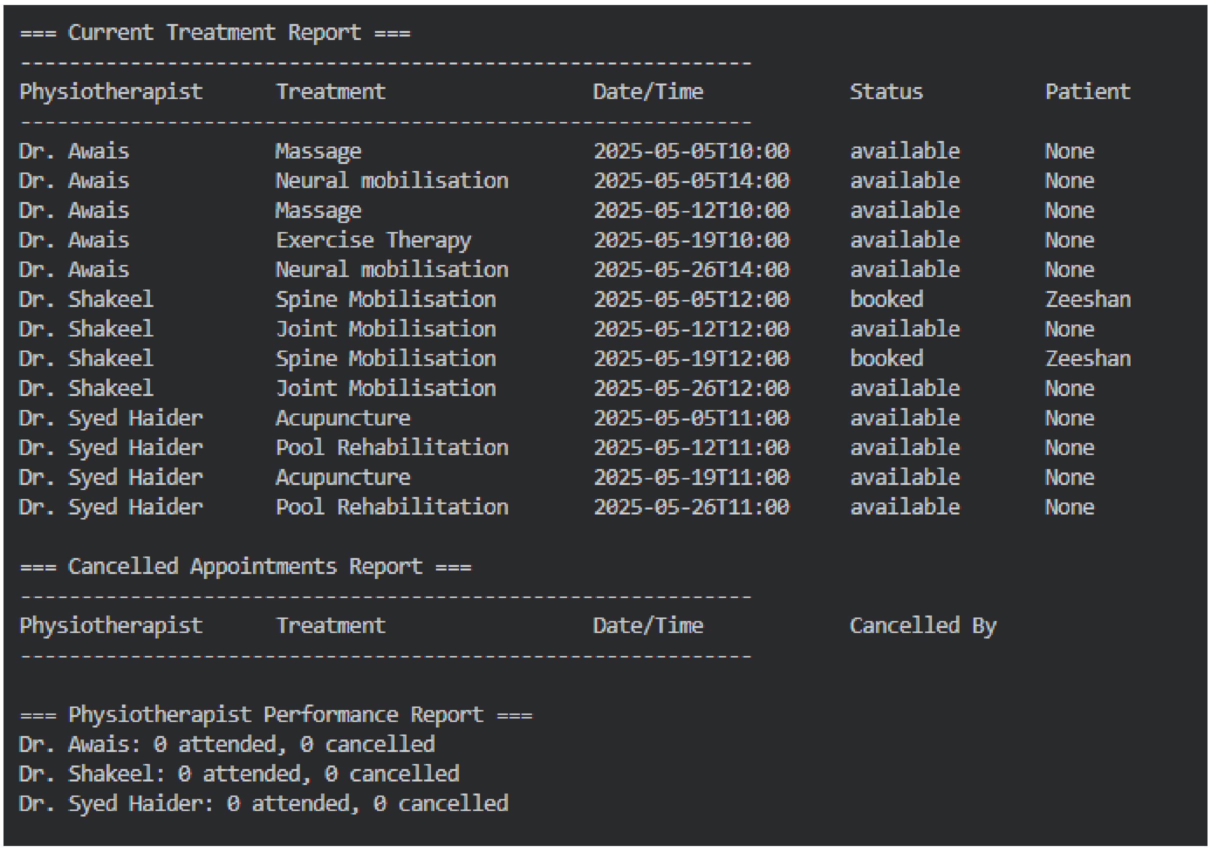


```
1. Add Patient
2. Remove Patient
3. View Patients
4. Book Appointment
5. Cancel Appointment
6. Change Appointment
7. Attend Appointment
8. Generate Report
9. Exit
Enter your choice: 3
Patient ID: 101, Name: Ammad, Address: 12 Cardigan Street, Faisalabad, Phone: 0711111111
Patient ID: 102, Name: Zeeshan, Address: 45 Oxford Lane, Jhelum, Phone: 0722222222
Patient ID: 103, Name: Danish, Address: 12 Street, Lahore, Phone: 0733333333
Patient ID: 104, Name: Jawad, Address: Rawalpindi, Phone: 0744444444
Patient ID: 105, Name: Shahzaib, Address: Islamabad, Phone: 0755555555
Patient ID: 201, Name: Ali Khan, Address: House 5, Sector F-8/3, Islamabad, Phone: 03001234567
Patient ID: 202, Name: Fatima Ahmed, Address: Flat 12, Gulberg III, Lahore, Phone: 03119876543
Patient ID: 203, Name: Usman Malik, Address: 25-B Satellite Town, Rawalpindi, Phone: 03335557788
Patient ID: 204, Name: Ayesha Raza, Address: 14 Commercial Area, DHA Phase 5, Karachi, Phone: 03451112233
Patient ID: 205, Name: Bilal Hassan, Address: House 45, University Town, Peshawar, Phone: 03007894561
```



```
Enter your choice: 4
Enter your Patient ID: 102

How would you like to book your appointment?
1. By expertise area
2. By physiotherapist name
Enter your choice (1 or 2): 1

Available Expertise Areas:
1. Physiotherapy
2. Rehabilitation
3. Osteopathy
Select expertise area (1-3): 1

All Treatments:
------------------------------------------------------------
No. Treatment                 Physiotherapist     Date         Time     Status
------------------------------------------------------------
1   Massage                   Dr. Awais           2025-05-05   10:00    Available
2   Neural mobilisation       Dr. Awais           2025-05-05   14:00    Available
3   Massage                   Dr. Awais           2025-05-12   10:00    Available
4   Exercise Therapy          Dr. Awais           2025-05-19   10:00    Available
5   Neural mobilisation       Dr. Awais           2025-05-26   14:00    Available
6   Spine Mobilisation        Dr. Shakeel         2025-05-05   12:00    Available
7   Joint Mobilisation        Dr. Shakeel         2025-05-12   12:00    Available
8   Spine Mobilisation        Dr. Shakeel         2025-05-19   12:00    Available
9   Joint Mobilisation        Dr. Shakeel         2025-05-26   12:00    Available
10  Acupuncture               Dr. Syed Haider     2025-05-05   11:00    Available
11  Pool Rehabilitation       Dr. Syed Haider     2025-05-12   11:00    Available
12  Acupuncture               Dr. Syed Haider     2025-05-19   11:00    Available
13  Pool Rehabilitation       Dr. Syed Haider     2025-05-26   11:00    Available
------------------------------------------------------------

Select treatment to book (1-13): 7

Appointment booked successfully!
Details: Joint Mobilisation with Dr. Shakeel on 2025-05-12 at 12:00 (Status: booked)
```


```
Enter your choice: 4
Enter your Patient ID: 102

How would you like to book your appointment?
1. By expertise area
2. By physiotherapist name
Enter your choice (1 or 2): 2

Available Physiotherapists:
1. Dr. Awais
2. Dr. Shakeel
3. Dr. Syed Haider
Select physiotherapist (1-3): 1

All Treatments:
------------------------------------------------------------
No. Treatment                Physiotherapist     Date         Time     Status
------------------------------------------------------------
1   Massage                  Dr. Awais           2025-05-05   10:00    Available
2   Neural mobilisation      Dr. Awais           2025-05-05   14:00    Available
3   Massage                  Dr. Awais           2025-05-12   10:00    Available
4   Exercise Therapy         Dr. Awais           2025-05-19   10:00    Available
5   Neural mobilisation      Dr. Awais           2025-05-26   14:00    Available
------------------------------------------------------------

Select treatment to book (1-5): 3

Appointment booked successfully!
Details: Massage with Dr. Awais on 2025-05-12 at 10:00 (Status: booked)

=== Boost Physio Clinic Booking System ===
```

```
=== Boost Physio Clinic Booking System ===
1. Add Patient
2. Remove Patient
3. View Patients
4. Book Appointment
5. Cancel Appointment
6. Change Appointment
7. Attend Appointment
8. Generate Report
9. Exit
Enter your choice: 7
Enter your Patient ID: 102

Your Appointments:
1. Massage with Dr. Awais on 2025-05-12T10:00 (Status: booked)
Select appointment to mark as attended (1-1): 1
Appointment marked as attended: Massage with Dr. Awais on 2025-05-12 at 10:00 (Status: attended)
```



```
=== Current Treatment Report ===
------------------------------------------------------------
Physiotherapist     Treatment                Date/Time          Status         Patient
------------------------------------------------------------
Dr. Awais           Massage                  2025-05-05T10:00   available      None
Dr. Awais           Neural mobilisation      2025-05-05T14:00   available      None
Dr. Awais           Massage                  2025-05-12T10:00   available      None
Dr. Awais           Exercise Therapy         2025-05-19T10:00   available      None
Dr. Awais           Neural mobilisation      2025-05-26T14:00   available      None
Dr. Shakeel         Spine Mobilisation       2025-05-05T12:00   booked         Zeeshan
Dr. Shakeel         Joint Mobilisation       2025-05-12T12:00   available      None
Dr. Shakeel         Spine Mobilisation       2025-05-19T12:00   booked         Zeeshan
Dr. Shakeel         Joint Mobilisation       2025-05-26T12:00   available      None
Dr. Syed Haider     Acupuncture              2025-05-05T11:00   available      None
Dr. Syed Haider     Pool Rehabilitation      2025-05-12T11:00   available      None
Dr. Syed Haider     Acupuncture              2025-05-19T11:00   available      None
Dr. Syed Haider     Pool Rehabilitation      2025-05-26T11:00   available      None

=== Cancelled Appointments Report ===
------------------------------------------------------------
Physiotherapist     Treatment                Date/Time          Cancelled By
------------------------------------------------------------


=== Physiotherapist Performance Report ===
Dr. Awais: 0 attended, 0 cancelled
Dr. Shakeel: 0 attended, 0 cancelled
Dr. Syed Haider: 0 attended, 0 cancelled
```

Conclusion

The system meets all requirements with:

- Efficient appointment management.
- Clear reporting.
- Scalable design (e.g., easy to add new physiotherapists).

Future Improvements:

- GUI interface.
- Extended timetable beyond 4 weeks.

References

1. 7COM1025 Coursework Briefing Sheet (2024/25).
2. Oracle Java Documentation.