Experiment-4

Student Name: Harsh Garg **UID:** 22BCS12253

Branch: CSE **Section/Group:** 22BCS_IOT-640/A

Semester: 6th **Date of Performance:** 11/01/2025

Subject Name: Project Based Learning in Java with Lab **Subject Code:** 22CSH-359

1. **Aim:**
   a) Write a Java program to implement an ArrayList that stores employee details (ID, Name, and Salary). Allow users to add, update, remove, and search employees.
   b) Create a program to collect and store all the cards to assist the users in finding all the cards in a given symbol using Collection interface.
   c) Develop a ticket booking system with synchronized threads to ensure no double booking of seats. Use thread priorities to simulate VIP bookings being processed first.
2. **Objective:**
   a) **For the Employee Management System:** To implement an ArrayList for storing and managing employee details dynamically.
   b) **For the Card Collection System:** To use the Collection interface for organizing and retrieving cards based on symbols.
   c) **For the Ticket Booking System:** To develop a synchronized, thread-safe ticket booking system with VIP priority handling.
3. **Procedure:**
   a) **For the Employee Management System:**
      - Take user input for employee details and store them in an ArrayList.
      - Provide options to add, update, remove, and search employees.
      - Implement a menu-driven system for user interaction.
      - Use loops and conditions to manage and modify employee records.
      - Display appropriate messages for successful or failed operations.

   b) **For the Card Collection System:**
      - Create a collection to store different types of cards.
      - Allow users to add and retrieve cards based on their symbols.
      - Implement search functionality to filter cards by symbol.
      - Use Java's Collection framework for efficient data handling.
      - Display matching cards or an appropriate message if none are found.

   c) **For the Ticket Booking System:**
      - Initialize seat booking with synchronized threads to prevent double booking.
      - Assign higher priority to VIP bookings for faster processing.
      - Allow multiple users to attempt bookings concurrently.
      - Ensure only one thread can book a seat at a time using synchronization.
      - Display booking status after each transaction.

4. **Code:**

a) **Employee Management System: -**

```
import java.util.ArrayList;
import java.util.Scanner;

class Employee {
    int id;
    String name;
    double salary;

    // Constructor
    Employee(int id, String name, double salary) {
        this.id = id;
        this.name = name;
        this.salary = salary;
    }

    // Return a string representation
    public String toString() {
        return id + ": " + name + " ($" + salary + ")";
    }
}

public class EmployeeApp {
    public static void main(String[] args) {
        ArrayList<Employee> employees = new ArrayList<>();
        Scanner sc = new Scanner(System.in);

        while (true) {
            System.out.println("\nMenu: 1. Add  2. Update  3. Remove  4. Search  5. List  6. Exit");
            System.out.print("Enter choice: ");
            int choice = sc.nextInt();
            if (choice == 6) break;
            switch (choice) {
                case 1:
                    System.out.print("Enter id, name, and salary: ");
                    int id = sc.nextInt();
                    String name = sc.next();
                    double salary = sc.nextDouble();
                    employees.add(new Employee(id, name, salary));
                    break;
                case 2:
                    System.out.print("Enter id to update: ");
                    id = sc.nextInt();
                    boolean updated = false;
                    for (Employee e : employees) {
                        if (e.id == id) {
```

```
                    System.out.print("New name: ");
                    e.name = sc.next();
                    System.out.print("New salary: ");
                    e.salary = sc.nextDouble();
                    updated = true;
                    break;
                }
            }
            if (!updated) System.out.println("Employee not found!");
            break;
        case 3:
            System.out.print("Enter id to remove: ");
            id = sc.nextInt();
            boolean removed = false;
            for (int i = 0; i < employees.size(); i++) {
                if (employees.get(i).id == id) {
                    employees.remove(i);
                    removed = true;
                    break;
                }
            }
            if (!removed) System.out.println("Employee not found!");
            break;
        case 4:
            System.out.print("Enter id to search: ");
            id = sc.nextInt();
            boolean found = false;
            for (Employee e : employees) {
                if (e.id == id) {
                    System.out.println(e);
                    found = true;
                }
            }
            if (!found) System.out.println("Employee not found!");
            break;
        case 5:
            System.out.println("Employee List:");
            for (Employee e : employees) {
                System.out.println(e);
            }
            break;
        default:
            System.out.println("Invalid choice!");
    }
  }
  sc.close();
 }
}
```

b) Card Collection Using a Collection: -

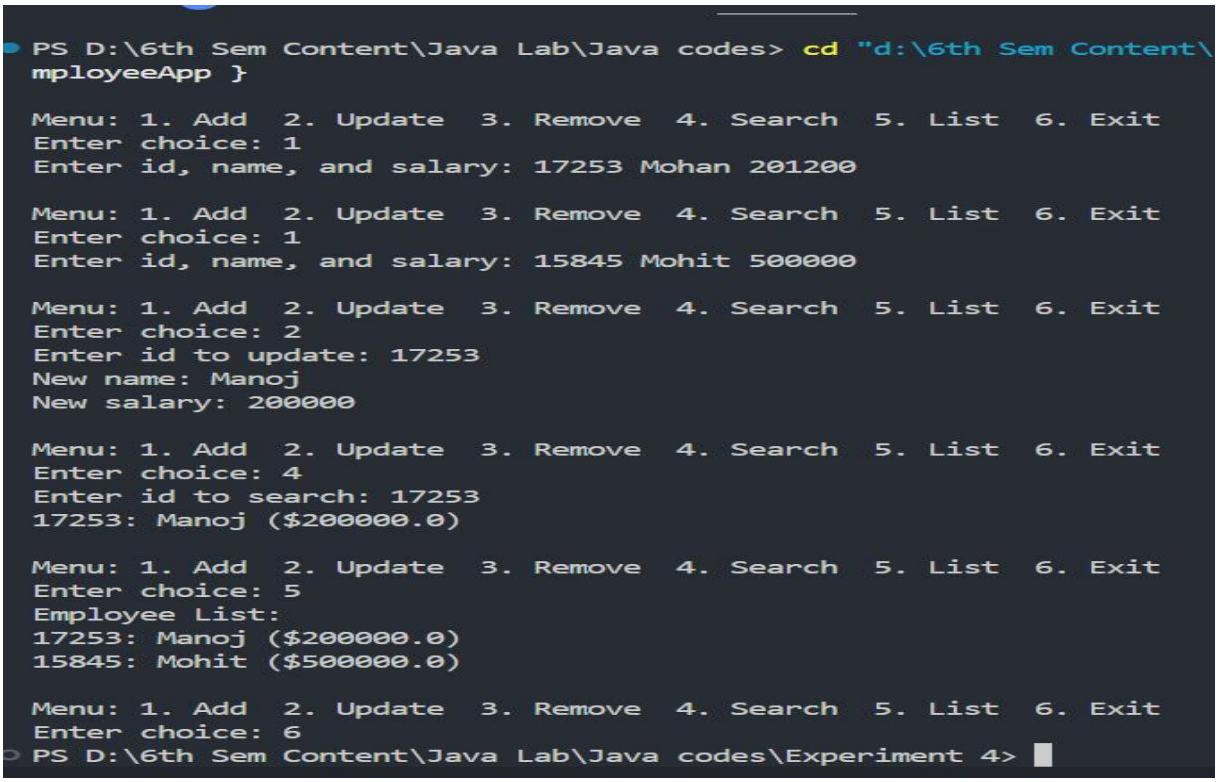
```
import java.util.*;
public class CardCollection {
   public static void main(String[] args) {
      // Map where the key is a card symbol and the value is a list of card names.
      Map<String, List<String>> cards = new HashMap<>();
      Scanner sc = new Scanner(System.in);

      while (true) {
         System.out.println("\nMenu: 1. Add Card  2. Find Cards by Symbol  3. Exit");
         System.out.print("Choice: ");
         int choice = sc.nextInt();
         sc.nextLine(); // consume newline
         if (choice == 3) break;

         if (choice == 1) {
            System.out.print("Enter card symbol: ");
            String symbol = sc.nextLine();
            System.out.print("Enter card name: ");
            String cardName = sc.nextLine();
            // Create a new list if symbol doesn't exist
            cards.putIfAbsent(symbol, new ArrayList<>());
            cards.get(symbol).add(cardName);
            System.out.println("Card added!");
         } else if (choice == 2) {
            System.out.print("Enter card symbol to search: ");
            String symbol = sc.nextLine();
            List<String> list = cards.get(symbol);
            if (list == null || list.isEmpty()) {
               System.out.println("No cards found for symbol: " + symbol);
            } else {
               System.out.println("Cards with symbol " + symbol + ": " + list);
            }
         } else {
            System.out.println("Invalid choice!");
         }
      }
      sc.close();
   }
}
```

c) Ticket Booking System with Synchronized Threads: -

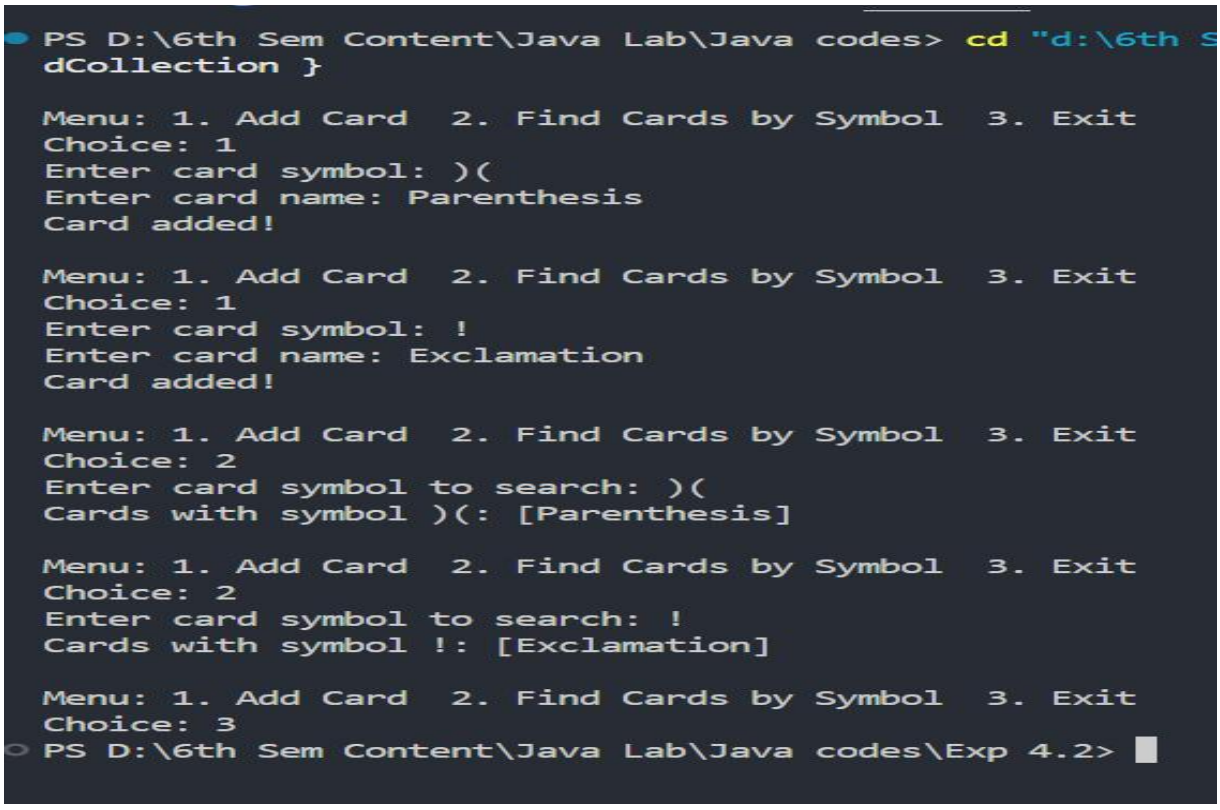
```
class TicketBookingSystem {
    int availableSeats = 5;
    // Synchronized method to ensure one thread at a time can book a seat.
    public synchronized void bookSeat(String passenger) {
        if (availableSeats > 0) {
            System.out.println(passenger + " booked seat number " + availableSeats);
            availableSeats--;
        } else {
            System.out.println(passenger + " found no seats available.");
        }
    }
}
class BookingThread extends Thread {
    TicketBookingSystem system;
    BookingThread(TicketBookingSystem system, String name, int priority) {
        super(name);
        this.system = system;
        setPriority(priority);
    }
    public void run() {
        system.bookSeat(getName());
    }
}
public class TicketBooking {
    public static void main(String[] args) {
        TicketBookingSystem system = new TicketBookingSystem();
        BookingThread t1 = new BookingThread(system, "VIP 1", Thread.MAX_PRIORITY);
        BookingThread t2 = new BookingThread(system, "VIP 2", Thread.MAX_PRIORITY);
        BookingThread t3 = new BookingThread(system, "Normal 1", Thread.NORM_PRIORITY);
        BookingThread t4 = new BookingThread(system, "Normal 2", Thread.NORM_PRIORITY);
        BookingThread t5 = new BookingThread(system, "Normal 3", Thread.NORM_PRIORITY);
        BookingThread t6 = new BookingThread(system, "Normal 4", Thread.NORM_PRIORITY);
        t1.start();
        t2.start();
        t3.start();
        t4.start();
        t5.start();
        t6.start();
    }
}
```

5. **Outputs:**

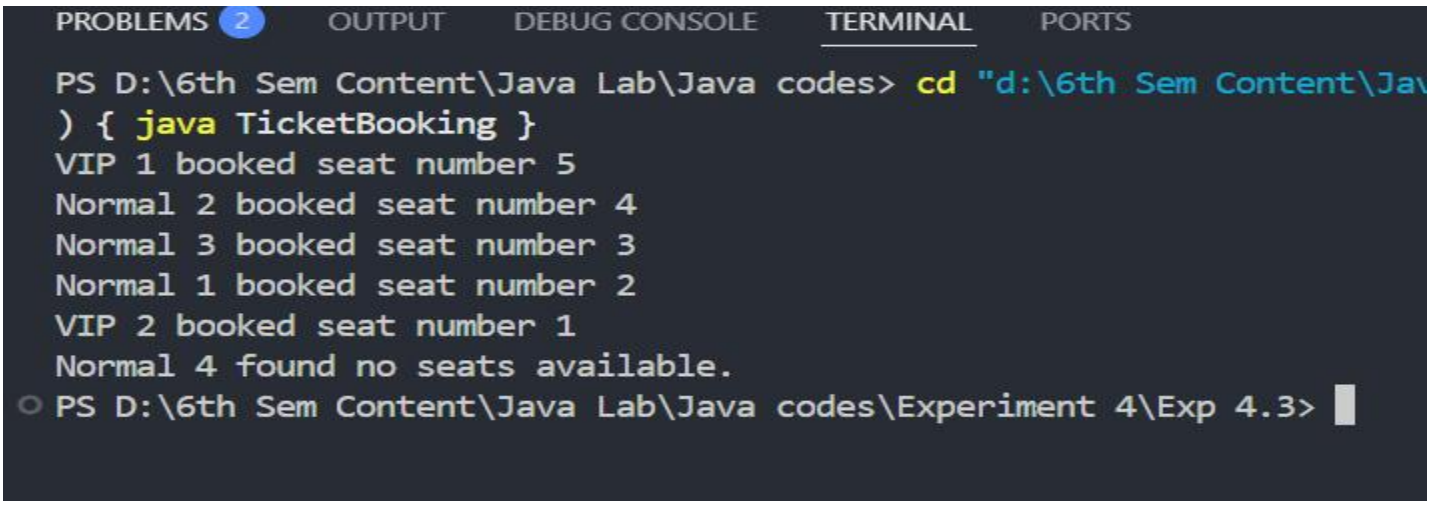
a) **Output for Employee Management System: -**



b) **Output for Card Collection Using a Collection: -**



c) Output for Ticket Booking System with Synchronized Threads: -



6. Learning Outcomes:

- Understand and implement Java Collections for efficient data storage and retrieval.
- Develop user-friendly programs with menu-driven interactions for dynamic data management.
- Apply exception handling to ensure robustness and prevent runtime errors.
- Utilize multithreading and synchronization to manage concurrent processes safely.
- Enhance problem-solving skills by designing real-world applications with Java.