Experiment 4.1

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Subject: PBLJ **Subject Code:22CSH-359**

Aim: 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.

Objective: The objective of this Java program is to implement an **ArrayList** to manage employee details, including ID**,** Name, and Salary.

Code:

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

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

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

    public int getId() {
        return id;
    }

    public String getName() {
        return name;
    }

    public double getSalary() {
        return salary;
    }

    public void setName(String name) {
        this.name = name;
    }

    public void setSalary(double salary) {
        this.salary = salary;
    }

    public String getDetails() {
```

```
        return "Employee ID: " + id + ", Name: " + name + ", Salary: " + salary;
    }
}

public class EmployeeManagementSystem {
    private static ArrayList<Employee> employees = new ArrayList<>();
    private static Scanner scanner = new Scanner(System.in);

    public static void main(String[] args) {
        while (true) {
            System.out.println("\nEmployee Management System");
            System.out.println("1. Add Employee data");
            System.out.println("2. Update Employee data");
            System.out.println("3. Remove Employee data");
            System.out.println("4. Search Employee data");
            System.out.println("5. Display All Employees data");
            System.out.println("6. Exit");
            System.out.print("Enter your choice: ");
            int choice = scanner.nextInt();
            scanner.nextLine();

            switch (choice) {
                case 1:
                    addEmployee();
                    break;
                case 2:
                    updateEmployee();
                    break;
                case 3:
                    removeEmployee();
                    break;
                case 4:
                    searchEmployee();
                    break;
                case 5:
                    displayEmployees();
                    break;
                case 6:
                    System.out.println("Exiting...");
                    return;
                default:
                    System.out.println("Invalid choice. Please try again.");
            }
        }
    }

    private static void addEmployee() {
        System.out.print("Enter Employee ID: ");
        int id = scanner.nextInt();
        scanner.nextLine();
        System.out.print("Enter Employee Name: ");
        String name = scanner.nextLine();
        System.out.print("Enter Employee Salary: ");
```

```
        double salary = scanner.nextDouble();
        employees.add(new Employee(id, name, salary));
        System.out.println("Employee added successfully!");
    }

    private static void updateEmployee() {
        System.out.print("Enter Employee ID to update: ");
        int id = scanner.nextInt();
        scanner.nextLine();
        for (Employee emp : employees) {
            if (emp.getId() == id) {
                System.out.print("Enter new Name: ");
                String name = scanner.nextLine();
                System.out.print("Enter new Salary: ");
                double salary = scanner.nextDouble();
                emp.setName(name);
                emp.setSalary(salary);
                System.out.println("Employee updated successfully!");
                return;
            }
        }
        System.out.println("Employee not found!");
    }

    private static void removeEmployee() {
        System.out.print("Enter Employee ID to remove: ");
        int id = scanner.nextInt();
        scanner.nextLine();
        employees.removeIf(emp -> emp.getId() == id);
        System.out.println("Employee removed successfully!");
    }

    private static void searchEmployee() {
        System.out.print("Enter Employee ID to search: ");
        int id = scanner.nextInt();
        scanner.nextLine();
        for (Employee emp : employees) {
            if (emp.getId() == id) {
                System.out.println(emp.getDetails());
                return;
            }
        }
        System.out.println("Employee not found!");
    }

    private static void displayEmployees() {
        if (employees.isEmpty()) {
            System.out.println("No employees found.");
            return;
        }
        for (Employee emp : employees) {
            System.out.println(emp.getDetails());
        }
```

}}

Output:

```
Employee Management System
1. Add Employee data
2. Update Employee data
3. Remove Employee data
4. Search Employee data
5. Display All Employees data
6. Exit
Enter your choice: 1
Enter Employee ID: 10533
Enter Employee Name: Deepak kumar
Enter Employee Salary: 45000
Employee added successfully!

Employee Management System
1. Add Employee data
2. Update Employee data
3. Remove Employee data
4. Search Employee data
5. Display All Employees data
6. Exit
Enter your choice: 5
Employee ID: 10533, Name: Deepak kumar, Salary: 45000.0

Employee Management System
1. Add Employee data
2. Update Employee data
3. Remove Employee data
4. Search Employee data
5. Display All Employees data
6. Exit
Enter your choice:
```

Learning Outcomes:

- Adding, updating, removing, and searching elements dynamically.
- Creating and managing objects using a class.
- Implementing `switch-case` and loops for menu-driven execution.
- Implementing `switch-case` and loops for menu-driven execution.
- Storing and retrieving structured employee data efficiently.

Experiment 4.2

1. **Aim:** 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.

2. **Objective:** The objective is to serialize and deserialize a Student object, store and retrieve its id, name, and GPA from a file, and handle exceptions like FileNotFoundException, IOException, and ClassNotFoundException.

3. Implementation Code:

```
import java.util.*;

class Card {
    String symbol;
    String name;

    public Card(String symbol, String name) {
        this.symbol = symbol;
        this.name = name;
    }

    public String getSymbol() {
        return symbol;
    }

    public String getName() {
        return name;
    }
}

public class CardCollectionManager_project {
    static Collection<Card> cards = new ArrayList<>();
    static Scanner scanner = new Scanner(System.in);

    public static void main(String[] args) {
        while (true) {
            System.out.println("\nCard Collection Manager");
            System.out.println("1. Add Card");
            System.out.println("2. Find Cards by Symbol");
            System.out.println("3. Display All Cards");
            System.out.println("4. Remove Card");
            System.out.println("5. Count Cards by Symbol");
            System.out.println("6. Check if a Card Exists");
            System.out.println("7. Exit");
            System.out.print("Enter your choice: ");
            int choice = scanner.nextInt();
            scanner.nextLine();

            switch (choice) {
                case 1:
```

```
                addCard();
                break;
            case 2:
                findCardsBySymbol();
                break;
            case 3:
                displayAllCards();
                break;
            case 4:
                removeCard();
                break;
            case 5:
                countCardsBySymbol();
                break;
            case 6:
                checkCardExists();
                break;
            case 7:
                System.out.println("Exiting...");
                return;
            default:
                System.out.println("Invalid choice. Try again.");
        }
    }
}

static void addCard() {
    System.out.print("Enter Card Symbol: ");
    String symbol = scanner.nextLine();
    System.out.print("Enter Card Number: ");
    String name = scanner.nextLine();
    cards.add(new Card(symbol, name));
    System.out.println("Card added successfully!");
}

static void findCardsBySymbol() {
    System.out.print("Enter symbol to search: ");
    String symbol = scanner.nextLine();
    boolean found = false;
    for (Card card : cards) {
        if (card.getSymbol().equalsIgnoreCase(symbol)) {
            System.out.println("Card Name: " + card.getName());
            found = true;
        }
    }
    if (!found) {
        System.out.println("No cards found for the given symbol.");
    }
}

static void displayAllCards() {
    if (cards.isEmpty()) {
        System.out.println("No cards in the collection.");
```

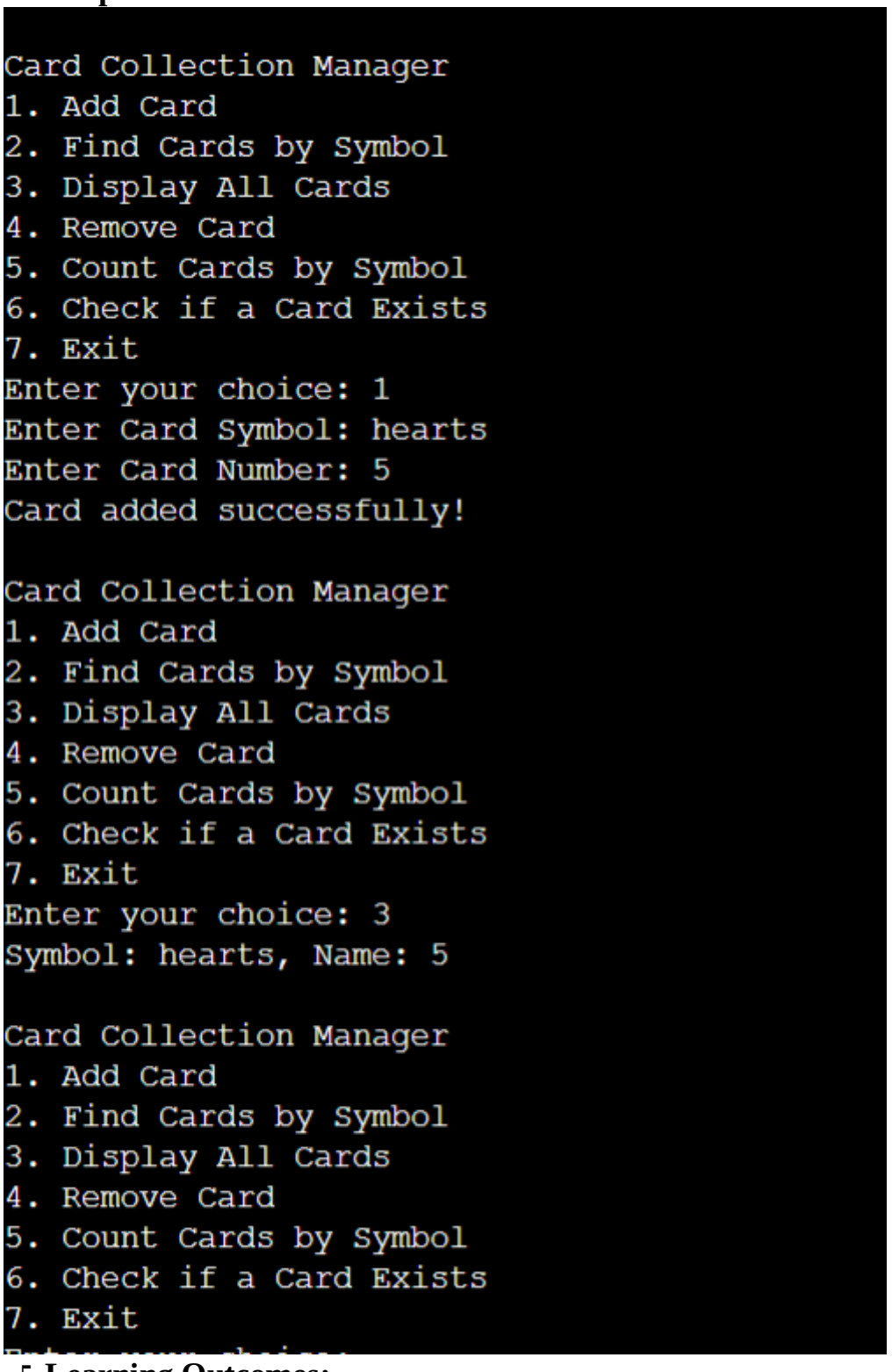
```
            return;
        }
        for (Card card : cards) {
            System.out.println("Symbol: " + card.getSymbol() + ", Name: " + card.getName());
        }
    }

    static void removeCard() {
        System.out.print("Enter Card Name to remove: ");
        String name = scanner.nextLine();
        boolean removed = cards.removeIf(card -> card.getName().equalsIgnoreCase(name));
        if (removed) {
            System.out.println("Card removed successfully!");
        } else {
            System.out.println("Card not found!");
        }
    }

    static void countCardsBySymbol() {
        System.out.print("Enter symbol to count: ");
        String symbol = scanner.nextLine();
        long count = cards.stream().filter(card ->
card.getSymbol().equalsIgnoreCase(symbol)).count();
        System.out.println("Total cards with symbol '" + symbol + "': " + count);
    }

    static void checkCardExists() {
        System.out.print("Enter Card Name to check: ");
        String name = scanner.nextLine();
        boolean exists = cards.stream().anyMatch(card -> card.getName().equalsIgnoreCase(name));
        if (exists) {
            System.out.println("Card exists in the collection.");
        } else {
            System.out.println("Card not found.");
        }
    }
}
```

4. **Output**



5. **Learning Outcomes:**

- Adding, updating, removing, and searching elements dynamically.
- Creating and managing objects using a class.
- Implementing `switch-case` and loops for menu-driven execution.
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- Storing and retrieving structured employee data efficiently.

Experiment 4.3

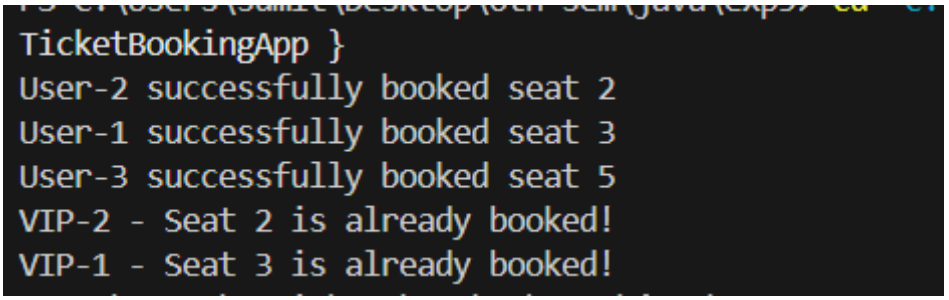
1. **Aim:** Develop a ticket booking system with synchronized threads to ensure no double booking of seats. Use thread priorities to simulate VIP bookings being processed first.
2. **Objective:**
   - Use synchronized methods to prevent race conditions.
   - Use thread priorities to handle VIP bookings before general bookings.
   - Ensure fairness in seat allocation using Thread.sleep() to simulate real-world delays.

3. Implementation Code:

```
import java.util.*;

class TicketBookingSystem {
    int totalSeats;
    boolean[] seats;

    TicketBookingSystem(int totalSeats) {
        this.totalSeats = totalSeats;
        this.seats = new boolean[totalSeats];
    }

    synchronized boolean bookSeat(int seatNumber, String customerName) {
        if (seatNumber < 0 || seatNumber >= totalSeats) {
            System.out.println(customerName + " - Invalid seat number!");
            return false;
        }

        if (!seats[seatNumber]) {
            seats[seatNumber] = true;
            System.out.println(customerName + " successfully booked seat " + seatNumber);
            return true;
        } else {
            System.out.println(customerName + " - Seat " + seatNumber + " is already booked!");
            return false;
        }
    }
}

class TicketBookingThread extends Thread {
    TicketBookingSystem system;
    int seatNumber;
    String customerName;

    TicketBookingThread(TicketBookingSystem system, int seatNumber, String customerName, int
priority) {
        this.system = system;
        this.seatNumber = seatNumber;
        this.customerName = customerName;
        setPriority(priority);
    }

    public void run() {
```

```
            try {
                Thread.sleep(100);
                system.bookSeat(seatNumber, customerName);
            } catch (InterruptedException e) {
                e.printStackTrace();
            }
        }
    }

    public class TicketBookingApp {
        public static void main(String[] args) {
            TicketBookingSystem system = new TicketBookingSystem(10);
            TicketBookingThread vip1 = new TicketBookingThread(system, 3, "VIP-1",
    Thread.MAX_PRIORITY);
            TicketBookingThread vip2 = new TicketBookingThread(system, 2, "VIP-2",
    Thread.MAX_PRIORITY);
            TicketBookingThread normal1 = new TicketBookingThread(system, 3, "User-1",
    Thread.MIN_PRIORITY);
            TicketBookingThread normal2 = new TicketBookingThread(system, 2, "User-2",
    Thread.MIN_PRIORITY);
            TicketBookingThread normal3 = new TicketBookingThread(system, 5, "User-3",
    Thread.NORM_PRIORITY);

            vip1.start();
            vip2.start();
            normal1.start();
            normal2.start();
            normal3.start();
        }
    }
```

4. Output:



5. Learning Outcomes:

- Understanding Multi-threading: Implemented parallel execution using the Thread class to handle multiple booking requests simultaneously.
- Synchronization for Data Safety: Used synchronized methods to ensure that no two threads can book the same seat at the same time, preventing race conditions.
- Thread Priorities & Scheduling: Assigned Thread.MAX_PRIORITY to VIP bookings to ensure they are processed before normal users.
- Concurrency Management: Demonstrated how multiple users can attempt bookings simultaneously without causing data inconsistencies.
- Seat Availability Control: Checked and updated seat booking status in a thread-safe manner to prevent double bookings.