Experiment 4.1

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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:

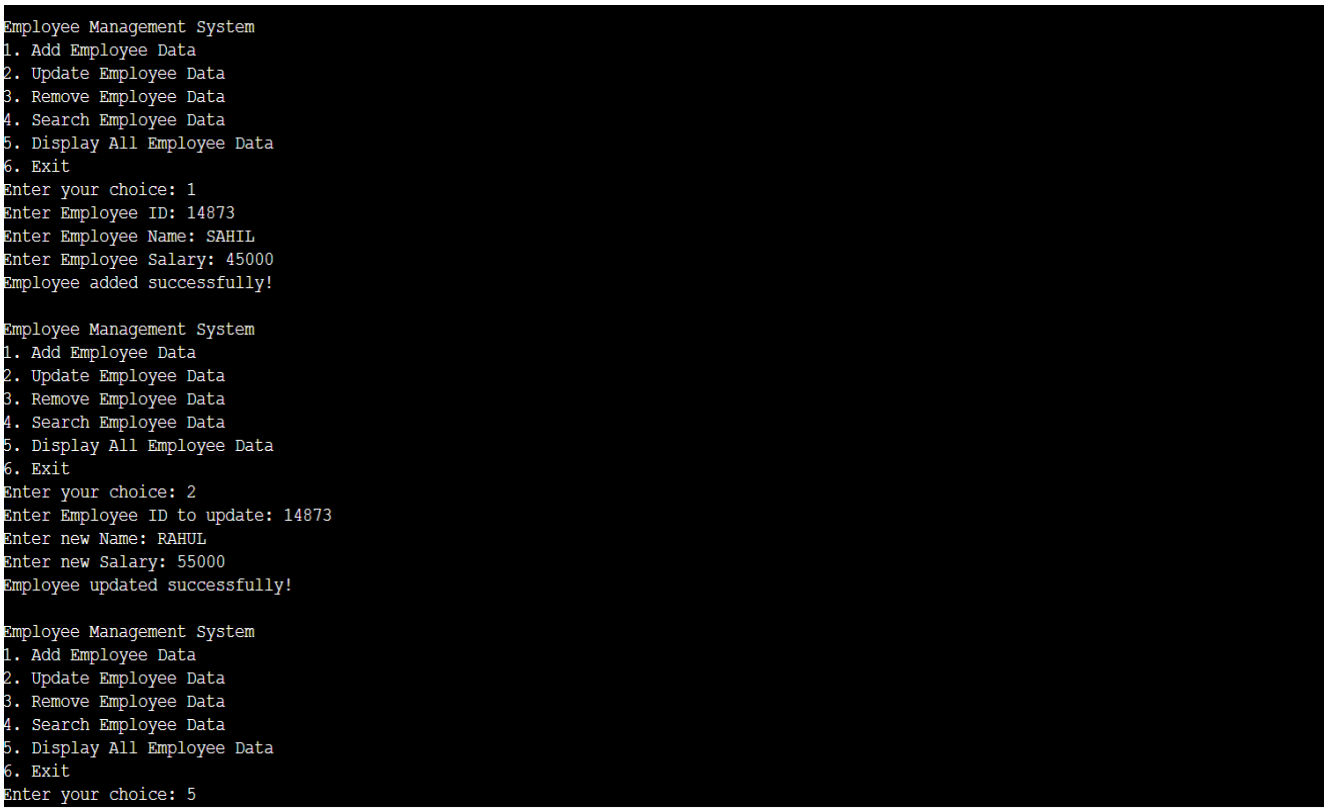
```
import java.util.ArrayList;
import java.util.Scanner;

class Employee {
    private int employeeId;
    private String employeeName;
    private double employeeSalary;

    public Employee(int employeeId, String employeeName, double employeeSalary) {
        this.employeeId = employeeId;
        this.employeeName = employeeName;
        this.employeeSalary = employeeSalary;
    }

    public int getEmployeeId() {
        return employeeId;
    }

    public String getEmployeeName() {
        return employeeName;
    }

    public double getEmployeeSalary() {
        return employeeSalary;
    }

    public void setEmployeeName(String employeeName) {
        this.employeeName = employeeName;
    }

    public void setEmployeeSalary(double employeeSalary) {
        this.employeeSalary = employeeSalary;
    }

    public String showDetails() {
```

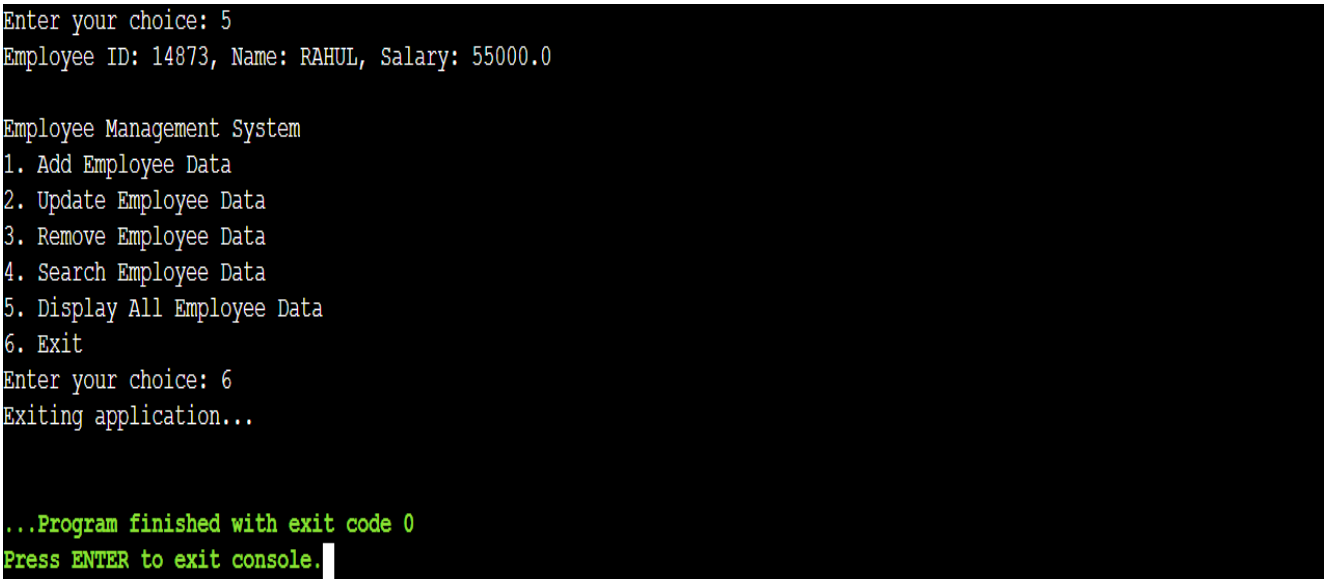
```
        return "Employee ID: " + employeeId + ", Name: " + employeeName + ", Salary: "
+ employeeSalary;
    }
}

public class EmployeeManagementSystem {
    private static ArrayList<Employee> employeeList = new ArrayList<>();
    private static Scanner inputScanner = 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 Employee Data");
            System.out.println("6. Exit");
            System.out.print("Enter your choice: ");
            int option = inputScanner.nextInt();
            inputScanner.nextLine();

            switch (option) {
                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 application...");
                    return;
                default:
                    System.out.println("Invalid choice. Please try again.");
            }
        }
    }

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

```
        System.out.print("Enter Employee Salary: ");
        double salary = inputScanner.nextDouble();

        employeeList.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 = inputScanner.nextInt();
        inputScanner.nextLine();

        for (Employee employee : employeeList) {
            if (employee.getEmployeeId() == id) {
                System.out.print("Enter new Name: ");
                String name = inputScanner.nextLine();
                System.out.print("Enter new Salary: ");
                double salary = inputScanner.nextDouble();
                employee.setEmployeeName(name);
                employee.setEmployeeSalary(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 = inputScanner.nextInt();
        inputScanner.nextLine();

        employeeList.removeIf(employee -> employee.getEmployeeId() == id);
        System.out.println("Employee removed successfully!");
    }

    private static void searchEmployee() {
        System.out.print("Enter Employee ID to search: ");
        int id = inputScanner.nextInt();
        inputScanner.nextLine();

        for (Employee employee : employeeList) {
            if (employee.getEmployeeId() == id) {
                System.out.println(employee.showDetails());
                return;
            }
        }
        System.out.println("Employee not found!");
    }

    private static void displayEmployees() {
        if (employeeList.isEmpty()) {
            System.out.println("No employees found.");
```

```
            return;
        }
        for (Employee employee : employeeList) {
            System.out.println(employee.showDetails());
        }
    }
}
```

Output:





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 {
    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

```
Card Collection Manager
1. Add Card
2. Find Cards by Symbol
3. Display All Cards
4. Remove Card
5. Count Cards by Symbol
6. Check if a Card Exists
7. Exit
Enter your choice: 1
Enter Card Symbol: DIAMOND
Enter Card Number: 5
Card added successfully!

Card Collection Manager
1. Add Card
2. Find Cards by Symbol
3. Display All Cards
4. Remove Card
5. Count Cards by Symbol
6. Check if a Card Exists
7. Exit
Enter your choice: 1
Enter Card Symbol: HEART
Enter Card Number: ACE
Card added successfully!

Card Collection Manager
1. Add Card
2. Find Cards by Symbol
3. Display All Cards
4. Remove Card
5. Count Cards by Symbol
6. Check if a Card Exists
```

```
5. Count Cards by Symbol
6. Check if a Card Exists
7. Exit
Enter your choice: 3
Symbol: DIAMOND, Name: 5
Symbol: HEART, Name: ACE

Card Collection Manager
1. Add Card
2. Find Cards by Symbol
3. Display All Cards
4. Remove Card
5. Count Cards by Symbol
6. Check if a Card Exists
7. Exit
Enter your choice: 7
Exiting...


...Program finished with exit code 0
Press ENTER to exit console.
```

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.
- Implementing `switch-case` and loops for menu-driven execution.
- 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, 4, "VIP-1",
    Thread.MAX_PRIORITY);
            TicketBookingThread vip2 = new TicketBookingThread(system, 1, "VIP-2",
    Thread.MAX_PRIORITY);
            TicketBookingThread normal1 = new TicketBookingThread(system, 3, "User-1",
    Thread.MIN_PRIORITY);
            TicketBookingThread normal2 = new TicketBookingThread(system, 1, "User-2",
    Thread.MIN_PRIORITY);
            TicketBookingThread normal3 = new TicketBookingThread(system, 4, "User-3",
    Thread.NORM_PRIORITY);

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

4. Output:

```
VIP-1 successfully booked seat 4
User-3 - Seat 4 is already booked!
User-1 successfully booked seat 3
User-2 successfully booked seat 1
VIP-2 - Seat 1 is already booked!


...Program finished with exit code 0
Press ENTER to exit console.
```

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.