Experiment 5

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Subject Name: JAVA **Subject Code: 22ITH-359**

Problem 1

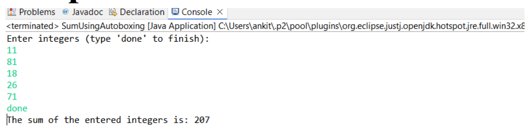
1. **Aim:** To develop a program that demonstrates the use of wrapper classes with a focus on autoboxing and unboxing by calculating the sum of a list of integers.

2. **Objective:**
   - To demonstrate the use of wrapper classes like Integer in Java.
   - To implement autoboxing and unboxing for seamless conversion between primitive types and their wrapper objects.
   - To parse string inputs into integers using Integer.parseInt() for accurate data processing.
   - To calculate the sum of a list of integers efficiently.

3. **Code:**

```
package mathoperations;

import java.util.ArrayList;
import java.util.List;
import java.util.Scanner;

public class SumUsingAutoboxing {
   public static void main(String[] args) {
      Scanner scanner = new Scanner(System.in);
      List<Integer> numbers = new ArrayList<>();

      System.out.println("Enter integers (type 'done' to finish):");
      while (true) {
         String input = scanner.nextLine();
         if (input.equalsIgnoreCase("done")) break;
         try {
                numbers.add(Integer.parseInt(input));
            } catch (NumberFormatException e) {
                System.out.println("Invalid input. Please enter an integer or 'done'.");
            }
        }

        System.out.println("The sum of the entered integers is: " + calculateSum(numbers));
        scanner.close();
    }

    public static int calculateSum(List<Integer> numbers) {
        int sum = 0;
        for (int num : numbers) sum += num;
        return sum;
    }
}
```

4. Output:



Problems Javadoc Declaration Console

```
<terminated> SumUsingAutoboxing [Java Application] C:\Users\ankit\.p2\pool\plugins\org.eclipse.justj.openjdk.hotspot.jre.full.win32.x8
Enter integers (type 'done' to finish):
11
81
18
26
71
done
The sum of the entered integers is: 207
```

Fig 1. SUM OF INTEGER

5. Learning Outcomes:

- Understand the concept and usage of wrapper classes in Java.
- Implement autoboxing and unboxing for automatic type conversion between primitives and objects.
- Parse string inputs into numeric values using methods like Integer.parseInt().
- Develop skills in handling user input and managing exceptions effectively.
- Perform basic data processing tasks, such as calculating the sum of integers from user input.

Problem 2

Aim:

To develop a Java program that demonstrates **serialization** and **deserialization** of a Student object by saving its data (ID, name, and GPA) to a file and retrieving it later.

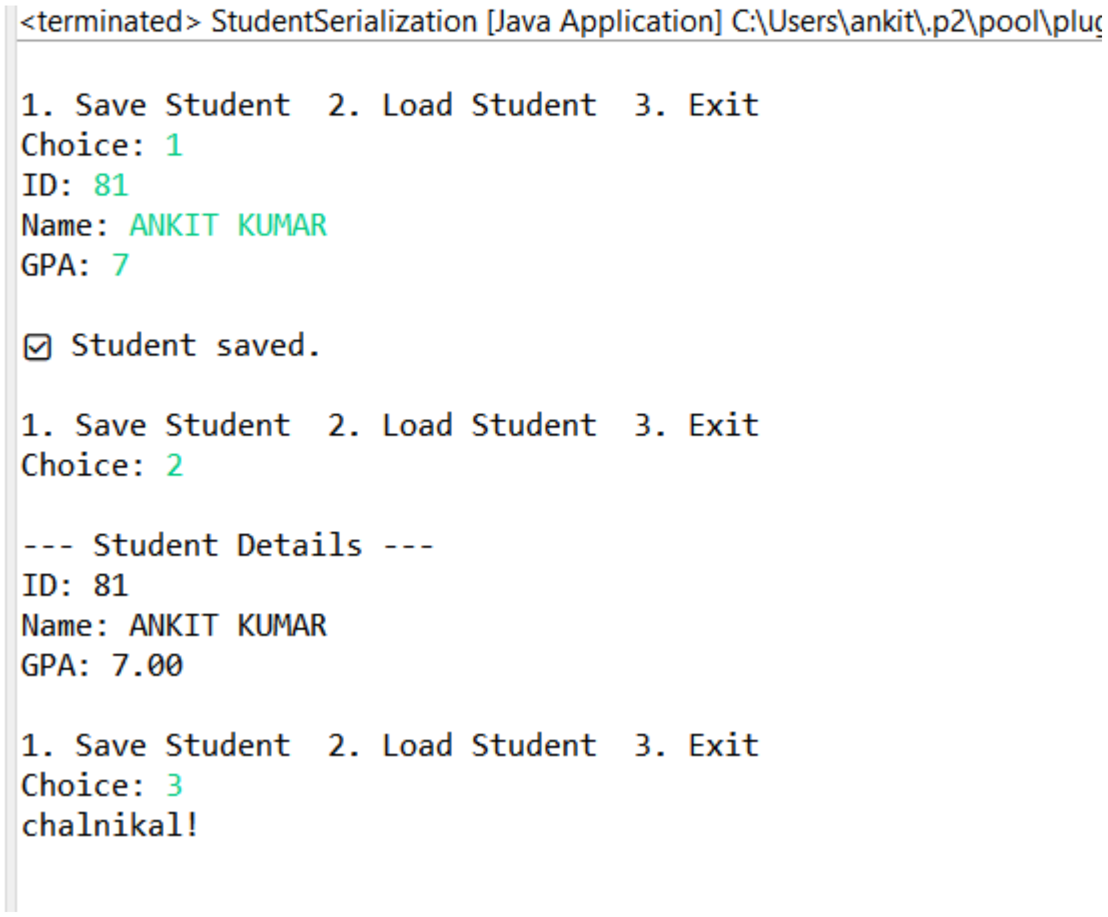
Objective:

- To implement serialization of a Student object and save it to a file.
- To perform deserialization and retrieve the object's data from the file.
- To handle file-related exceptions using proper exception handling mechanisms.
- To demonstrate persistent storage and retrieval of object data in Java.

Code:

```
package school;

import java.io.*;
import java.util.Scanner;

class BeStudent implements Serializable {
    private static final long serialVersionUID = 1L;
    private int id;
    private String name;
    private double gpa;

    public BeStudent(int id, String name, double gpa) {
        this.id = id;
        this.name = name;
        this.gpa = gpa;
    }

    public void display() {
        System.out.printf("\n--- Student Details ---\nID: %d\nName: %s\nGPA: %.2f\n", id,
name, gpa);
    }
}

class StudentFileManager {
    private static final String FILE = "student.ser";
    public static void save(BeStudent student) {
        try (ObjectOutputStream out = new ObjectOutputStream(new FileOutputStream(FILE)))
{
            out.writeObject(student);
            System.out.println("\n✅ Student saved.");
        } catch (IOException e) {
            System.out.println("❌ Save error: " + e.getMessage());
        }
    }

    public static BeStudent load() {
        if (!new File(FILE).exists()) return null;
        try (ObjectInputStream in = new ObjectInputStream(new FileInputStream(FILE))) {
            return (BeStudent) in.readObject();
        } catch (IOException | ClassNotFoundException e) {
            System.out.println("❌ Load error: " + e.getMessage());
        }
        return null;
    }
}

public class StudentSerialization {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        while (true) {
            System.out.print("\n1. Save Student  2. Load Student  3. Exit\nChoice: ");
            switch (sc.nextInt()) {
                case 1 -> {
                    System.out.print("ID: "); int id = sc.nextInt();
                    sc.nextLine(); // Consume newline
                    System.out.print("Name: "); String name = sc.nextLine();
                    System.out.print("GPA: "); double gpa = sc.nextDouble();
                    StudentFileManager.save(new BeStudent(id, name, gpa));
                }
                case 2 -> {
                    BeStudent s = StudentFileManager.load();
                    if (s != null) s.display();
                    else System.out.println("❌ No data found.");
                }
                case 3 -> {
                    System.out.println("Chalnikal!"); sc.close(); return;
                }
                default -> System.out.println("❌ Invalid choice.");
            }
        }
    }
```

Output:



```
<terminated> StudentSerialization [Java Application] C:\Users\ankit\.p2\pool\plu

1. Save Student  2. Load Student  3. Exit
Choice: 1
ID: 81
Name: ANKIT KUMAR
GPA: 7

☑ Student saved.

1. Save Student  2. Load Student  3. Exit
Choice: 2

--- Student Details ---
ID: 81
Name: ANKIT KUMAR
GPA: 7.00

1. Save Student  2. Load Student  3. Exit
Choice: 3
chalnikal!
```

Fig 2.1. Student details

1. Learning Outcomes:

- Understanding the concepts of serialization and deserialization in Java.
- Learning to save and retrieve object data from files using streams.
- Implement exception handling for common file I/O errors.
- Developing the ability to manage persistent object data efficiently.
- Gain hands-on experience with Java's ObjectOutputStream and ObjectInputStream classes.

Problem 3

1. Aim:

To develop a menu-based Java application for managing employee records, including adding new employees, displaying all employee details, and storing data persistently using file handling.

2. Objective:

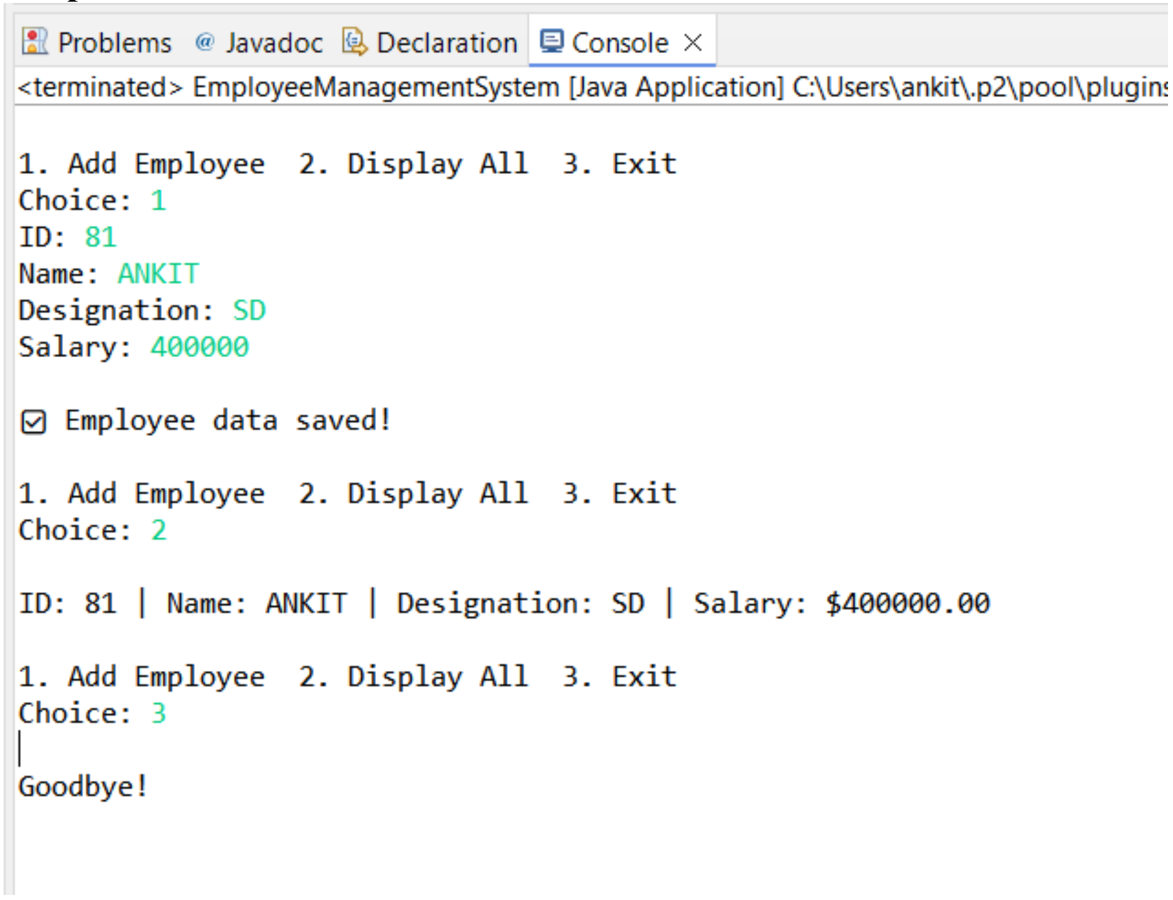
- To gather and store employee details (name, ID, designation, salary) in a file using file handling.
- To display all stored employee records from the file.
- To implement exception handling for robust file operations.
- To develop a user-friendly and efficient console-based interface for employee management..

3. Code:

```
package employees;
import java.io.*;
import java.util.ArrayList;
import java.util.List;
import java.util.Scanner;

class Employee implements Serializable {
    private static final long serialVersionUID = 1L;
    private int id;
    private String name;
    private String designation;
    private double salary;

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

    public void display() {
        System.out.printf("\nID: %d | Name: %s | Designation: %s | Salary: $%.2f\n", id,
name, designation, salary);
    }
}

class EmployeeFileManager {
    private static final String FILE = "employees.dat";

    public static void save(List<Employee> employees) {
        try (ObjectOutputStream out = new ObjectOutputStream(new
FileOutputStream(FILE))) {
            out.writeObject(employees);
            System.out.println("\n✅ Employee data saved!");
        } catch (IOException e) {
            System.out.println("❌ Save error: " + e.getMessage());
        }
    }

    @SuppressWarnings("unchecked")
    public static List<Employee> load() {
        File file = new File(FILE);
        if (!file.exists()) return new ArrayList<>();
        try (ObjectInputStream in = new ObjectInputStream(new FileInputStream(FILE))) {
            return (List<Employee>) in.readObject();
        } catch (IOException | ClassNotFoundException e) {
            System.out.println("❌ Load error: " + e.getMessage());
        }
        return new ArrayList<>();
    }
}
```

```
public class EmployeeManagementSystem {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        List<Employee> employees = EmployeeFileManager.load();

        while (true) {
            System.out.print("\n1. Add Employee  2. Display All  3. Exit\nChoice: ");
            switch (sc.nextInt()) {
                case 1 -> {
                    System.out.print("ID: "); int id = sc.nextInt();
                    sc.nextLine();
                    System.out.print("Name: "); String name = sc.nextLine();
                    System.out.print("Designation: "); String designation = sc.nextLine();
                    System.out.print("Salary: "); double salary = sc.nextDouble();
                    employees.add(new Employee(id, name, designation, salary));
                    EmployeeFileManager.save(employees);
                }
                case 2 -> {
                    if (employees.isEmpty()) System.out.println("\nNo employees found!");
                    else employees.forEach(Employee::display);
                }
                case 3 -> {
                    System.out.println("\nGoodbye!"); sc.close(); return;
                }
                default -> System.out.println("❌ Invalid choice.");
            }
        }
    }
}
```

4. Output:



```
<terminated> EmployeeManagementSystem [Java Application] C:\Users\ankit\.p2\pool\plugins

1. Add Employee  2. Display All  3. Exit
Choice: 1
ID: 81
Name: ANKIT
Designation: SD
Salary: 400000

☑ Employee data saved!

1. Add Employee  2. Display All  3. Exit
Choice: 2

ID: 81 | Name: ANKIT | Designation: SD | Salary: $400000.00

1. Add Employee  2. Display All  3. Exit
Choice: 3

Goodbye!
```

Fig 3.1. Employee Management System

5. Learning Outcomes:

- Implement file handling operations (read/write) in Java.
- Store and retrieve employee data from a file using object serialization.
- Develop a menu-driven application for managing employee data.
- Apply exception handling techniques to manage runtime errors effectively.
- Develop modular Java code using classes and methods for better maintainability.