Experiment - 5

Student Name: Md Rameez Ahmad **UID: 22BCS10314**
Branch: B.ECSE **Section: IOT-643-A**
Semester: 6th **DOP: 24/02/25**
Subject: PBLJ **Subject Code: 22CSH-359**

1) **Aim:** Develop Java programs using autoboxing, serialization, file handling, and efficient data processing and management.

2) **Problem Statement:**
   a. Write a Java program to calculate the sum of a list of integers using autoboxing and unboxing. Include methods to parse strings into their respective wrapper classes (e.g., Integer.parseInt()).
   b. Create a Java program to serialize and deserialize a Student object. The program should: Serialize a Student object (containing id, name, and GPA) and save it to a file. Deserialize the object from the file and display the student details. Handle FileNotFoundException, IOException, and ClassNotFoundException using exception handling.
   c. Create a menu-based Java application with the following options. 1.Add an Employee 2. Display All 3. Exit If option 1 is selected, the application should gather details of the employee like employee name, employee id, designation and salary and store it in a file. If option 2 is selected, the application should display all the employee details. If option 3 is selected the application should exit.

3) **Algorithm:**

a. Sum of a List of Integers Using Autoboxing and Unboxing:
- Initialize a list of integers.
- Convert a list of string numbers into integers using `Integer.parseInt()`.
- Use autoboxing to store the integers in an `ArrayList<Integer>`.
- Iterate through the list and use unboxing to sum the integers.
- Display the sum.

b. Serialization & Deserialization of Student Object:
- Create a Student class with attributes: ID, Name, and GPA.
- Implement Serializable interface in the Student class.
- Serialize the object using ObjectOutputStream and save it in a file.
- Deserialize the object using ObjectInputStream and display its attributes.
- Handle exceptions: FileNotFoundException, IOException, and ClassNotFoundException.

c. Menu-based Employee Management System:
- Create an `Employee` class with attributes: ID, Name, Designation, and Salary.
- Implement a menu-driven system:

  Option 1: Take employee details as input and save to a file.
  Option 2: Read from the file and display all employee records.

  Option 3: Exit the application.

- Use serialization to store and retrieve employee data.

4) Program:

a. Sum of a List of Integers Using Autoboxing and Unboxing:

```
import java.util.ArrayList; import
java.util.List;

public class AutoBoxingSum {     public static
void main(String[] args) {         // Given list of
strings representing numbers
        String[] strNumbers = {"10", "20", "30", "40", "50"};

        // Autoboxing: Converting string array into a list of Integers
        List<Integer> numbers = new ArrayList<>();
        for (String str : strNumbers) {
            numbers.add(Integer.parseInt(str));  // Autoboxing
        }

        // Calculating the sum with unboxing
        int sum = 0;         for (Integer
num : numbers) {             sum +=
num;  // Unboxing
        }

        // Displaying the sum
        System.out.println("Sum of numbers: " + sum);
    }
}
```

b. Serialization & Deserialization of Student Object:

```
import java.io.*;

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

    public Student(int id, String name, double gpa) {
        this.id = id;
this.name = name;
this.gpa = gpa;
    }
    public void display() {
        System.out.println("ID: " + id + ", Name: " + name + ", GPA: " + gpa);
    }
}

public class StudentSerialization {
public static void main(String[] args) {
String filename = "student_data.ser";

        // Creating a student object
        Student student = new Student(101, "Alice", 3.9);

        // Serialization
        try (ObjectOutputStream out = new ObjectOutputStream(new
FileOutputStream(filename))) {              out.writeObject(student);
            System.out.println("Student object serialized successfully.");
        } catch (IOException e) {
            System.err.println("Error during serialization: " + e);
        }

        // Deserialization
        try (ObjectInputStream in = new ObjectInputStream(new FileInputStream(filename))) {
            Student deserializedStudent = (Student) in.readObject();
System.out.println("Deserialized Student details:");
deserializedStudent.display();          } catch
(FileNotFoundException e) {
            System.err.println("File not found: " + e);
        } catch (IOException e) {
            System.err.println("I/O error: " + e);
        } catch (ClassNotFoundException e) {
            System.err.println("Class not found: " + e);
        }
    }
}
```

c. Menu-based Employee Management System:

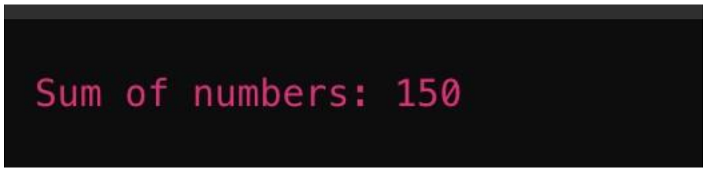
```
import java.io.*; import
java.util.ArrayList; import
java.util.List;
import java.util.Scanner;
```

```
class Employee implements Serializable {
private static final long serialVersionUID = 1L;
int id;
   String name, designation;
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.println("ID: " + id + ", Name: " + name + ", Designation: " + designation + ", Salary: "
+ salary);
   }
}

public class EmployeeManagement {
   static final String FILE_NAME = "employees.ser";

   public static void main(String[] args) {
Scanner scanner = new Scanner(System.in);
      List<Employee> employees = loadEmployees();

      while (true) {
         System.out.println("\nMenu:\n1. Add Employee\n2. Display All\n3. Exit");
         System.out.print("Choose an option: ");
int choice = scanner.nextInt();

         switch (choice) {
case 1:
               // Adding an employee
               System.out.print("Enter Employee ID: ");
               int id = scanner.nextInt();
scanner.nextLine();  // Consume newline
               System.out.print("Enter Name: ");
               String name = scanner.nextLine();
               System.out.print("Enter Designation: ");
               String designation = scanner.nextLine();
System.out.print("Enter Salary: ");                    double
salary = scanner.nextDouble();

               employees.add(new Employee(id, name, designation, salary));
saveEmployees(employees);
               System.out.println("Employee added successfully!");
```

```
                    break;
                case
2:
                    // Displaying all employees
                    System.out.println("\nEmployee Details:");
if (employees.isEmpty()) {
                        System.out.println("No employee records found.");
                    } else {
                        for (Employee emp : employees) {
                            emp.display();
                        }
}
break;
                case
3:
                    // Exit the program
                    System.out.println("Exiting the application...");
scanner.close();                System.exit(0);
                    break;

default:
                    System.out.println("Invalid choice. Try again.");
            }
        }
    }

    // Load employees from the file
    public static List<Employee> loadEmployees() {
        try (ObjectInputStream in = new ObjectInputStream(new FileInputStream(FILE_NAME))) {
return (List<Employee>) in.readObject();        } catch (FileNotFoundException e) {
return new ArrayList<>();
        } catch (IOException | ClassNotFoundException e) {
e.printStackTrace();            return new ArrayList<>();
        }
    }

    // Save employees to the file
    public static void saveEmployees(List<Employee> employees) {
        try (ObjectOutputStream out = new ObjectOutputStream(new FileOutputStream(FILE_NAME))) {
out.writeObject(employees);        } catch (IOException e) {            e.printStackTrace();
        }
    }
}
```

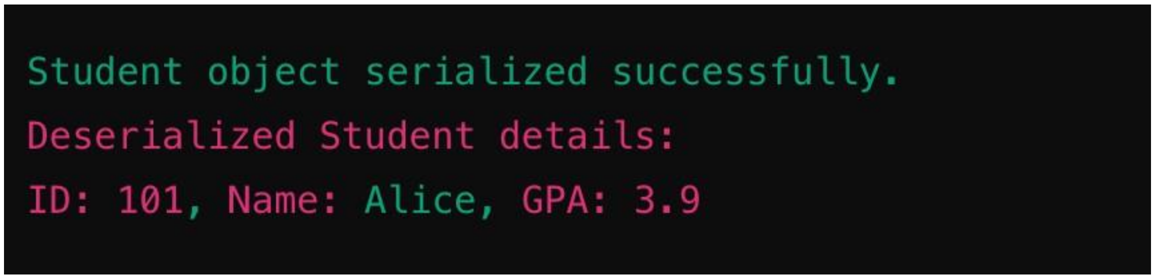
5) OUTPUT:

a. **Sum of a List of Integers Using Autoboxing and Unboxing:**



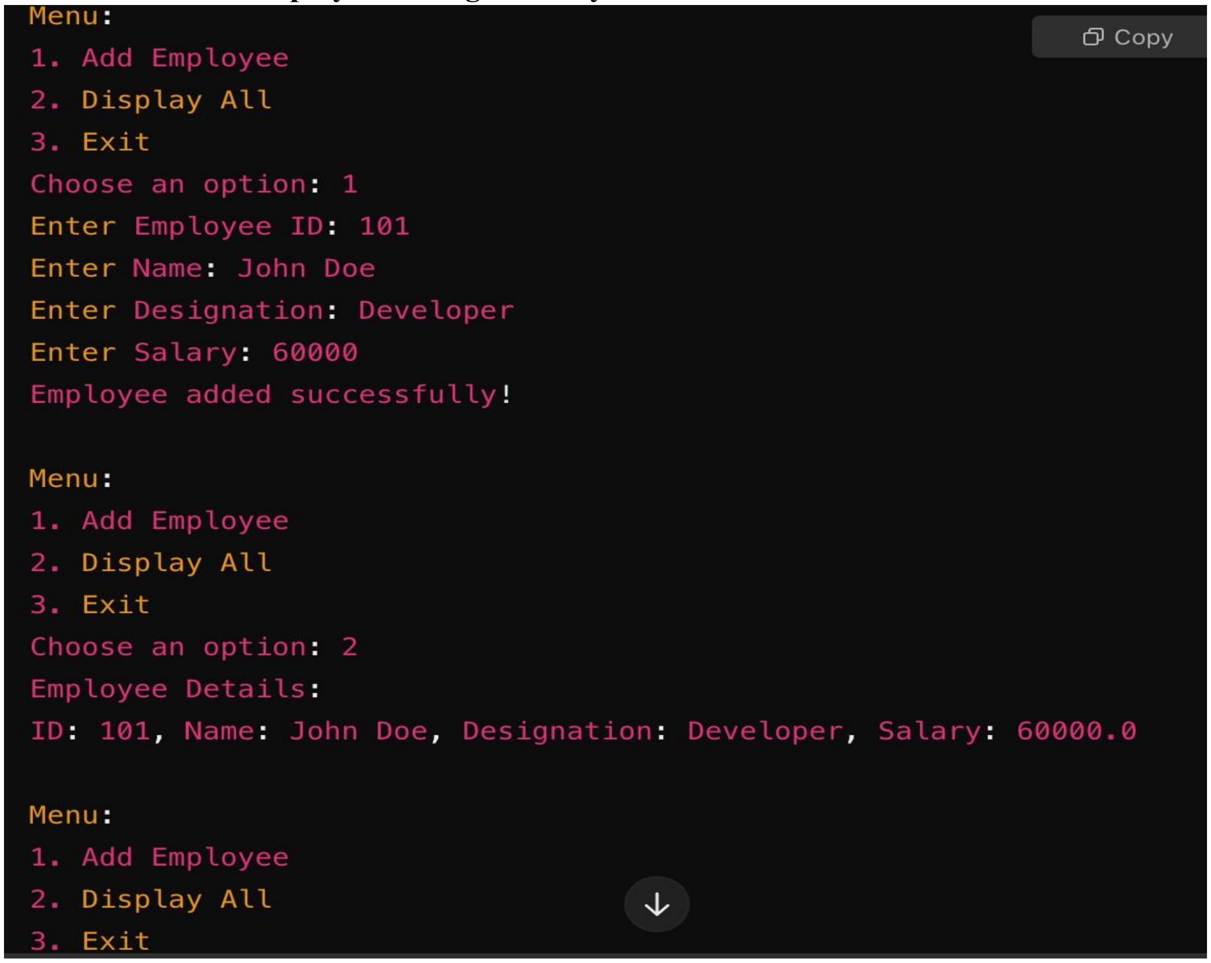
```
Sum of numbers: 150
```

b. **Serialization & Deserialization of Student Object:**



```
Student object serialized successfully.
Deserialized Student details:
ID: 101, Name: Alice, GPA: 3.9
```

c. **Menu-based Employee Management System:**



```
Menu:
1. Add Employee
2. Display All
3. Exit
Choose an option: 1
Enter Employee ID: 101
Enter Name: John Doe
Enter Designation: Developer
Enter Salary: 60000
Employee added successfully!

Menu:
1. Add Employee
2. Display All
3. Exit
Choose an option: 2
Employee Details:
ID: 101, Name: John Doe, Designation: Developer, Salary: 60000.0

Menu:
1. Add Employee
2. Display All
3. Exit
```

6) Learning Outcomes:

Understand and implement **autoboxing and unboxing** in Java.
Learn **serialization and deserialization** to store and retrieve objects.
Gain proficiency in **file handling** for data storage and retrieval.
Develop **exception handling** skills for robust applications.
Design and implement a **menu-driven application** for user interaction.
Work with **object-oriented programming (OOP) concepts** in Java.
Build real-world **data management applications** using Java.