

Experiment 5.1

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Aim: 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()).

Objective: Demonstrate **autoboxing** and **unboxing** in Java by converting string numbers into Integer objects, storing them in a list, and computing their sum.

Algorithm:

Step 1: Initialize the Program

1. Start the program.
2. Import ArrayList and List classes.
3. Define the AutoboxingExample class.

Step 2: Convert String Array to Integer List

1. Define the method parseStringArrayToIntegers(String[] strings).
2. Create an empty ArrayList<Integer>.
3. Iterate through the string array:
 - o Convert each string to an Integer using Integer.parseInt(str).
 - o Add the integer to the list (**autoboxing** happens here).
4. Return the list of integers.

Step 3: Calculate the Sum of Integers

1. Define the method calculateSum(List<Integer> numbers).
2. Initialize a variable sum to 0.
3. Iterate through the list:
 - o Extract each integer (**unboxing** happens here).
 - o Add it to sum.
4. Return the total sum.

Step 4: Execute Main Function

1. Define main(String[] args).
2. Create a string array with numeric values.
3. Call parseStringArrayToIntegers() to convert it into a list of integers.
4. Call calculateSum() to compute the sum.
5. Print the result.

Step 5: Terminate the Program

1. End the execution.

Code:

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

public class AutoboxingExample {
    public static void main(String[] args) {
        String[] numberStrings = {"50", "30", "30", "40", "50"};

        List<Integer> numbers = parseStringArrayToIntegers(numberStrings);

        int sum = calculateSum(numbers);

        System.out.println("The sum of the numbers is: " + sum);
    }

    public static List<Integer> parseStringArrayToIntegers(String[] strings) {
        List<Integer> integerList = new ArrayList<>();
        for (String str : strings) {
            integerList.add(Integer.parseInt(str));
        }
        return integerList;
    }

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

Output:

```
PS C:\Users\kusha> ^C
PS C:\Users\kusha>
PS C:\Users\kusha> & 'C:\Program Files\Java\jdk-17\bin\java.exe' '-XX:+ShowCodeDetailsInExceptionMessages' '-cp' 'C:\Users\kusha\AppData\Local\Temp\vscodesws_89cb4\jdt_ws\jdt.ls-java-project\bin' 'AutoboxingExample'
The sum of the numbers is: 200
PS C:\Users\kusha> █
```

Learning Outcomes:

- Understand the concept of **autoboxing and unboxing** in Java and how primitive types are automatically converted to their wrapper classes and vice versa.
- Learn how to **convert string values into Integer objects** using `Integer.parseInt()` and store them in a list.
- Gain experience in **working with ArrayLists** to store and manipulate a collection of numbers dynamically.
- Develop proficiency in **iterating through collections** and performing arithmetic operations like summation.

Experiment 5.2

1. Aim: 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.

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. Algorithm:

Step 1: Initialize the Program

1. Start the program.
2. Import the necessary classes (java.io.*).
3. Define a Student class implementing Serializable.
4. Declare attributes:
 - id (int)
 - name (String)
 - gpa (double)
5. Define a constructor to initialize Student objects.
6. Override toString() to display student details.

Step 2: Define the Serialization Method

1. Create serializeStudent(Student student).
2. Use a try-with-resources block to create an ObjectOutputStream:
 - Open a FileOutputStream to write to student.ser.
 - Write the Student object to the file using writeObject().
3. Handle exceptions:
 - FileNotFoundException → Print error message.
 - IOException → Print error message.
4. Print a success message if serialization is successful.

Step 3: Define the Deserialization Method

1. Create deserializeStudent().
2. Use a try-with-resources block to create an ObjectInputStream:
 - Open a FileInputStream to read student.ser.
 - Read the Student object using readObject().
3. Handle exceptions:
 - FileNotFoundException → Print error message.
 - IOException → Print error message.
 - ClassNotFoundException → Print error message.
4. Print the deserialized student details.

Step 4: Execute Main Function

1. Define main(String[] args).
2. Create a Student object with sample data.
3. Call serializeStudent() to save the object.
4. Call deserializeStudent() to read and display the object.

Step 5: Terminate the Program

1. End execution.

4. Implementation Code:

```
import java.io.*;

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

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

    @Override
    public String toString() {
        return "Student{id=" + id + ", name=" + name + ", gpa=" + gpa + "}";
    }
}

public class StudentSerialization {
    private static final String FILE_NAME = "student.ser";

    public static void main(String[] args) {
        Student student = new Student(1, "Kushan Jigyasu", 7.4);
        serializeStudent(student);
        deserializeStudent();
    }

    public static void serializeStudent(Student student) {
        try (ObjectOutputStream oos = new ObjectOutputStream(new
        FileOutputStream(FILE_NAME))) {
            oos.writeObject(student);
            System.out.println("Student object serialized successfully.");
        } catch (FileNotFoundException e) {
            System.err.println("File not found: " + e.getMessage());
        } catch (IOException e) {
            System.err.println("IOException occurred: " + e.getMessage());
        }
    }

    public static void deserializeStudent() {
        try (ObjectInputStream ois = new ObjectInputStream(new FileInputStream(FILE_NAME)))
        {
            Student student = (Student) ois.readObject();
            System.out.println("Deserialized Student: " + student);
        } catch (FileNotFoundException e) {
            System.err.println("File not found: " + e.getMessage());
        } catch (IOException e) {
            System.err.println("IOException occurred: " + e.getMessage());
        } catch (ClassNotFoundException e) {

```



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```
        System.err.println("Class not found: " + e.getMessage());
    }
}
}
```

5. Output

```
PS C:\Users\kusha> ^C
PS C:\Users\kusha>
PS C:\Users\kusha> & 'C:\Program Files\Java\jdk-17\bin\java.exe' '-XX:+ShowCodeDetailsInExceptionMessages' '-cp' 'C:\Users\kusha\AppData\Local\Temp\vscodesws_89cb4\jdt_ws\jdt.ls-java-project\bin' 'StudentSerialization'
Student object serialized successfully.
Deserialized Student: Student{id=1, name='Kushan Jigyasu', gpa=7.4}
PS C:\Users\kusha>
```

6. Learning Outcomes:

- Understand object serialization and deserialization in Java.
- Learn how to use ObjectOutputStream and ObjectInputStream for file operations.
- Implement exception handling for FileNotFoundException, IOException, and ClassNotFoundException.
- Gain hands-on experience in storing and retrieving objects from a file.
- Develop skills in data persistence and file management using Java.

Experiment 5.3

1. **Aim:** 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.
2. **Objective:** The objective is to develop a menu-based Java application that allows users to **add employee details, store them in a file, and display all stored employee records**, with an option to exit the program.

3. Algorithm:

Step 1: Initialize the Program

1. Start the program.
2. Import `java.util.*` and `java.util.concurrent.*` for thread handling.
3. Define a class `TicketBookingSystem` with:
 - A `List<Boolean>` representing seat availability (true for available, false for booked).
 - A synchronized method `bookSeat(int seatNumber, String passengerName)` to ensure thread safety.

Step 2: Implement Seat Booking Logic

1. Define `bookSeat(int seatNumber, String passengerName)`:
 - If the seat is available (true), mark it as booked (false).
 - Print confirmation: "Seat X booked successfully by Y".
 - If already booked, print: "Seat X is already booked."

Step 3: Define Booking Threads

1. Create a class `PassengerThread` extending `Thread`:
 - Store passenger name, seat number, and booking system reference.
 - Implement `run()` method to call `bookSeat()`.

Step 4: Assign Thread Priorities

1. Create VIP and Regular passenger threads.
2. Set higher priority for VIP passengers using `setPriority(Thread.MAX_PRIORITY)`.
3. Set default priority for regular passengers.

Step 5: Handle User Input & Simulate Booking

1. In `main()`, create an instance of `TicketBookingSystem`.
2. Accept number of seats and bookings from the user.
3. Create multiple `PassengerThread` instances for VIP and regular passengers.
4. Start all threads using `start()`.

Step 6: Synchronization & Preventing Double Booking

1. Use the synchronized keyword in `bookSeat()` to ensure only one thread accesses it at a time.
2. Ensure thread execution order by assigning higher priority to VIP threads.

Step 7: Display Final Booking Status

1. After all threads finish execution, display the list of booked seats.
2. End the program with a message: "All bookings completed successfully."

4. Implementation Code:

```
import java.io.*;
import java.util.*;
```

```
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;
}

@Override
public String toString() {
    return "Employee ID: " + id + ", Name: " + name + ", Designation: " + designation
+ ", Salary: " + salary;
}
}

public class EmployeeManagementSystem {
    private static final String FILE_NAME = "employees.ser";
    private static List<Employee> employees = new ArrayList<>();

    public static void addEmployee() {
        Scanner scanner = new Scanner(System.in);
        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 Designation: ");
        String designation = scanner.nextLine();
        System.out.print("Enter Salary: ");
        double salary = scanner.nextDouble();

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

    public static void displayAllEmployees() {
        loadEmployees();
        if (employees.isEmpty()) {
            System.out.println("No employees found.");
        } else {
            for (Employee employee : employees) {
                System.out.println(employee);
            }
        }
    }
}
```

```
private static void saveEmployees() {
    try (ObjectOutputStream oos = new ObjectOutputStream(new
FileOutputStream(FILE_NAME))) {
        oos.writeObject(employees);
    } catch (IOException e) {
        System.err.println("Error saving employees: " + e.getMessage());
    }
}

@SuppressWarnings("unchecked")
private static void loadEmployees() {
    try (ObjectInputStream ois = new ObjectInputStream(new
FileInputStream(FILE_NAME))) {
        employees = (List<Employee>) ois.readObject();
    } catch (FileNotFoundException e) {
        employees = new ArrayList<>();
    } catch (IOException | ClassNotFoundException e) {
        System.err.println("Error loading employees: " + e.getMessage());
    }
}

public static void main(String[] args) {
    Scanner scanner = new Scanner(System.in);
    while (true) {
        System.out.println("\nEmployee Management System");
        System.out.println("1. Add an Employee");
        System.out.println("2. Display All Employees");
        System.out.println("3. Exit");
        System.out.print("Enter your choice: ");
        int choice = scanner.nextInt();
        scanner.nextLine();

        switch (choice) {
            case 1:
                addEmployee();
                break;
            case 2:
                displayAllEmployees();
                break;
            case 3:
                System.out.println("Exiting...");
                return;
            default:
                System.out.println("Invalid choice! Please try again.");
        }
    }
}
```


5. Output:

```
1. Add an Employee
2. Display All Employees
3. Exit
Enter your choice: 1
Enter Employee ID: 111
Enter Employee Name: Kushan Jigyasu
Enter Designation: HR
Enter Salary: 10,000
Employee added successfully!

Employee Management System
1. Add an Employee
2. Display All Employees
3. Exit
Enter your choice: █
```

6. Learning Outcomes:

- Understand file handling and serialization in Java to store and retrieve objects persistently.
- Learn how to implement a menu-driven console application using loops and conditional statements.
- Gain experience in object-oriented programming (OOP) by defining and managing Employee objects.
- Practice exception handling to manage file-related errors like FileNotFoundException and IOException.
- Develop skills in list manipulation and user input handling using ArrayList and Scanner.