ALGORITHMS_ DATA STRUCTURES.

Exercise 1: Inventory Management System

Inventorymanager.java

Code:

```
package Inventory;

import java.util.HashMap;

public class InventoryManager {

    private HashMap<String, Product> inventory = new HashMap<>();

    public void addProduct(Product product) {

        inventory.put(product.getProductId(), product);

    }


    public void updateProduct(String productId, String name, int quantity, double price) {

        Product product = inventory.get(productId);

        if (product != null) {

            product.setProductName(name);

            product.setQuantity(quantity);

            product.setPrice(price);

        } else {

            System.out.println("Product not found.");

        }

    }

    public void deleteProduct(String productId) {

        if (inventory.remove(productId) == null) {

            System.out.println("Product not found.");

        }

    }

    public void displayInventory() {
```

```
        for (Product product : inventory.values()) {
            System.out.println(product);
        }
    }
}
```

Main.java:

Code:

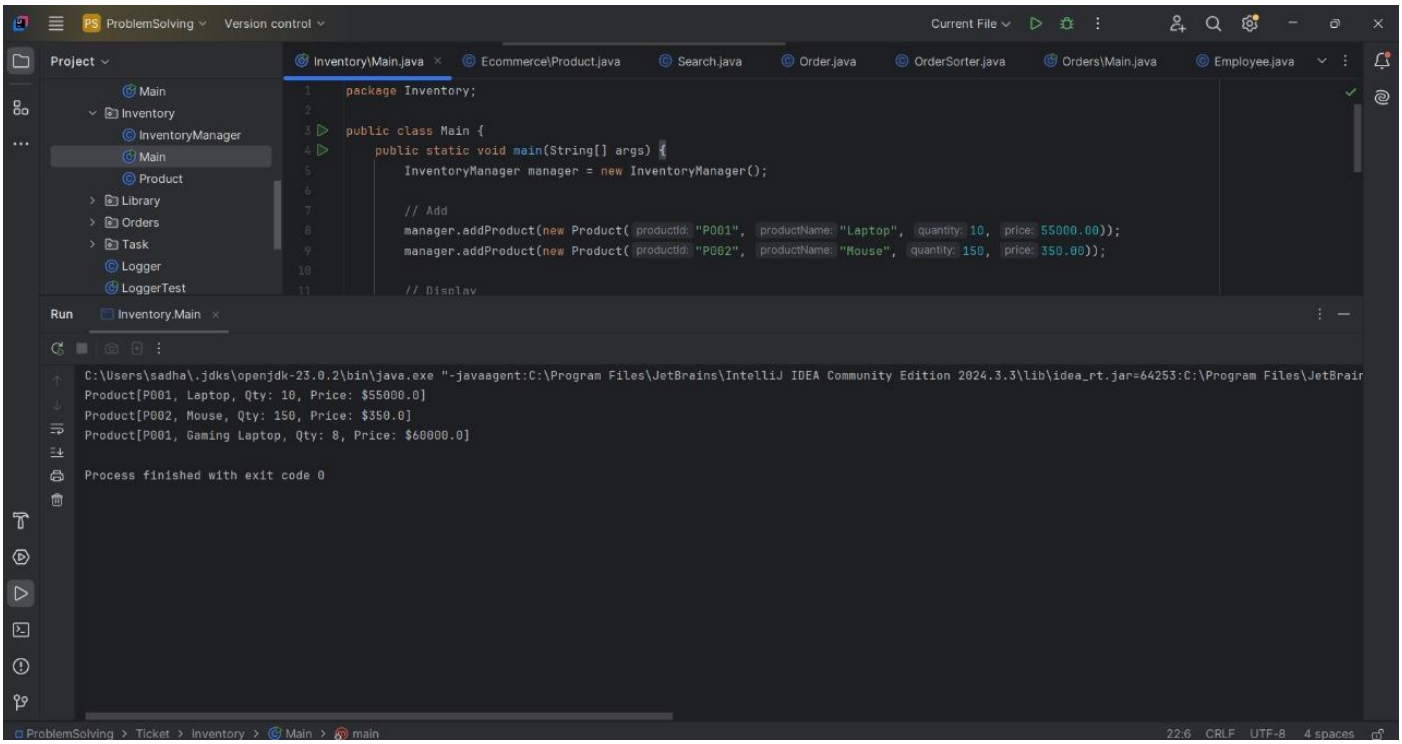
```
package Inventory;
public class Main {
    public static void main(String[] args) {
        InventoryManager manager = new InventoryManager();
        manager.addProduct(new Product("P001", "Laptop", 10, 55000.00));
        manager.addProduct(new Product("P002", "Mouse", 150, 350.00));
        manager.displayInventory();
        manager.updateProduct("P001", "Gaming Laptop", 8, 60000.00);
        manager.deleteProduct("P002");
        manager.displayInventory();
    }
}
```

Product.java

```
package Inventory;
public class Product {
    private String productId;
    private String productName;
    private int quantity;
    private double price;

    public Product(String productId, String productName, int quantity, double price) {
        this.productId = productId;
        this.productName = productName;
        this.quantity = quantity;
```

```
        this.price = price;
    }
    public String getProductId() { return productId; }
    public String getProductName() { return productName; }
    public int getQuantity() { return quantity; }
    public double getPrice() { return price; }

    public void setProductName(String productName) { this.productName = productName; }
    public void setQuantity(int quantity) { this.quantity = quantity; }
    public void setPrice(double price) { this.price = price; }

    @Override
    public String toString() {
        return "Product[" + productId + ", " + productName + ", Qty: " + quantity + ", Price: $" + price + "]";
    }
}
```

OUTPUT:



Exercise 2: E-commerce Platform Search Function

Main.java:

```
package Ecommerce;
public class Main {
    public static void main(String[] args) {
        Product[] products = {
            new Product("P001", "Laptop", "Electronics"),
            new Product("P002", "Shoes", "Footwear"),
            new Product("P003", "Mouse", "Electronics"),
            new Product("P004", "Shirt", "Clothing"),
            new Product("P005", "Keyboard", "Electronics")
        };

        System.out.println("=== Linear Search ===");
        Product foundLinear = Search.linearSearch(products, "Mouse");
        System.out.println(foundLinear != null ? foundLinear : "Product not found");
        System.out.println("\n=== Binary Search ===");
        Search.sortProductsByName(products);
        Product foundBinary = Search.binarySearch(products, "Mouse");
        System.out.println(foundBinary != null ? foundBinary : "Product not found");
    }
}
```

Product.java:

```
package Ecommerce;
public class Product {
    private String productId;
    private String productName;
    private String category;
```

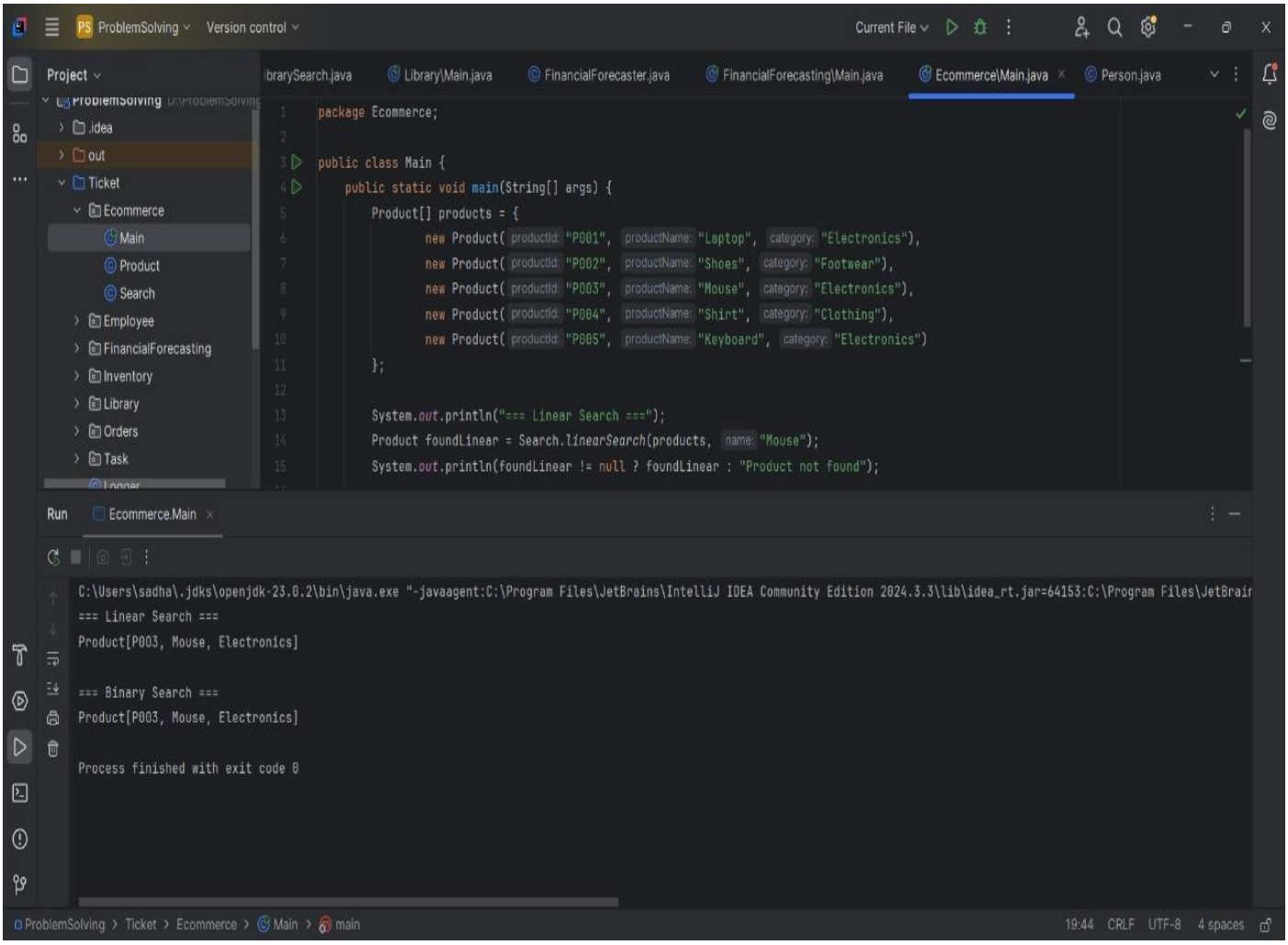
```
    public Product(String productId, String productName, String category) {
        this.productId = productId;
        this.productName = productName;
        this.category = category;
    }
    public String getProductId() { return productId; }
    public String getProductName() { return productName; }
    public String getCategory() { return category; }
    @Override
    public String toString() {
        return "Product[" + productId + ", " + productName + ", " + category + "]";
    }
}
```

Search.java:

```
package Ecommerce;
import java.util.Arrays;
import java.util.Comparator;
public class Search {
    public static Product linearSearch(Product[] products, String name) {
        for (Product product : products) {
            if (product.getProductName().equalsIgnoreCase(name)) {
                return product;
            }
        }
        return null;
    }
    public static Product binarySearch(Product[] products, String name) {
        int left = 0;
        int right = products.length - 1;
```

```
        while (left <= right) {
            int mid = (left + right) / 2;
            int cmp = products[mid].getProductName().compareToIgnoreCase(name);

            if (cmp == 0) return products[mid];
            else if (cmp < 0) left = mid + 1;
            else right = mid - 1;
        }
        return null;
    }
    public static void sortProductsByName(Product[] products) {
        Arrays.sort(products, Comparator.comparing(Product::getProductName,
String.CASE_INSENSITIVE_ORDER));
    }
}
```

Output:



<u>Exercise 3: Sorting Customer Orders</u>

Main.c

```
package Orders;

public class Main {

   public static void main(String[] args) {

      Order[] orders = {

            new Order("O001", "Alice", 1500.0),

            new Order("O002", "Bob", 950.0),

            new Order("O003", "Charlie", 2050.5),

            new Order("O004", "David", 1200.0)

      };


      System.out.println("Original Orders:");

      for (Order order : orders) System.out.println(order);
```

```
        System.out.println("\nSorted using Bubble Sort:");
        OrderSorter.bubbleSort(orders);
        for (Order order : orders) System.out.println(order);
        orders = new Order[]{
                new Order("O001", "Alice", 1500.0),
                new Order("O002", "Bob", 950.0),
                new Order("O003", "Charlie", 2050.5),
                new Order("O004", "David", 1200.0)
        };
        System.out.println("\nSorted using Quick Sort:");
        OrderSorter.quickSort(orders, 0, orders.length - 1);
        for (Order order : orders) System.out.println(order);
    }
}
```

Order.java:

```
package Orders;
public class Order {
    private String orderId;
    private String customerName;
    private double totalPrice;

    public Order(String orderId, String customerName, double totalPrice) {
        this.orderId = orderId;
        this.customerName = customerName;
        this.totalPrice = totalPrice;
    }

    public double getTotalPrice() { return totalPrice; }
```

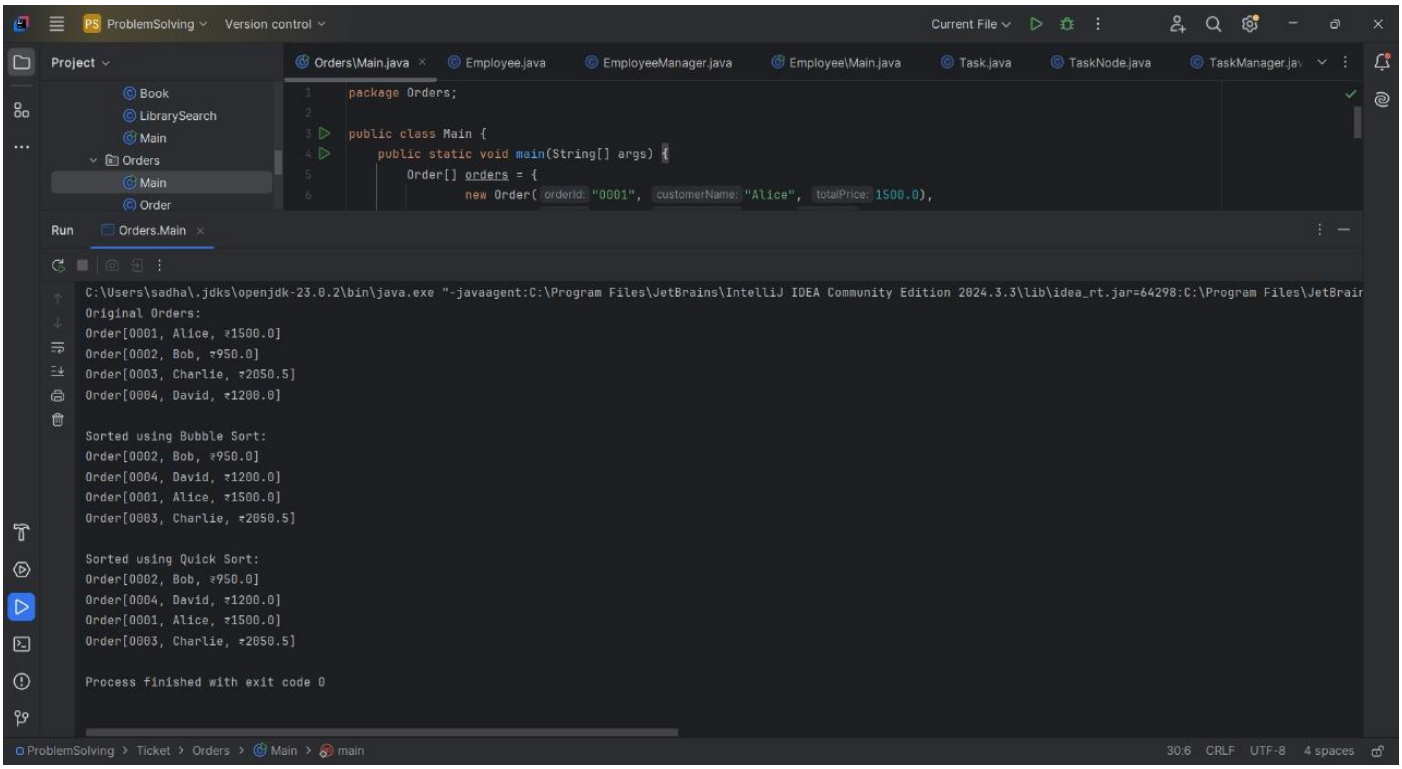
```
    @Override
    public String toString() {
        return "Order[" + orderId + ", " + customerName + ", ₹" + totalPrice + "]";
    }
}
```

Ordersorted.java:

```
package Orders;
public class OrderSorter {
    public static void bubbleSort(Order[] orders) {
        int n = orders.length;
        for (int i = 0; i < n - 1; i++) {
            boolean swapped = false;
            for (int j = 0; j < n - i - 1; j++) {
                if (orders[j].getTotalPrice() > orders[j + 1].getTotalPrice()) {
                    Order temp = orders[j];
                    orders[j] = orders[j + 1];
                    orders[j + 1] = temp;
                    swapped = true;
                }
            }
            if (!swapped) break;
        }
    }
    public static void quickSort(Order[] orders, int low, int high) {
        if (low < high) {
            int pivotIndex = partition(orders, low, high);
            quickSort(orders, low, pivotIndex - 1);
            quickSort(orders, pivotIndex + 1, high);
        }
    }
```

```
    private static int partition(Order[] orders, int low, int high) {
        double pivot = orders[high].getTotalPrice();
        int i = low - 1;
        for (int j = low; j < high; j++) {
            if (orders[j].getTotalPrice() <= pivot) {
                i++;
                Order temp = orders[i];
                orders[i] = orders[j];
                orders[j] = temp;
            }
        }
        Order temp = orders[i + 1];
        orders[i + 1] = orders[high];
        orders[high] = temp;
        return i + 1;
    }
}
```

Output:



Exercise 4: Employee Management System

Main.java

```
package Employee;

public class Main {

    public static void main(String[] args) {

        EmployeeManager manager = new EmployeeManager(5);


        manager.addEmployee(new Employee("E001", "Alice", "Manager", 75000));

        manager.addEmployee(new Employee("E002", "Bob", "Engineer", 50000));

        manager.addEmployee(new Employee("E003", "Charlie", "HR", 40000));


        System.out.println("All Employees:");

        manager.displayEmployees();


        System.out.println("\nSearch for E002:");

        Employee emp = manager.searchEmployee("E002");

        System.out.println(emp != null ? emp : "Not found");


        System.out.println("\nDelete E002:");

        manager.deleteEmployee("E002");


        System.out.println("\nAll Employees after deletion:");

        manager.displayEmployees();

    }

}
```

Employee.java

```
package Employee;

public class Employee {

    private String employeeId;

    private String name;
```

```
    private String position;
    private double salary;

    public Employee(String employeeId, String name, String position, double salary) {
        this.employeeId = employeeId;
        this.name = name;
        this.position = position;
        this.salary = salary;
    }

    public String getEmployeeId() { return employeeId; }
    public String getName() { return name; }
    public String getPosition() { return position; }
    public double getSalary() { return salary; }
    @Override
    public String toString() {
        return "Employee[" + employeeId + ", " + name + ", " + position + ", ₹" + salary + "]";
    }
}
```

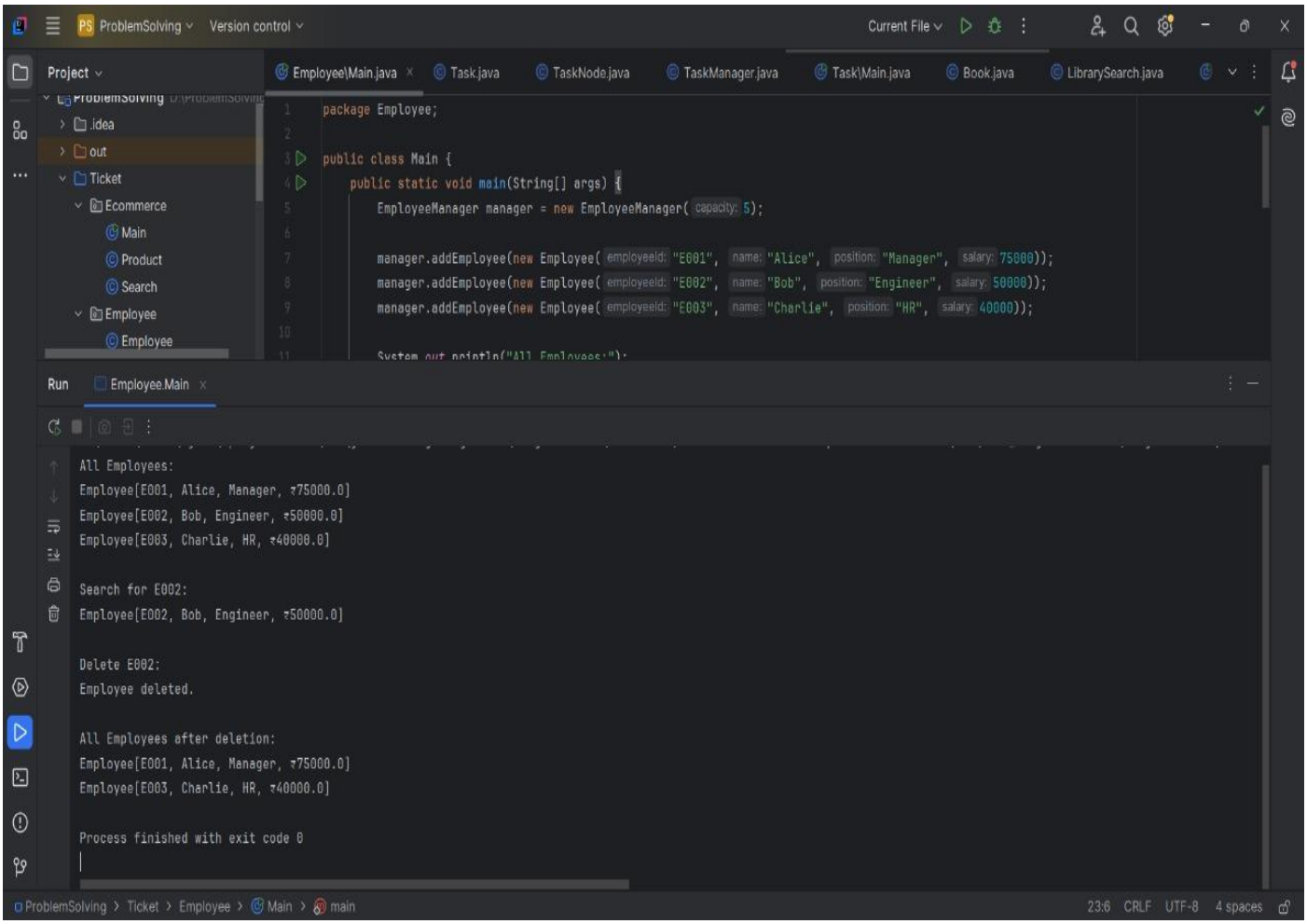
Employeemanager.java:

```
package Employee;
public class EmployeeManager {
    private Employee[] employees;
    private int size;

    public EmployeeManager(int capacity) {
        employees = new Employee[capacity];
        size = 0;
    }
    public void addEmployee(Employee emp) {
```

```
    if (size < employees.length) {
        employees[size++] = emp;
    } else {
        System.out.println("Cannot add more employees. Array is full.");
    }
}
public Employee searchEmployee(String empId) {
    for (int i = 0; i < size; i++) {
        if (employees[i].getEmployeeId().equals(empId)) {
            return employees[i];
        }
    }
    return null;
}

public void displayEmployees() {
    for (int i = 0; i < size; i++) {
        System.out.println(employees[i]);
    }
}
public void deleteEmployee(String empId) {
    int index = -1;
    for (int i = 0; i < size; i++) {
        if (employees[i].getEmployeeId().equals(empId)) {
            index = i;
            break;
        }
    }
    if (index != -1) {
        // Shift left
        for (int i = index; i < size - 1; i++) {
```

```
            employees[i] = employees[i + 1];
        }
        employees[--size] = null;
        System.out.println("Employee deleted.");
    } else {
        System.out.println("Employee not found.");
    }
  }
}
```

OUTPUT:



Exercise 5: Task Management System

Main.java:

```
package Task;

public class Main {

    public static void main(String[] args) {

        TaskManager manager = new TaskManager();


        manager.addTask(new Task("T001", "Design UI", "Pending"));

        manager.addTask(new Task("T002", "Implement Backend", "In Progress"));

        manager.addTask(new Task("T003", "Write Tests", "Pending"));


        System.out.println("All Tasks:");

        manager.displayTasks();


        System.out.println("\nSearch T002:");

        Task found = manager.searchTask("T002");

        System.out.println(found != null ? found : "Task not found");


        System.out.println("\nDeleting T002:");

        manager.deleteTask("T002");


        System.out.println("\nAll Tasks After Deletion:");

        manager.displayTasks();

    }

}
```

Task.java:

```
package Task;

public class Task {

    private String taskId;
```

```
    private String taskName;
    private String status;

    public Task(String taskId, String taskName, String status) {
        this.taskId = taskId;
        this.taskName = taskName;
        this.status = status;
    }

    public String getTaskId() { return taskId; }
    public String getTaskName() { return taskName; }
    public String getStatus() { return status; }

    public void setStatus(String status) { this.status = status; }

    @Override
    public String toString() {
        return "Task[" + taskId + ", " + taskName + ", " + status + "]";
    }
}
```

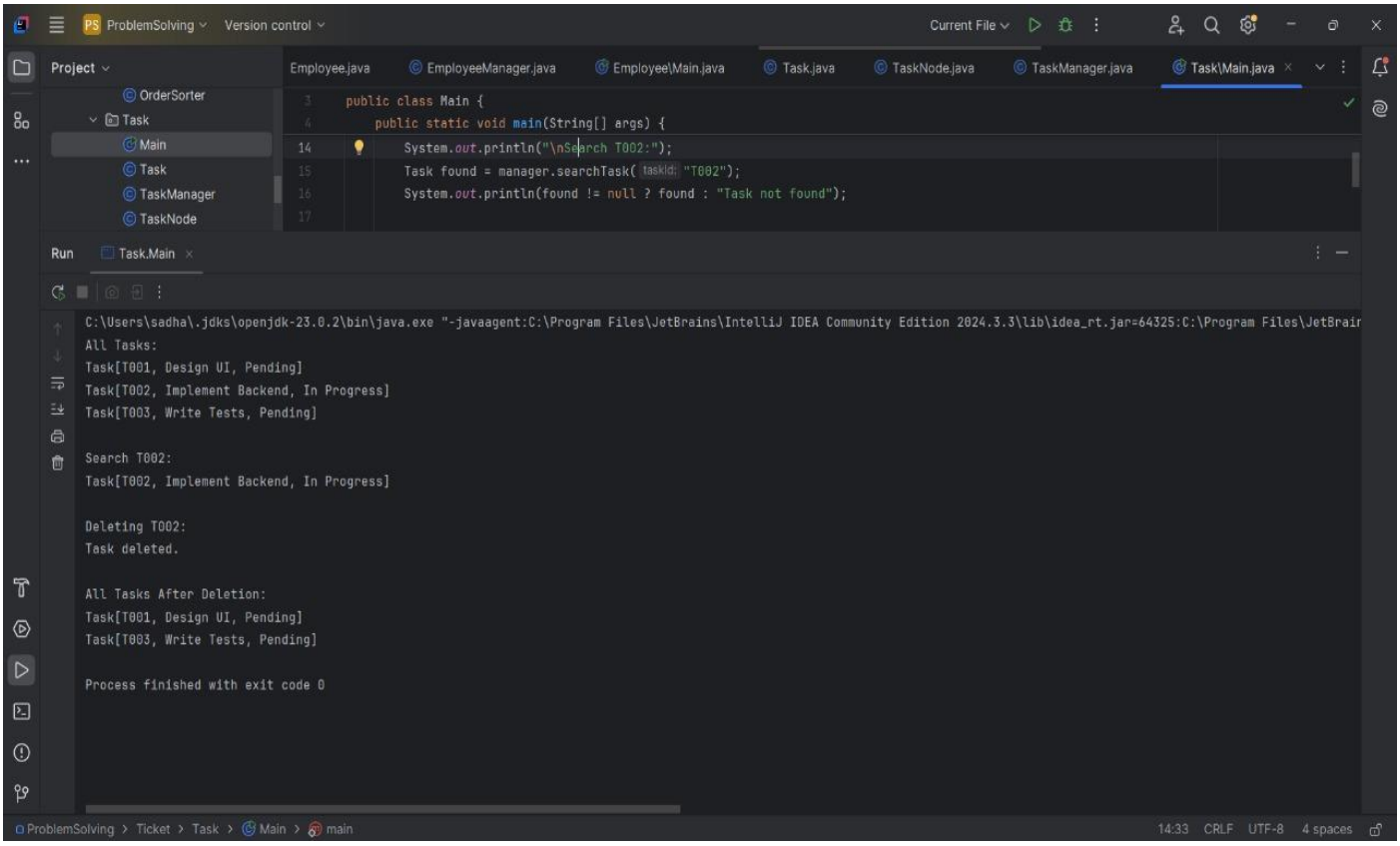
Taskmanager.java:

```
package Task;
public class TaskManager {
    private TaskNode head;
    public void addTask(Task task) {
        TaskNode newNode = new TaskNode(task);
        if (head == null) {
            head = newNode;
        } else {
            TaskNode current = head;
```

```
        while (current.next != null) {
            current = current.next;
        }
        current.next = newNode;
    }
}

public Task searchTask(String taskId) {
    TaskNode current = head;
    while (current != null) {
        if (current.task.getTaskId().equals(taskId)) {
            return current.task;
        }
        current = current.next;
    }
    return null;
}
public void displayTasks() {
    TaskNode current = head;
    while (current != null) {
        System.out.println(current.task);
        current = current.next;
    }
}
public void deleteTask(String taskId) {
    if (head == null) return;

    if (head.task.getTaskId().equals(taskId)) {
        head = head.next;
        System.out.println("Task deleted.");
        return;
```

```
        }

        TaskNode current = head;
        while (current.next != null && !current.next.task.getTaskId().equals(taskId)) {
            current = current.next;
        }
        if (current.next != null) {
            current.next = current.next.next;
            System.out.println("Task deleted.");
        } else {
            System.out.println("Task not found.");
        }
    }
}
```

OUTPUT:



Exercise 6: Library Management System

Main.java

```
package Library;

public class Main {

   public static void main(String[] args) {

      Book[] books = {

            new Book("B001", "The Alchemist", "Paulo Coelho"),

            new Book("B002", "Clean Code", "Robert C. Martin"),

            new Book("B003", "Atomic Habits", "James Clear"),

            new Book("B004", "1984", "George Orwell")

      };


      System.out.println("=== Linear Search ===");

      Book foundLinear = LibrarySearch.linearSearch(books, "Atomic Habits");

      System.out.println(foundLinear != null ? foundLinear : "Book not found");


      System.out.println("\n=== Binary Search ===");

      LibrarySearch.sortByTitle(books); // Must sort first

      Book foundBinary = LibrarySearch.binarySearch(books, "Atomic Habits");

      System.out.println(foundBinary != null ? foundBinary : "Book not found");

   }

}
```

Book.java

```
package Library;

public class Book {

   private String bookId;

   private String title;

   private String author;
```

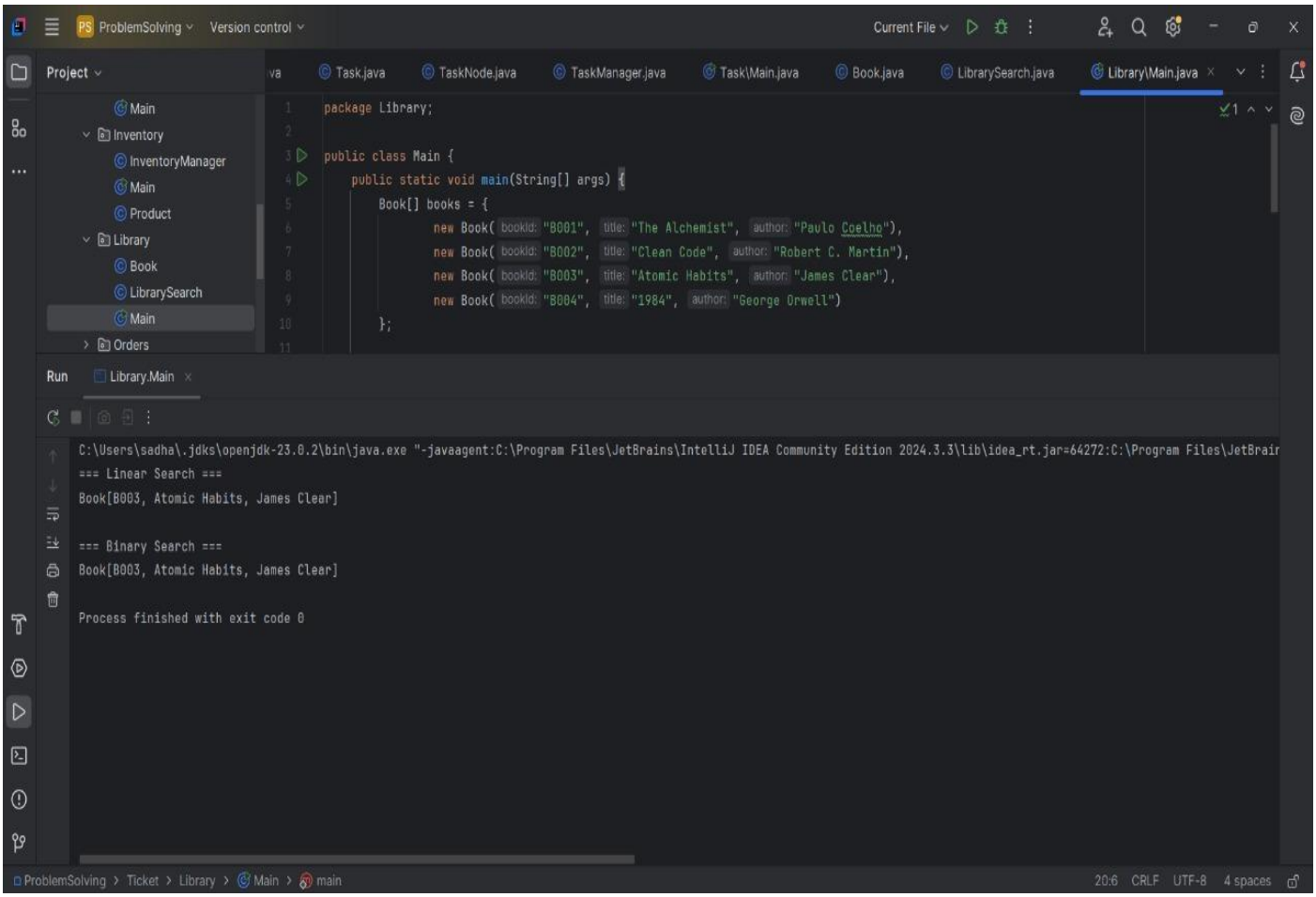
```
    public Book(String bookId, String title, String author) {
        this.bookId = bookId;
        this.title = title;
        this.author = author;
    }
    public String getTitle() { return title; }
    public String getAuthor() { return author; }

    @Override
    public String toString() {
        return "Book[" + bookId + ", " + title + ", " + author + "]";
    }
}
```

Library.java:

```
package Library;
import java.util.Arrays;
import java.util.Comparator;
public class LibrarySearch {
    public static Book linearSearch(Book[] books, String title) {
        for (Book book : books) {
            if (book.getTitle().equalsIgnoreCase(title)) {
                return book;
            }
        }
        return null;
    }
    public static Book binarySearch(Book[] books, String title) {
        int left = 0, right = books.length - 1;
        while (left <= right) {
            int mid = (left + right) / 2;
```

```
            int cmp = books[mid].getTitle().compareToIgnoreCase(title);
            if (cmp == 0) return books[mid];
            else if (cmp < 0) left = mid + 1;
            else right = mid - 1;
        }
        return null;
    }
    public static void sortByTitle(Book[] books) {
        Arrays.sort(books, Comparator.comparing(Book::getTitle, String.CASE_INSENSITIVE_ORDER));
    }
}
```

OUTPUT:



Exercise 7: Financial Forecasting

Main.java:

```
package FinancialForecasting;

public class Main {

    public static void main(String[] args) {

        double initialValue = 10000;

        double growthRate = 0.08; // 8%

        int years = 5;


        double result1 = FinancialForecaster.futureValueRecursive(initialValue, growthRate, years);

        System.out.printf("Future Value (Recursive): ₹%.2f%n", result1);


        double[] memo = new double[years + 1];

        double result2 = FinancialForecaster.futureValueMemo(initialValue, growthRate, years, memo);

        System.out.printf("Future Value (Memoized): ₹%.2f%n", result2);

    }

}
```

Financial forecaster.java:

```
package FinancialForecasting;

public class FinancialForecaster {

    public static double futureValueRecursive(double currentValue, double growthRate, int years) {


        if (years == 0) return currentValue;


        return futureValueRecursive(currentValue, growthRate, years - 1) * (1 + growthRate);

    }


    public static double futureValueMemo(double currentValue, double growthRate, int years, double[]
memo) {

        if (years == 0) return currentValue;
```

```
        if (memo[years] != 0.0) return memo[years];

        memo[years] = futureValueMemo(currentValue, growthRate, years - 1, memo) * (1 + growthRate);
        return memo[years];
    }
}
```

OUTPUT: