Software Construction & Development (SE3001)

Final Exam

Date: December 31, 2024

Course Instructor(s)

Dr. Farooq Ahmed, Mr. Waqas Ali

Total Time:	**3 hour**
Total Marks:	**80**
Total Questions:	**5**

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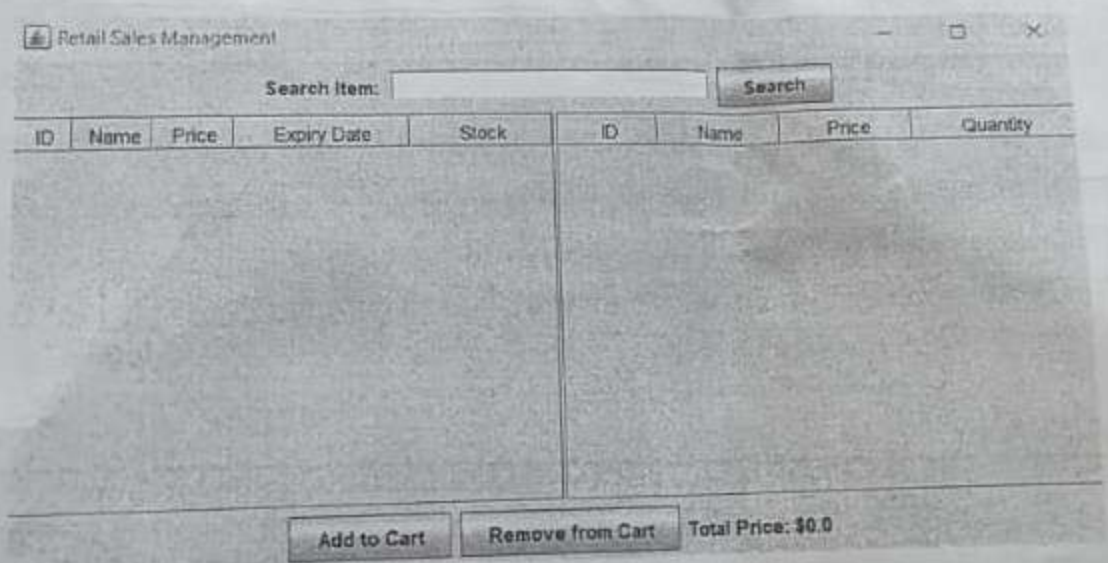
Do not write below this line

Attempt all questions on the answer sheet

CLO 1: Apply software engineering concepts to construct (i.e. design, develop, and test) software in team setting

Question 1 **[20 marks]**

A retail company wants to create a desktop application to manage sales on items which are present in database of named "company_db" under the table "items_table".



In above figure, left table is itemsTable and right one is cartTable. The application should allow the user to search items and add them to a cartTable, calculate the total price, and remove selected items. Design of GUI for this application is done in initComponents() method using Java Swing and there is **NO** need to implement that.

Your task is to implement the necessary functionality for:

- **searching** items
- **adding** items
- **calculating** the total **cart price** dynamically
- **removing** selected items.

```
public class Main extends JFrame {
    private JTextField searchField;
    private JButton searchButton, addButton, removeButton;
    private JTable itemsTable, cartTable;
    private JLabel totalLabel;
    private DefaultTableModel itemsTableModel, cartTableModel;
    private double totalPrice = 0.0;
    public Main() {
      initComponents(); // no need to implement this method
      // Event Handlers
      searchButton.addActionListener(new SearchAction());
      addButton.addActionListener(new AddToCartAction());
      removeButton.addActionListener(new RemoveFromCartAction());

    }
    // Implement the missing code
} // end of Main class
```

CLO 2: Implement software design patterns as part of software construction activity

Question 2 **[20 marks]**

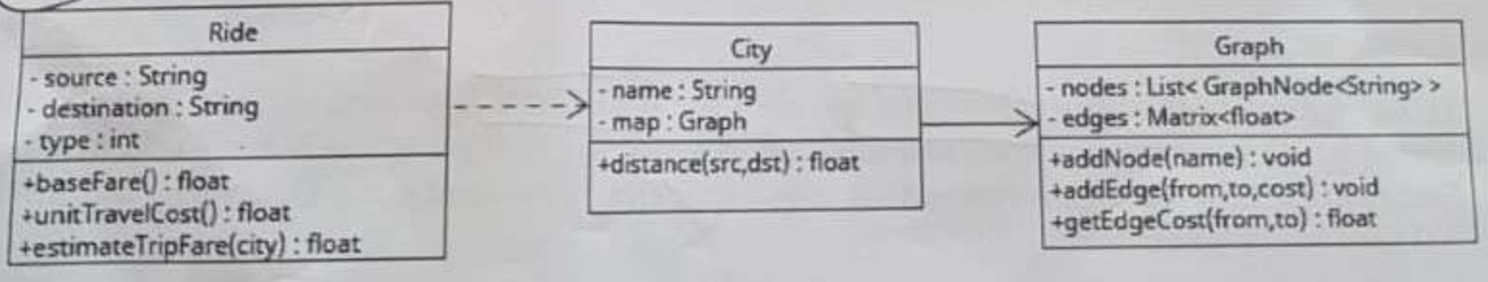
A smart home system uses a client-server architecture (implemented using socket programming) to control lights in different rooms. Each client represents a light bulb that sends its status (on/off) to the server every second. The server monitors all bulbs and sends a notification to a central dashboard if any light stays on for more than a specified duration (e.g., 5 minutes).

Implement a server that can handle multiple clients representing light bulbs. The server should:

1. Monitor each client's status in real-time using threading.
2. Maintain a record of how long each light bulb remains on.
3. Notify the dashboard when any bulb exceeds the specified on-time limit.

CLO 3: Design Test Cases for a Software System

Question 3 **[20 marks]**



Consider a simplified class diagram for a ride hailing service. Rides can be availed for traveling from source to destination within the city. Each ride has a type (e.g. 1 for car, 2 for bike, etc.) that helps determine the base fare (e.g. Rs. 100 for car and Rs. 50 for bike, etc.) as well as travel cost per unit distance (e.g. Rs. 50 per km for car and Rs. 20 per km for bike, etc.). Total fare can be estimated as a sum of base fare and travel distance (from source to destination) multiplied by unit cost.

City class maintains a map (using a Graph) to determine the distance from a given source to destination. Graph is implemented as an adjacency matrix to determine cost of a direct edge from one node to other. For simplicity, it can be assumed that ride hailing service is available within the city only and inter-city travel is not covered.

Write unit test code (using JUnit) for **Ride** and **City** classes while using the Graph class appropriately. There is **no need** to write tests for Graph class but it will be helpful in testing other (Ride and City) classes.

CLO 4: Use a version control system as part of software construction activity

Question 4 **[5+5 marks]**

Answer the following questions:

(a) What is the purpose of using tags in Git version control system? Explain in comparison with commit messages and revision numbers.

(b) What problems can occur while merging one branch to the other and how to handle them?

CLO 5: Implement the deployment related steps to bring the constructed software in use

Question 5 **[5+5 marks]**

Answer the following questions:

(a) Why are digital signatures important during the release distribution process?

(b) What is the significance of generating API documentation? How can it be facilitated?