

CITY UNIVERSITY OF HONG KONG

Course code & title : CS 3342 Software Design

Session : Semester A 2009/10

Time allowed : Two hours

This paper has 12 pages (including this cover page).

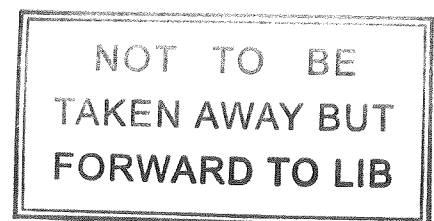
1. This paper consists of 8 questions.
 2. Answer ALL questions in Section A and in Section B.
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Student Number: _____

Programme: _____

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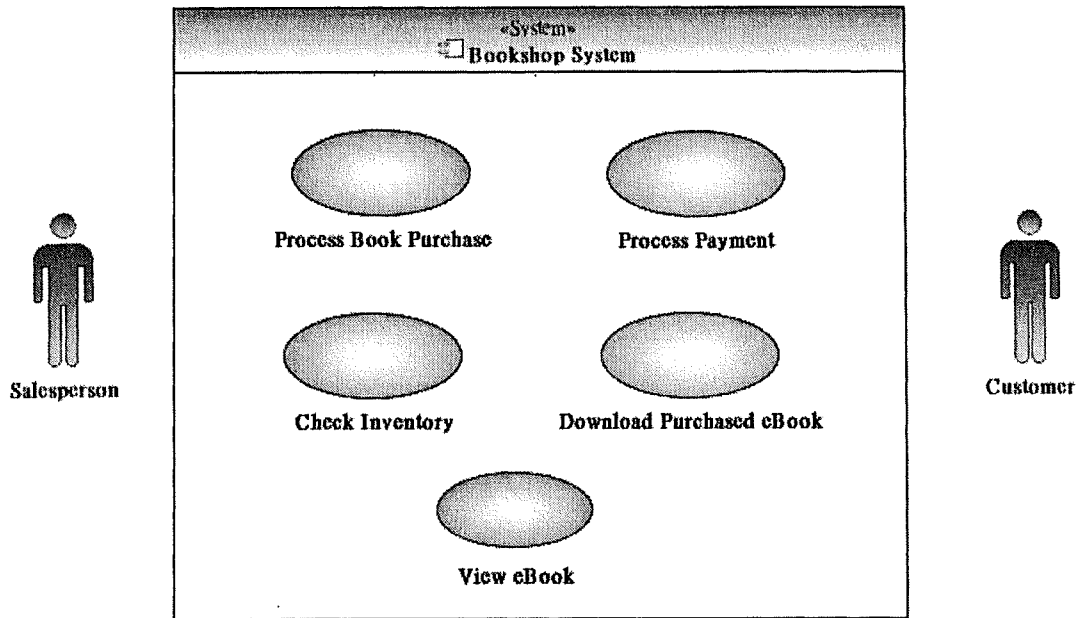
Section A [Fundamentals] (40%)

1. [CILO 1: Software Process] (10%)

If you and your teammates have decided to develop software incrementally, what will you and your teammates do (elaborate or use an example to illustrate the activities and involved procedures to link up these activities)?

2. [CILO 2: Capturing Requirements] (10%)

The following use case diagram models the operational requirements of a bookshop in a shopping mall. However, this bookshop only sells e-books.



Requirement R1: To purchase an e-book successfully, the system must perform the following three tasks in sequence. First, it checks the inventory to confirm there is at least one available licence key for the e-book. Second, it processes the payments. Third, the customer downloads a copy of the e-book with a license key.

Question 2(a). Modify the above diagram so that it can present the requirement R1 and the relationship between the actors and the use cases. (6%)

Question 2(b). Explain your solution for Question 2(a). (4%)




3. [CILO 3: Object-Oriented Analysis] (10%)

Represent the following situations using the UML class diagram notations.

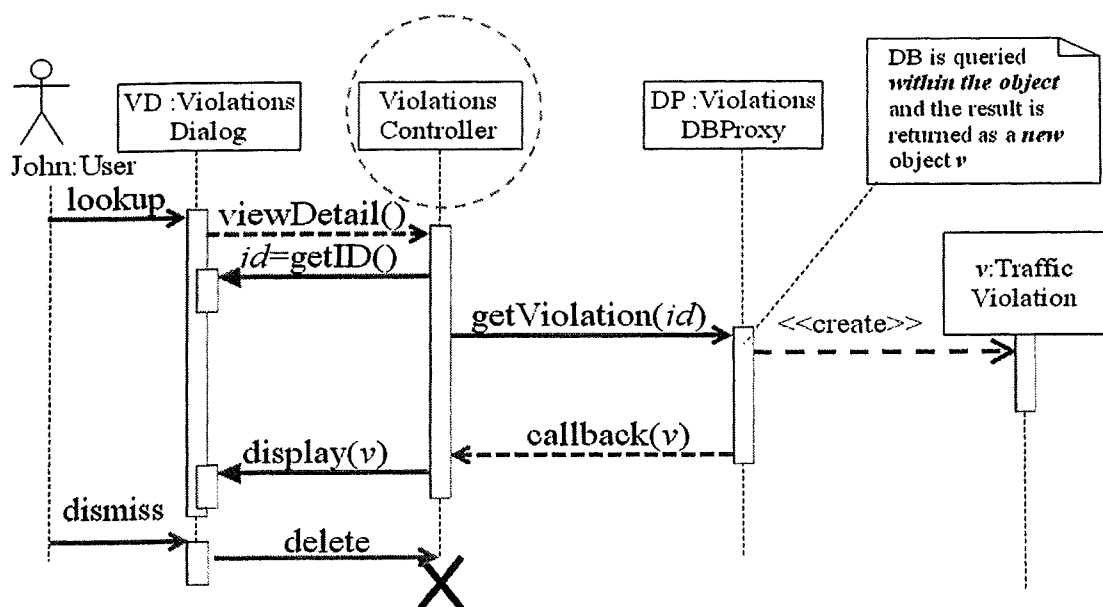
Question 3. There are three types of bank account, namely *savings account*, *credit card account*, and *PowerVantage account*. A *PowerVantage account* is actually a pair of *savings account* and a *credit card account*. A customer can deposit money to any accounts, but can only withdraw money from his/her owned account(s). Some accounts are *joint accounts*, each of which is jointly owned by multiple customers. (10%)

4. [CILO 4: Object-Oriented Design] (10%)

Question 4(a). What are the design classes represented by each of the following three symbols? Briefly state the purpose of each design class. (6%)

Symbol	Name of Design Class	Purpose
		
		
		

Question 4(b). The following sequence diagram aims to model that the system will retrieve an error message from a database server when a user submits a display error message request. However, it contains a few modeling problems. Identify the problems. One problem (a lifetime should be an object, not a class) has been shown (i.e., the dotted line circle) on the diagram for your reference. (4%)



Section B [Modeling] (60%)

5. Modeling Object Behavior [CILO 4: Object-Oriented Design] (15%)

Based on the following list of requirements, describe the life of a **digital photo display** (DPD) in a state machine diagram. Remember to show the activities with any state, and any event or action or guarding condition of any transition.

Requirements:

- When DPD is powered on, the system will load a photo and turn on the LED light to green.
- After the LED has been turned to green, the system will show the photo and turn the LED to white.
- After showing a photo for three seconds, the system will automatically load another photo, and turn on the Green LED.
- Sometimes, a user may press the pause button when the system displaying a photo. If this button is being pressed, the system will continuously display the photo and shows the LED as white.
- After the pause button has been released, the system will count for three seconds, and automatically load another photo, and turn on the LED to green.
- When a user presses the “Power Off” button, the system will turn of the LED, and then the system will be shut down.

6. Modeling Object Interactions [CILO 4: Object-Oriented Design] (25%)

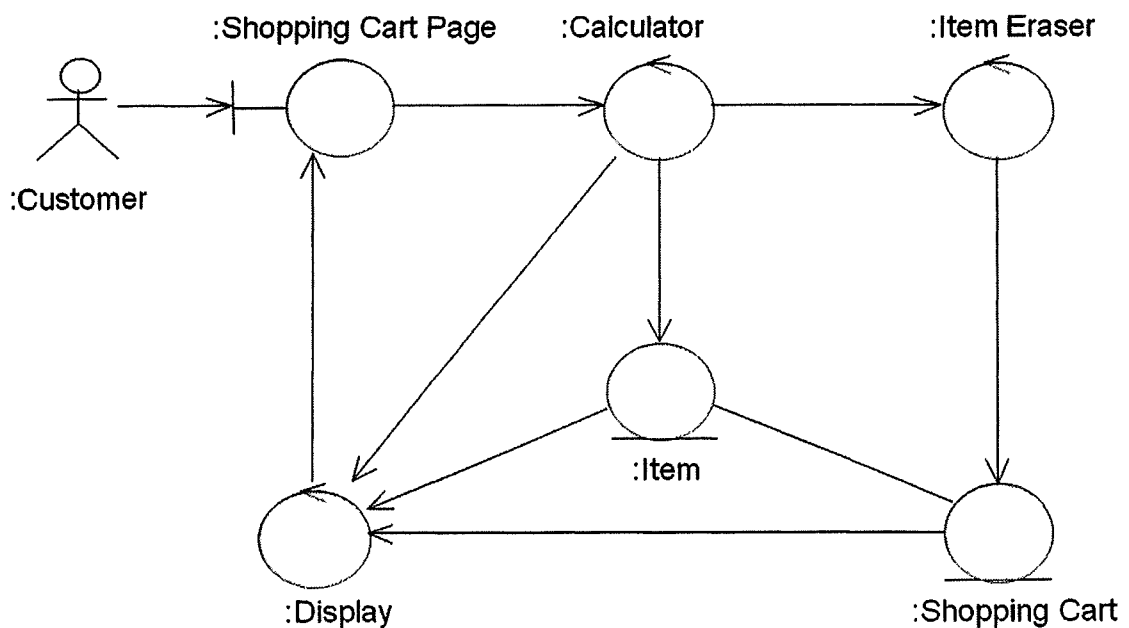
In the following box, it shows a design use case description and a communication diagram representing a high-level plan of object interactions.

Main Success Scenario:

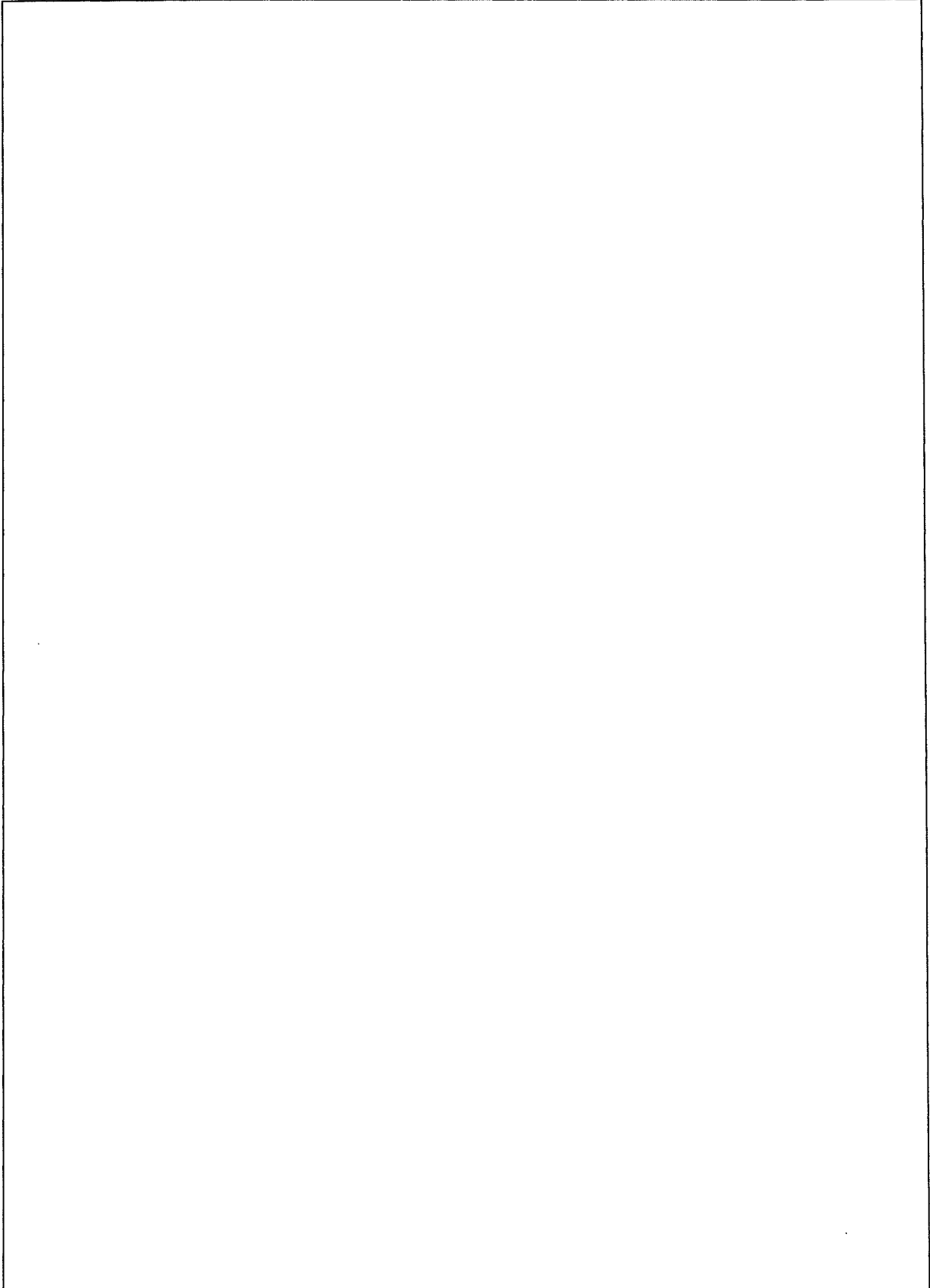
On the Shopping Cart Page, the Customer modifies the quantity of a Line Item in the Shopping Cart and then presses the Update button. The system stores the new quantity, and then computes and displays the new cost for that Line Item. The Customer presses the Continue Shopping button. The system returns control to the use case from which it received control.

Alternative Course of Events:

- If the Customer changes the quantity of the Item to 0, the system deletes that Item from the Shopping Cart.
- If the Customer presses the Delete button, the system deletes that Item from the Shopping Cart.

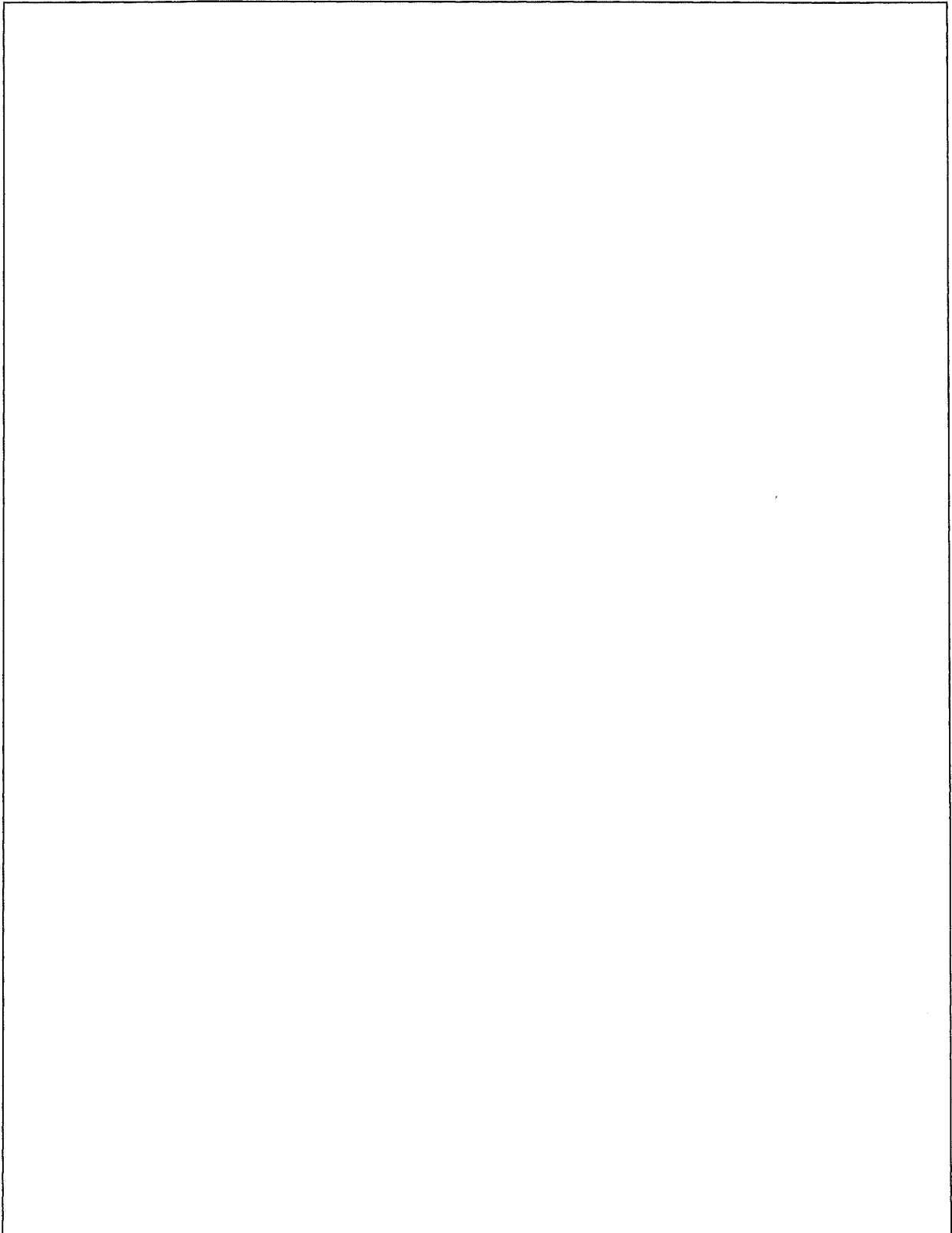


Question 6(a). Sketch a **sequence diagram** to represent the object interaction sequences specified in the design use case description and the communication diagram. (10%)

A large, empty rectangular box with a thin black border, intended for the student to sketch a sequence diagram. The box occupies the majority of the lower half of the page.

Question 6(b). Explain *three* types of design skills that you have illustrated through your sequence diagram in Question 6(a) (e.g., centralized or decentralized design, design classes, object creation or destruction, the usage of combinedFragment (“ref”, “alt”, “opt”, “break”, and so on), and any others that we have covered in the lectures or tutorials). (9%)

Question 6(c). Draw a **class diagram** for your sequence diagram in Question 6(a). Your class diagram only needs to show classes and relationships (e.g., associations, shared or composite aggregation, or inheritance) between classes. There is no need to show attributes or methods. (6%)

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7. Roles of Variable [CILO 4: Object-Oriented Design] (10%)

There are at least ten types of role for variables, namely “constant/fixed value”, “stepper”, “most-recent holder”, “most-wanted holder”, “gatherer”, “follower”, “one-way flag”, “temporary”, “organizer”, and “transformation”.

Question 7(a). The following code fragment wants to find out the smallest value among ten given integers. There are in total four variables used in this code fragment. Identify the role of each variable. (6%)

```
public class FindSmallest {
    public static void main(String[] args) {
        int i, s, n; int m = 10;
        System.out.print("Enter the 1. number: ");
        s = UserInputReader.readInt();
        for (i = 2; i <= m; i++) {
            System.out.print("Enter the number" + i + ": ");
            n = UserInputReader.readInt();
            if (number < s) s = n;
        }
        System.out.println("The result is " + s);
    }
}
```

The role of *i* is:

The role of *s* is:

The role of *n* is:

The role of *m* is:

Question 7(b). Can the concept of “roles of variable” be applied to improve the quality of (i) sequence diagram, (ii) class diagram, (iii) communication diagram, and (iv) use case specification? (4%)

8. Modeling Requirements (10%)

Question 8(a). Describe the purpose of **one** use case specification in your OOA report. [5%]

Question 8(b). Give any two successful guarantees that your stated use case specification aim to provide. Explain briefly how each successful guarantee is achieved by the use case specification. [5%]