NATIONAL UNIVERSITY OF SINGAPORE

SCHOOL OF COMPUTING

SEMESTER II, AY2009-10
EXAMINATION FOR

CS2103 – SOFTWARE ENGINEERING

MAY 2010 Time Allowed: 2 Hours

INSTRUCTIONS TO CANDIDATES

1. This examination paper contains NINE(9) questions and comprises NINETEEN (19) printed pages, including this page.
2. Answer **ALL** questions within the space in this booklet
3. This is an Open Book examination.
4. Please write your Matriculation Number below.

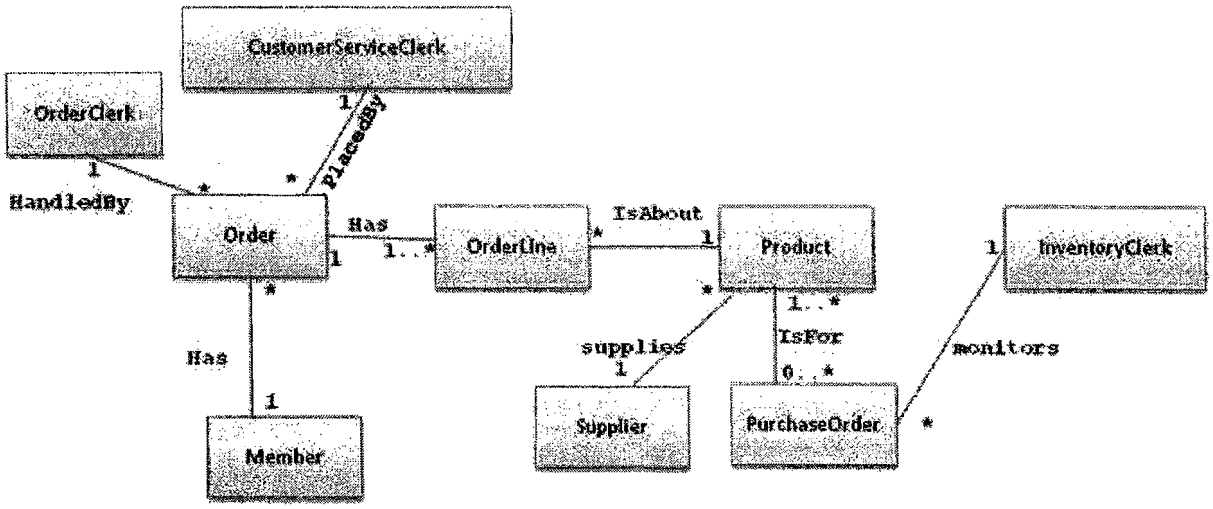
MATRICULATION NO: _____

This portion is for examiner's use only

Question	Marks	Remarks
Q1	/20	
Q2	/10	
Q3	/8	
Q4	/8	
Q5	/8	
Q6	/6	
Q7	/12	
Q8	/10	
Q9	/8	
Total	/90	

Questions 1 to 3 refer to the following description and the domain diagram:

A mail order company has business services for its registered users. The company has Customer Service, Sales, Dispatch & Finance departments.
A registered member can order items either by filling order form and sending to the Customer Service by fax or giving details to a customer service assistant over the phone . Customer Service verifies membership and forwards the order to Sales. Sales processes the order if stock is available and issues delivery notes to Dispatch. If stock is not enough, Sales issues a purchase order to the supplier . When the items are available, Dispatch delivers the item and Finance issues an invoice to the member. Finance receives invoice from supplier if any items are purchased by Sales. It verifies that the items have been received and issues payment to the supplier. A member without any transaction for a period of one year is removed from the membership list and needs to re-apply to reinstate it. Every member has an order limit based on his/her past transactions with the company. Initially, at the time of registration, the order limit for a member is set to $1000.
In order to improve operational efficiency , the Company has hired your team to develop a software for the activities related to membership maintenance, order processing and delivery of order.



An order can be for many products. For each product ordered, there is one Orderline associated to an order, which essentially captures the qty ordered for that product and calculates price for that qty.

Question 1 **20 marks(5 marks each)**

(i) Illustrate the above business workflow through a UML Activity diagram.

(ii) Illustrate your understanding of the scope of the project through a UML Use Case diagram.

Note : You can number the use cases above as UC01, UC02 for easy reference in answering (iii) and (iv).

(iii) Suggest a ranking for the use cases, identified above in (ii), for a development schedule in the format as given below .The reason for your choice of rank could be e.g. directly improves efficiency of business, high impact - affects system architecture, Less often used process , Low impact on system architecture or similar.

(iv) Suggest with reason , a software development process model. Identify which of High and Medium ranked uses cases in (iii) be analyzed, designed and implemented in the development phases/ iterations according to the model of your choice .

Answer space (on pages 4-7)

Answer 1 (i)

Answer 1 (ii)

Answer 1(iii)

Rank (High/Medium/Low)	Use Case Number or Name	Reason
Example : Low	Example : UC01	Example : Low impact on system architecture

Answer 1 (iv)

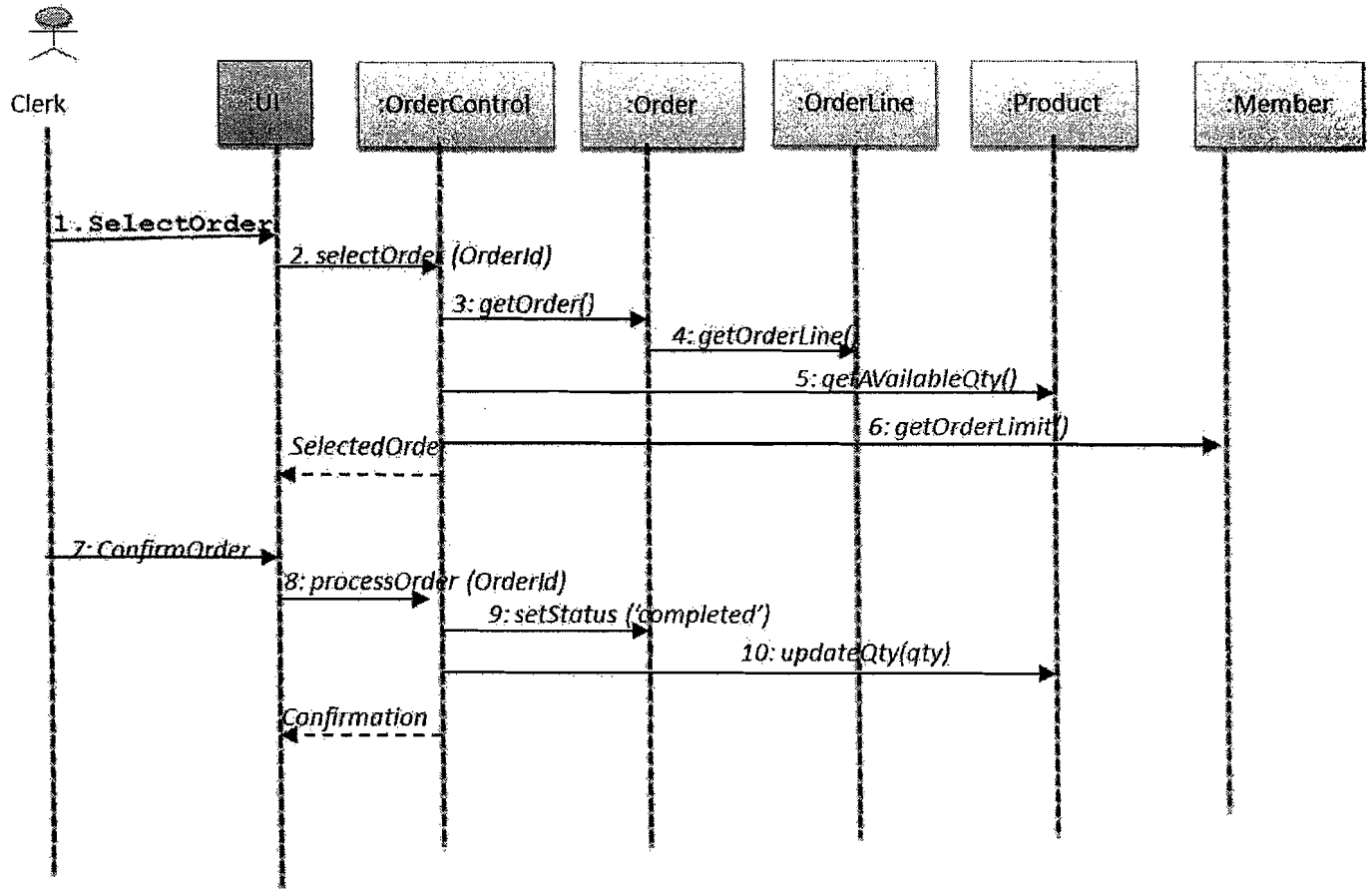
Development Process Model :				
Reasons for the above choice :				
Iteration number or Phase name	Use case (name or number)	Tick(√) the column if use case is to be analyzed / designed / implemented in the corresponding phase or iteration.		
		Analyze	**Design**	**Implement**
Example : Iteration 1	*UC 01, UC10*	√	√	

Question 2 : **10 marks(5 marks each)**

Given below is an MSS and two alternative scenarios for the use case UC-99 'Process Order ' for the mail order company requirements. A sequence diagram for UC - 99 is also given . **Based on the alternative scenario descriptions, UC 99-1 and UC99-2 , add details to the respective skeletal sequence diagrams given at the end of these descriptions. You need not draw interactions for the steps which are common to the sequence diagram of UC-99.**

UC 99 : Process Order **Post-condition** : The sales order is completed.
Pre-condition : A sales order of available items is submitted

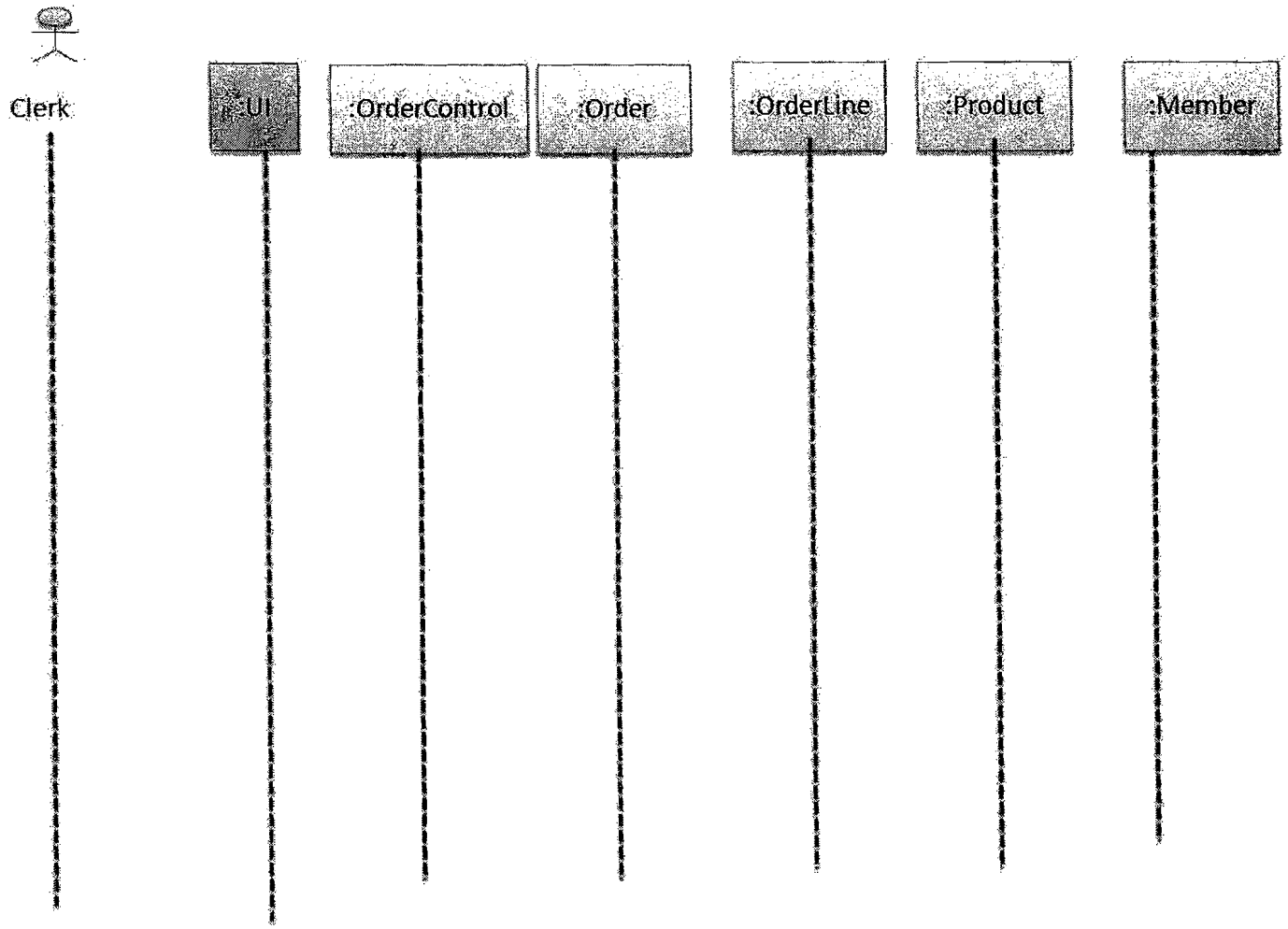
1. The order processing clerk selects a sales order.
2. The system checks the availability of each item, and checks the order limit for the member .
3. The system confirms all items are available and that member's order limit is more than the placed order value; and displays the items and quantities of the order.
4. The order processing clerk then processes all items of the order i.e. prepares the information to be dispatched to the Dispatch.
5. The system updates the status of the sales order to 'completed'



UC 99-1 : Process Order - Alternative 1
Post-condition : The sales order is put on hold and a reorder request is submitted
Pre-condition : A sales order of items costs $1000 and the present order limit of customer is $2000.

1. The order processing clerk selects a sales order.
2. The system checks the availability of each item, and checks the order limit for the member .
3. The system displays that an item which costs $1000 is not available
4. The clerk submits a reorder request
5. The sales order is marked as "pending - reorder item"

Skeletal UC 99-1



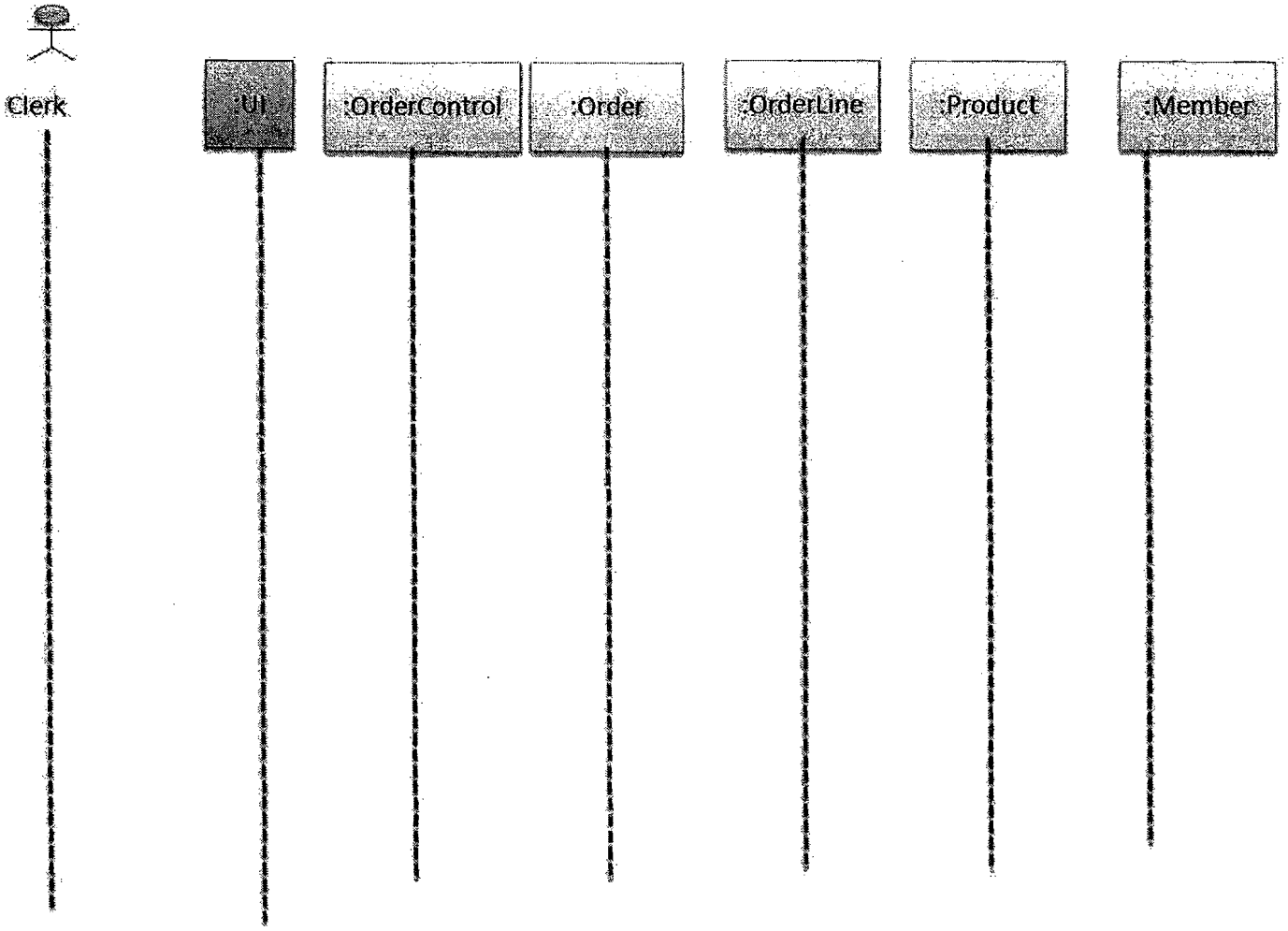
UC 99-2 : Process Order - Alternative 2

Post-condition : The sales order is put on hold and a request for deposit is sent to the member .

Pre-condition : A sales order of items costs $2000 and the present order limit of customer is $1000.

1. The order processing clerk selects a sales order.
2. The system checks the availability of each item, and checks the order limit for the member .
3. The system displays that all items are available, but members' order limit is less than the placed order value.
4. The clerk submits a request for printing a request for deposit
5. System retrieves member details and prints a request letter
6. The sales order is marked as "pending - deposit".

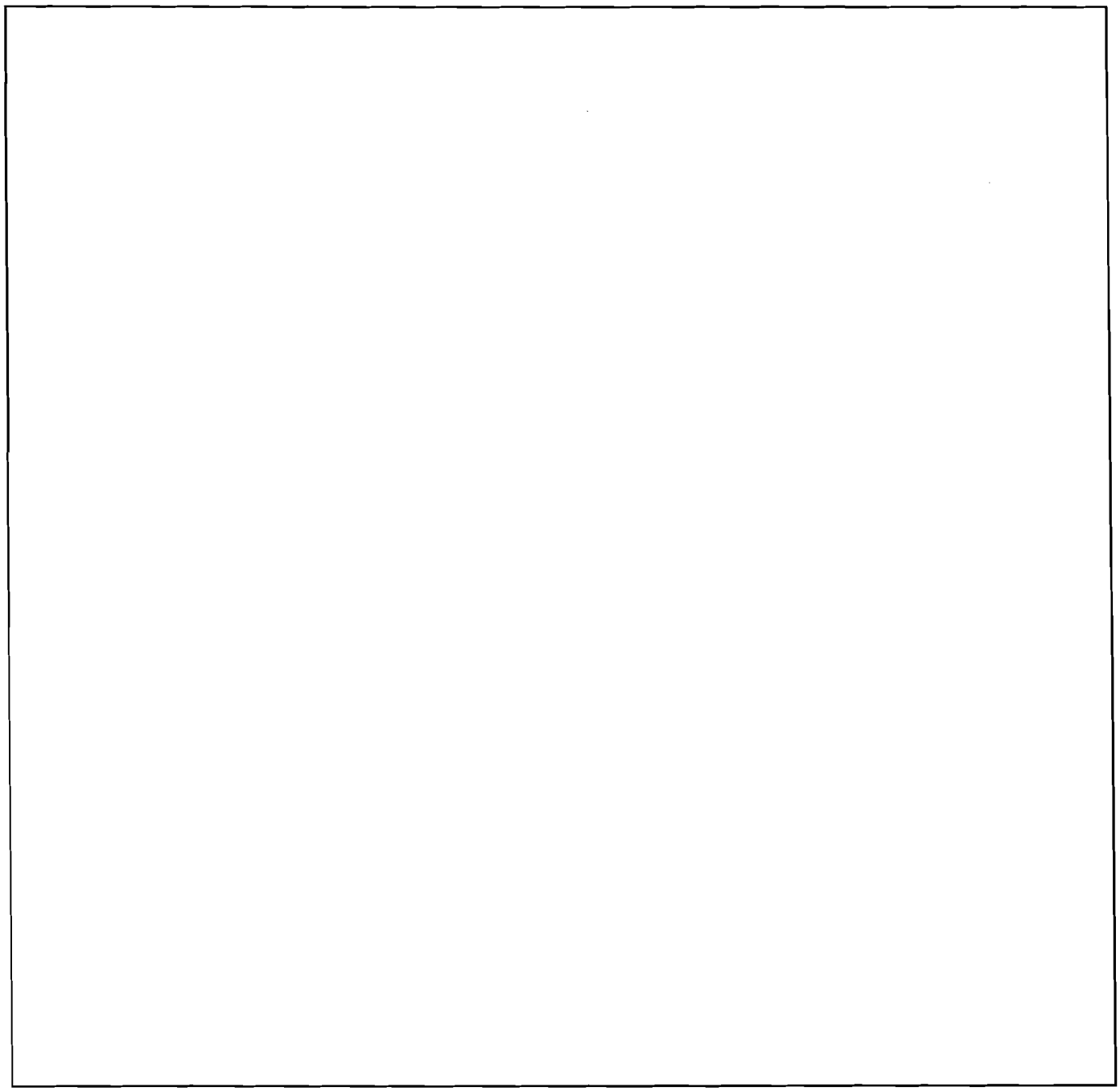
Skeletal UC 99-2



Question 3 : **8 marks**

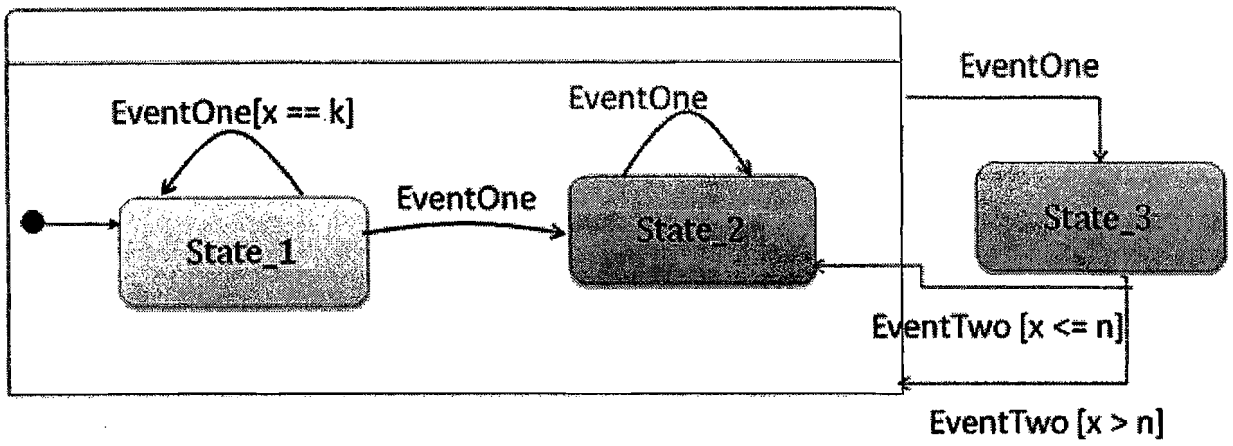
Develop a class diagram based on the information you have dealt with in answering questions 1 and 2 above. You need not provide classes which are **not** participating in the sequences discussed in question 2.

Answer 3:



Question 4: **8 marks**

Following state-chart has modeling defects (missing or ambiguous information). **Find 4 such defects and list them in the table below.**



Answer

Defect	Description
1	
2	
3	
4	

Question 5 **8 marks**

For an EMS requirement, your 2-member team divided the geographical area into rectangular resource zones. Another 2-member team designed each zone as a square shaped object. Your supervisor merged the two teams for the implementation phase. This new merged team realized that square can be defined as a rectangle. Thus, code was seen to have class SquareZone as a sub-class of class RectangularZone. Your supervisor in iteration-2 review commented that if the classes are immutable, there is no problem. SquareZone will satisfy all properties of RectangularZone, and Substitution principle is not violated. But if the classes have mutators, substitution principle can be violated.

You understood Supervisor's comments. **Write a short note (or illustrate through an example code) to your team members, who did not understand the Supervisor's comments, clearly explaining your understanding of mutability, immutability, and substitution principle applicable in the context here.**

Answer 5:

Question 6: **6 marks**

Consider following description and **suggest a design pattern** . **Illustrate your suggestion by drawing a pattern diagram which shows classes, associations and relevant methods corresponding to the information given below.** You can make reasonable assumptions should you need to add more elements in terms of classes , methods or associations.

An advertisement (or advert) is made up of media clips(sound clips and video clips) each of which can be played individually or as part of an advert. Some advert clips are made up of sequences of clips, such that each sequence is in turn made up of sound clips and video clips. Each of these i.e. advert sequence, sound and video clips have a behavior play() . For advert sequence, an invocation of behavior play() results in it sending a play() message to each of its components in turn.

Answer 6 :

Your suggestion i.e. name of the pattern :

Diagram :

Question 7 : **12 marks**

Assume your EMS-team of 4 members has followed iterative development process model. Here is a summary of the implementation schedule and dependencies of some of the components :

Component	Iteration	Team Member	Dependencies
EMSTask	2	Binny	None
EMSResource	2	Jack	None
EMSTaskResource	3	Johnny	EMSTask, EMSResource
EMSDispatcher	3	Karen	EMSResource, EMSTaskResource
EMSCallTaker	2	Johnny	EMSTask
EMSControl	3	Kenny (yourself)	EMSTaskResource, EMSTask, EMSResource
EMSAdmin	3	Binny	None

You (Kenny) are tasked with planning the EMS **Testing(unit/integration/system)** for the above components to be carried out in planned iterations 2 to 5. In addition to your team members, you also have your tutor, Mr Wally, who has volunteered to help you with testing anytime. **Suggest a testing schedule in the table given on next page .** For any additional comments you may have for your reasoning, use the space given below .

	Write the <u>iteration(s)</u> <u>2/3/4/5/</u> in which testing will be carried out	Tester Name(s)	Why (reason – why the tester is allocated to the phase(s)
Unit Testing			
Integration Testing			
System Test			

Question 8 : **10 marks**

Mark a cell with √ in the following table **to show dependency of test case development in each of the test phases** i.e. Unit Test, integration Test, System Test, and Acceptance Test **on** the Analysis and Design models developed in earlier phases of development.

	Domain Model	Use Case Model	Activity Model	Architecture	Class Model	Sequence Model	State Chart
Unit Test							
Integration Test							
System Test							
Acceptance Test							

Write the reasons for your choices in the table below

	Reasons
Unit Test Dependency choices	
Integration Test Dependency choices	
System Test Dependency choices	
Acceptance Test Dependency choices	

Question 9: **8 marks**

An EMS-Game requires to track time it takes between the task creation time(hh:mm) and the task completion time(hh:mm) given in 12-hour format. The following pseudocode finds the elapsed time(hh:mm) assuming that the elapsed time is less than 24 hrs.

1. // readTaskCreationTime start-hr, start-min, start-zone(am or pm)
2. // readTaskCompletionTime end-hr, end-min, end-zone(am or pm)
3. if(start-hr == 12) start-hr= setTo(start-hr,0);
4. if(start-zone ==pm) start-hr= add(start-hr,12);
5. if(end-hr == 12) end-hr= setTo(end-hr,0);
6. if(end-zone ==pm) end-hr = add(end-hr,12);
7. if (end-min <start-min) { end-min = add(end-min,1); end-hr = subtract(end-hr,1); }
8. if (end-hr < start-hr) end-hr = add(end-hr,24);
9. // calculateElpasedTime(start-hr, start-min, end-hr, end-min);

Find a **minimum set of test cases** that achieves 100% statement coverage for statements 3 to 8.

TaskCreationTime	TaskCompletionTime	Expected Elapsed Time

Write <u>additional</u> test cases in the table below , to achieve 100% branch coverage. If you think your answer in (i) provides 100% branch coverage as well, state so here :

TaskCreationTime	TaskCompletionTime	Expected Elapsed Time

Note : the number of empty rows provided is not an indication of number of minimum or maximum test cases. Use space on next page to write more test cases, if needed.

---End of paper---