NATIONAL UNIVERSITY OF SINGAPORE
SCHOOL OF COMPUTING

SEMESTER II (2004-05)
EXAMINATION FOR

CS2103: SOFTWARE ENGINEERING

April 2005 Time Allowed: 2 Hours

INSTRUCTIONS TO CANDIDATES

1. This examination paper consists of **eight(8)** questions and comprises **nineteen(19)** printed pages. Answer **ALL** questions.
2. Write your answers in the **blank spaces** in this answer book only.
3. This is an **OPEN BOOK** examination.
4. Please fill in your **Matriculation Number** below.

Matriculation Number: | | | | | | | | | | |

For Official Use Only :

	Marks
Question 1 (max 10)	
Question 2 (max 15)	
Question 3 (max 10)	
Question 4 (max 10)	
Question 5 (max 20)	
Question 6 (max 7)	
Question 7 (max 15)	
Question 8 (max 13)	
TOTAL: (max 100)	

Question 1 **10 marks**

Draw a class diagram for the following description of a sales order system. You are required to include classes, attributes, operations, and relationships (simple associations/ generalization/ aggregation) from the given information. Provide meaningful names to the modeling elements included in your answer. You need not include multiplicities, relationship labels, navigation, attribute types , visibility symbols, operation return values or parameters.

The sales order system captures information of an order placed for a product. Each product has a unit price and description. When a product is ordered , quantity is captured and subtotal for the ordered quantity is calculated. Each order is given an identification number , a delivery date and time. Name, address and phone of customer is recorded for delivery purposes. A customer may place more than one orders. System keeps records of customers even though they don't have any active order in place. System allows three methods of payment - check, cash, or credit card. For check payment bankId and checkId are recorded. For credit card , card number , verification code, and expiry date of card are recorded. For cash ,tendered amount is captured.

Answer :

Question 2 **15 marks**

Following is a description of a trading system for a stock brokerage firm:

A client of stock trading service at a stock brokerage firm may open one or more accounts for stock trading. An account can be categorized into two types : cash account and margin account.
Trading system needs to be registered with one or more stock exchanges before clients can trade.
Once registered client can buy or sell stock based on current price, bid price, ask price, and traded volume information of a stock provided by stock exchange on which stock is listed. Stock is traded on the trading system if the system is registered with the stock exchange which lists it.
A trade order – buy or sell , is issued by client for an account. All trade orders are forwarded to Trading system for execution. There are three possible outcomes of a trade order :
- it gets completed
- it is partially completed
- it is not executed.

When an order is fully or partially completed, trading system returns a transaction detail of the order .
Each order will have one execution result which consists of one or more of these transactions.

A domain analysis resulted in following classes ; note that attributes for some of the classes are also identified and are stated in the parenthesis following the class name:

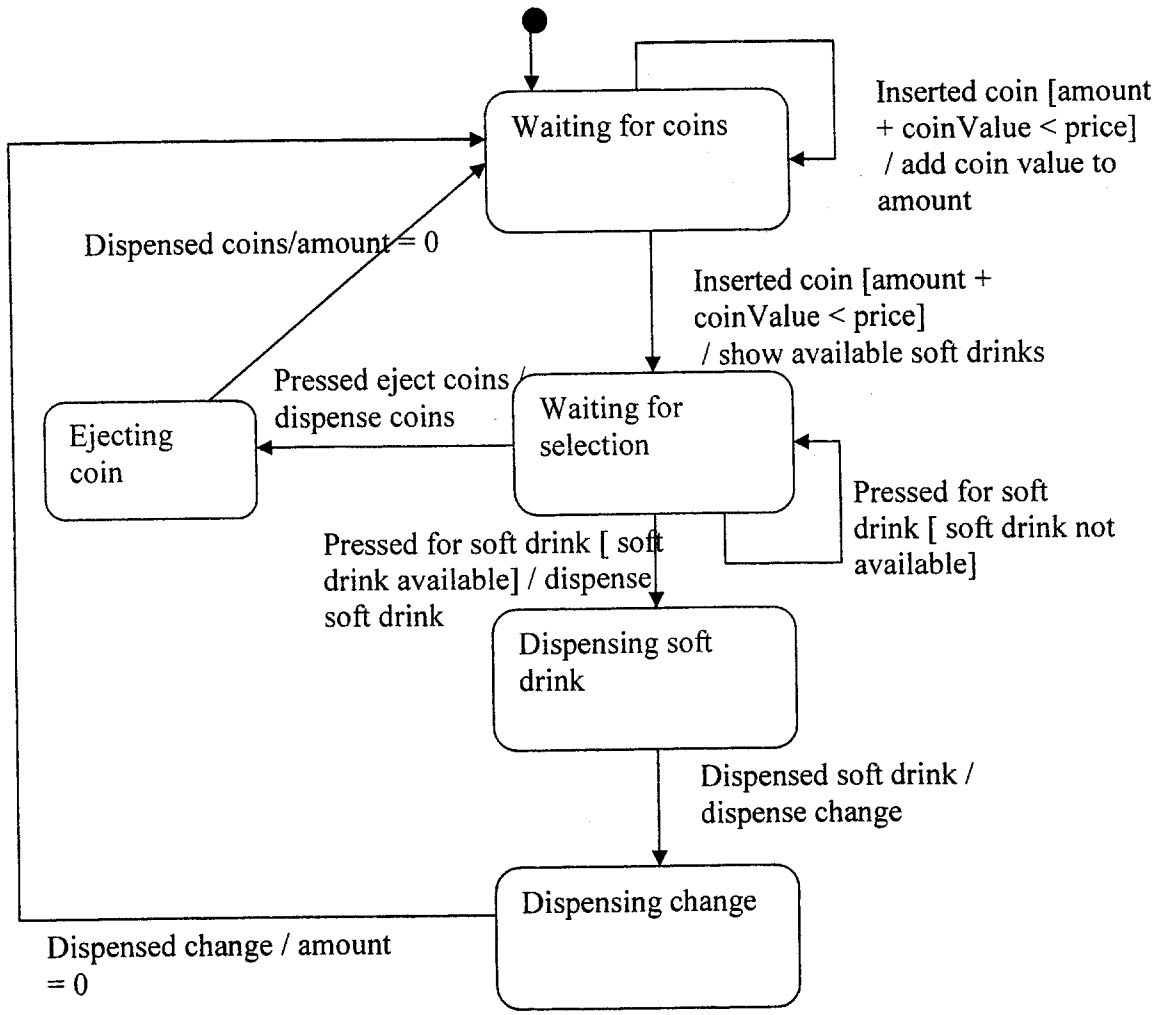
BuyOrder
Sell Order
Stock(code, name)
StockExchange
StockTradingSystem
Client(id, name, address, telNumber)
Account
TradeOrder(date, price, numberOfShares)
CashAccount
MarginAccount
ExecutionResult
Transaction

Use these classes and description given above to draw a class diagram . You need to add appropriate relationships (consider simple associations, generalization, and aggregation) between classes and indicate multiplicities.
You need not add attribute compartments, relationship labels , navigation, operations or any other information to the class diagram.

Answer

Question 3 **10 marks**

Given below is a state diagram for control object of a soft drink vending machine. It is followed by a skeletal of its corresponding class. You are required to extract information from the state diagram to provide declarations for the class ; code for constructor method for the class , and code for insertedCoin method . Assume that action 'show available soft drinks ' is realized by calling a method displayAvailableDrinks().



Answer : (write code in the space provided in the skeletal below.)

```
Class VendingMachineControl {

int state;
int amount, price;

// write any additional declarations in the space below




// provide code for the constructor in the space below




// fill in code for the method insertedCoin() , based on the state diagram , in the space
provided below ; write parameters for the methods, if any.

public void insertedCoin(                                    ) {




} // end insertedCoin
// you need not provide code for any other method.
}// end VendingMachineControl
```

Question 4 **10 marks**

Draw a sequence diagram for the following scenario of a lift control system.

A passenger presses UP button on ground level of a building . A request is sent to lift controller to arrive at ground floor. Lift controller opens the doors. Passenger enters the lift and presses sixth floor button. Lift controller receives the request to go to floor 6. The lift controller then waits for a timeout (an internal event of lift controller), closes the doors, controls the motor to go up and waits for the arrival (another internal event of lift controller) . When the lift arrives at sixth floor, the lift controller opens the doors. In the sequence lift controller interacts with door and motor objects.
You need not draw activation boxes for the objects when message is received. i.e. simply draw message arrows, appropriately labeled, to the life lines of objects in an appropriate time sequence.

Hint :
You may consider classes - UpButton, LiftController, LiftDoor etc. and methods open(), close(), arrive() etc.

Answer (here or next page)

Answer (4 contd.)

Question 5 **20 marks**

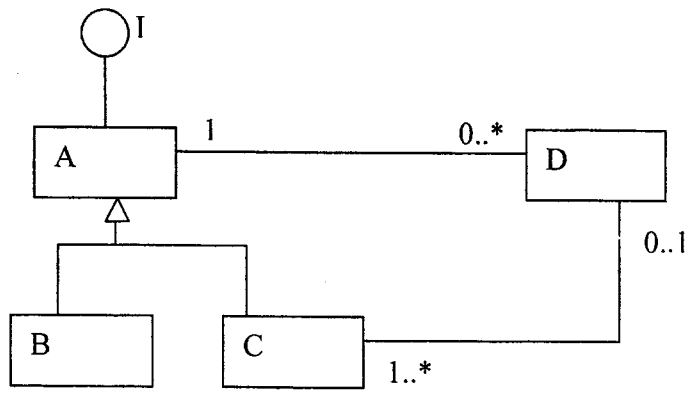
Write Java code to implement the class(es) along with their associations as you see in following figures . You are expected to provide complete method code if the information is available in the diagram. However, in the absence of sufficient information , you may provide only method signatures.

(i)

Publication
#title : string = "" - author : string - published : Date - comments[0..*] : string
+createPublication(string, string, Date) : Publication - setTitle (string) + addComment(string)

Answer (i)

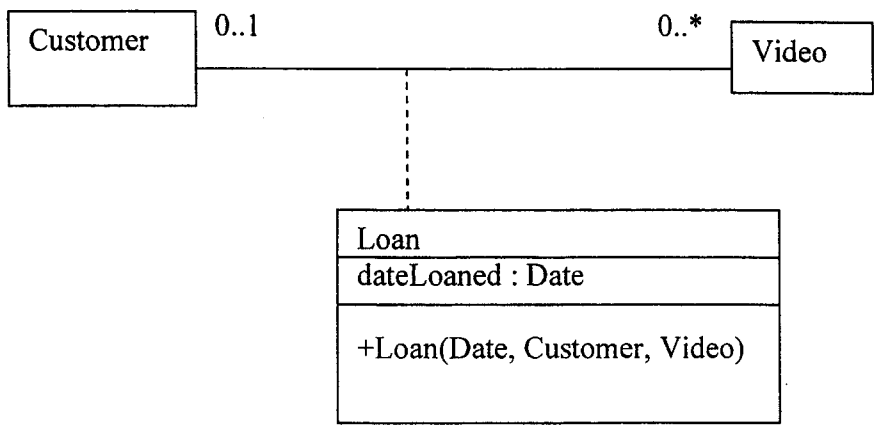
(ii)



Note : No methods are available in the class icons. State only method signatures which could be relevant in implementing the associations

Answer (ii)

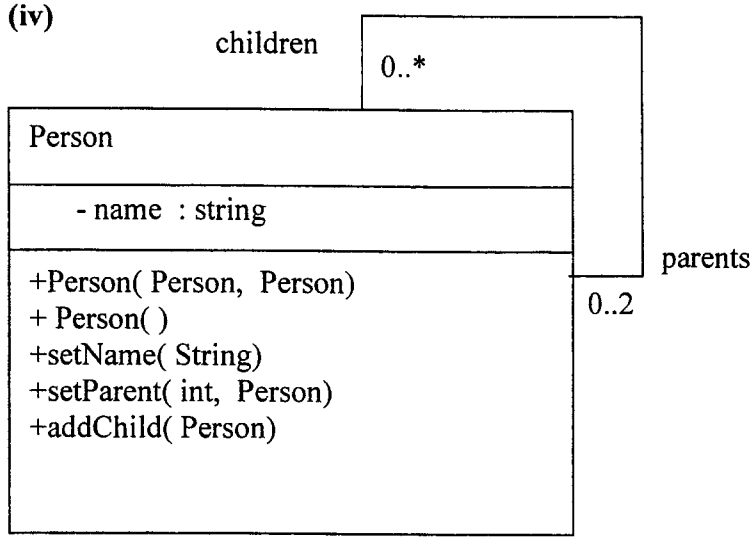
(iii)



Note : Responsibility for maintaining referential integrity is given to Loan.

Answer (iii)

(iv)


children
0..*
Person
- name : string
+Person(Person, Person)
+ Person( )
+setName(String)
+setParent(int, Person)
+addChild(Person)
parents
0..2

Answer (iv)

Question 6

(i) **4 marks**

Consider classes Flyer and Bird. Class Bird inherits from Flyer. One of the methods available in Flyer is hasWings(). Consider that Bird has methods hasWings(), and canFly() . Method canFly () in class Bird prints " this Bird can fly". In the main method of a test class, following is declared

```
Flyer f;
f = new Bird();
```

(a) State the method binding at compile time as well as at run-time for f.hasWings() .

(b) State the results along with the reasons when f.canFly() is compiled and executed.

Answer :

(ii) **3 marks**

Read the following and state the result or problems you may find when the code is executed :

```
class A {
public A() {
System.out.println( "In A" );
}
}

class B extends A {
public B() {
System.out.println( "In B" );
}
}
class Constructors {
public static void main( String args[] ) {
System.out.println( "Construct A" );
A me = new A();
System.out.println( "Construct B" );
B meToo = new B();
}
}
```

Answer :

Question 7

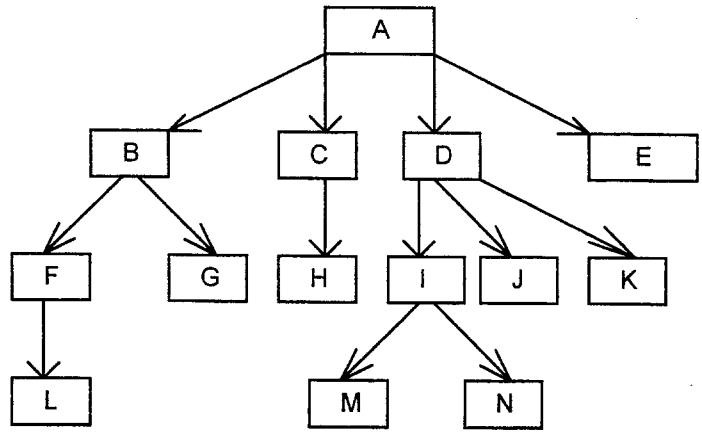
(i) **7 marks**

Study the specification given below for the class, Membership, which has been designed to handle membership information for a media service. Suggest possible equivalence classes.

Any employed person , student or senior citizen can become member of the media service by contributing a small donation. If a person is a student or senior citizen then only $25 is needed to become a member. All others , must contribute $50 to become a member. Anyone donating $200 or more becomes a Life member and avails special services and tax benefits. Donation up to and including a limit of $1000 are accepted.

(ii) **8 marks**

The structure chart below illustrates the hierarchy of modules in a software sub-system:



Describe the sequence of module tests for integrating the modules using the breadth-first bottom-up approach.

Answer

Question 8

(i) **4 marks**

Despite the fact that modeling is a natural process for humans , development of an appropriate model for a software system is perhaps the most difficult aspect of software engineering.
Do you agree with above statement ? Support your answer with an appropriate reasoning. Be brief and specific in your answer.

Answer :

(ii) **4 marks**

Fill in the blanks by choosing names of two design patterns which make the statement true.

_____ is often implemented as _____ .

(iii) **5 marks**

BookingSystem class , or Restaurant class or the class which represents a controller , in your project is, or could have been, implemented using a design pattern. State which design pattern is suitable and give relevant code which is / could have been used to implement it. You need to choose only one class to show implementation. You need to provide only for relevant attributes and methods to implement the pattern.

Answer

----END OF PAPER----