NATIONAL UNIVERSITY OF SINGAPORE

SCHOOL OF COMPUTING

SEMESTER 2 (2008/2009)
EXAMINATION FOR

CS2103 – SOFTWARE ENGINEERING

April 2009 Time Allowed: 2 Hours

INSTRUCTIONS TO CANDIDATES

1. This examination paper contains **SEVEN (7)** questions and comprises **SIXTEEN(16)** 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	/10	
Q2	/7	
Q3	/10	
Q4	/10	
Q5	/8	
Q6	/10	
Q7	/15	
Total	/70	

Question 1 **(2+2+2+2+2)**

(a) A Process is a sequence of steps used to accomplish a task. Give two reasons why a process is important for software development ?

Answer :

(b) State any two features of class modeling that is not part of a domain class diagram ?

Answer :

(c) What is the general principle of assigning responsibilities to objects ?

Answer :

(d) Given is a simple flow of events for measuring pulse rate by a patient-monitoring system :
1. A patients' pulse is being monitored.
2. The pulse reader measures the pulse rate to be 'n' pulses per minute.
3. The monitoring machine records the current time and pulse rate.
4. The monitoring machine issues an alert if the pulse rate is beyond a safe range specified for the patient.

State a pre-condition and a post-condition for the above flow of events .

Answer :

(e) Consider the method "Pop" of a class "Stack". Calling "Pop" retrieves the top item on the stack. Give a pre-condition to retrieve the top item, and a post-condition for the method.

Answer :

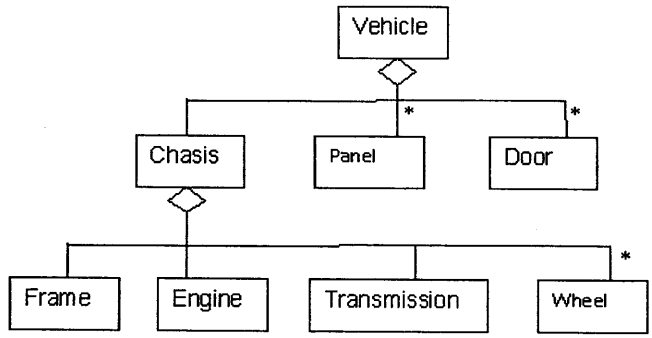
Question 2 **7 marks**

State which software development process model (Waterfall /Incremental/ Evolutionary / Iterative/ Prototyping) will have the following features :

Feature	**Your Answer (make one choice)**
The users uncover what their needs are as the development takes shape.	
Customer feedback often doesn't come until very late.	
The key idea is to take a small subset of features of the system and take them through Analysis -> Design -> Implementation -> Verification & Validation, instead of waiting for the entire system to pass through each phase.	
A phase takes the output artifact from the previous phase as input and it does not start until the previous phase is complete.	
Validation doesn't happen soon enough as a result cost of error is often high.	
Customer feedback comes into play early in the software development process.	
Cost of making an error is significantly lower compared to other model(s).	

Question 3 **(5+5) marks**

(a) Following shows an aggregation of vehicle parts. Show how this aggregation be modeled using a General Hierarchy and/or Composite pattern. You may suggest classes of your choice.



Answer :

(b) Provide a class model, only class(es) and association(s) with multiplicities, for the following requirement :
A course requires other prerequisite courses to be taken first. If two courses cover nearly same material, taking one of them would preclude a student from taking the other. Such courses are said to be mutually exclusive. The reasons or descriptions for preclusion as well as for the prerequisite also need to be captured.

Answer :

Question 4 : **(5+5) marks**

(a) Read the following description :

A computer manufacturer offers the possibility of purchasing computers via internet. The customer can select a computer on the manufacturer's web page. The computers are classified into servers, desktops, and portables. The customer can select a standard configuration or can build a desired configuration online. The configurable components such as memory are presented as lists of available options. For each new configuration, the system can calculate price. Price is shown to the customer when he chooses a standard configuration. Price is also computed when customer customizes a configuration. Customer may choose to order the computer online or may request that salesperson contact him/her to explain order details, negotiate price etc before the order is actually placed. To place an order, the customer must fill out the shipment and payment information. Acceptable payment methods are credit cards and cheques. Once the order has been entered, the system sends a confirmation e-mail message to the customer with details of the order. While waiting for the arrival of the computer, the customer can check the order status online at any time. The back end order processing consists of the steps needed to verify the customer's credentials and payment method, to request the ordered configuration from the warehouse, to print an invoice, and to request the warehouse to ship the computer to the customer. After customer's order is entered, the salesperson sends an electronic request, an invoice, to warehouse with details of the ordered configuration. The warehouse obtains the invoice from the salesperson and ships the computer to the customer.

Your task : Draw a model which shows **Order** and **Computer** classes with the association between them to explicitly capture a constraint ' an order identifies a computer with a unique configuration number'. You are required to indicate attributes, attribute types for both the classes, and multiplicity of the association between them.
Hint : Recall that a computer is ordered after being configured by a customer. A standard or customized configuration can be granted a unique configuration number.

Answer :

Question 4 (b)

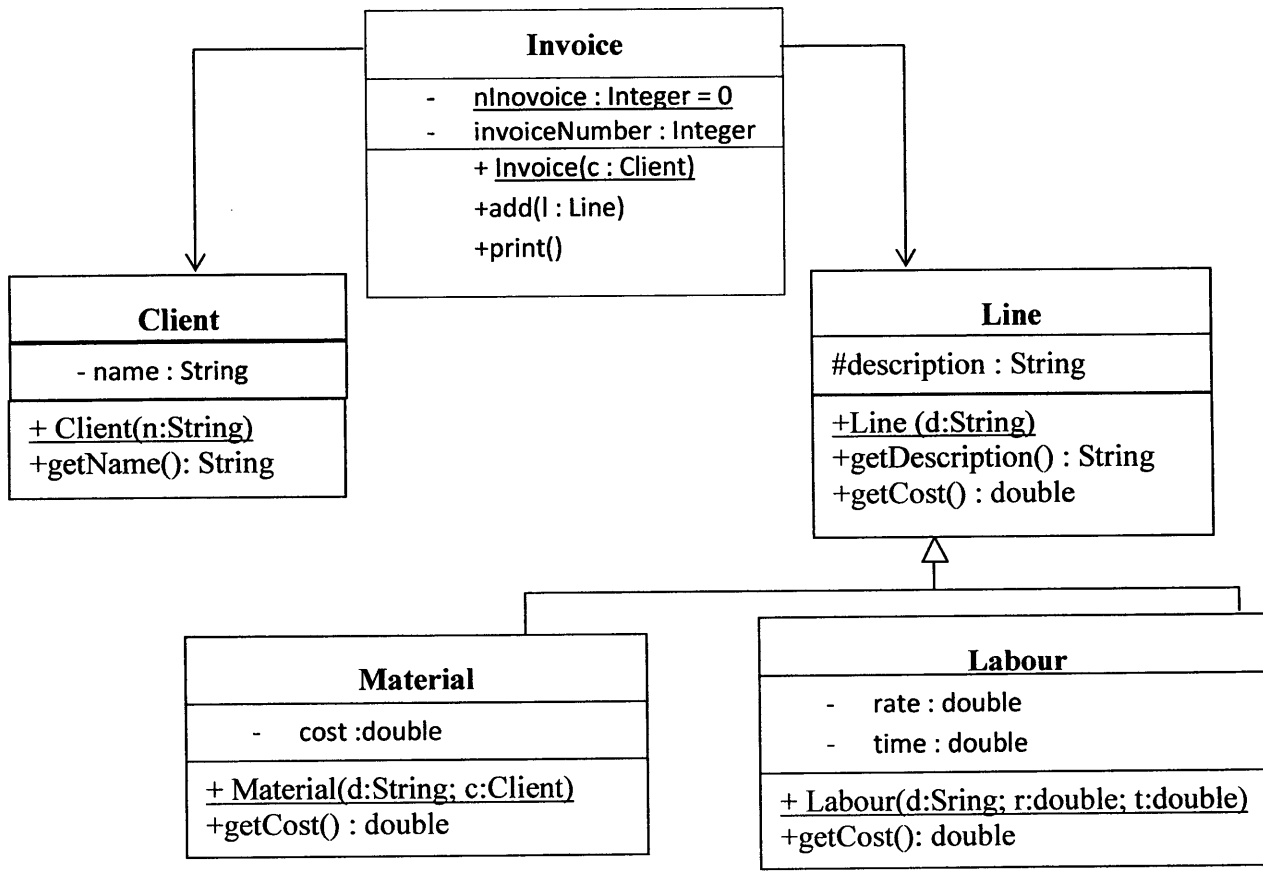
Compare the cohesion of EmailMessage class in the following codes and comment which one is more cohesive and why ?

```
class EmailMessage {                    // version-1
        private String sendTo;
        private String subject;
        private String message;
        public EmailMessage(String to, String subject, String message) {
        this.sendTo = to;
        this.subject = subject;
        this.message = message;
         }
        public void SendMessage() {
        // sends message using sendTo, subject and message
         }
}

class EmailMessage {                    // version-2
        private String sendTo;
        private String subject;
        private String message;
        private String username;
        public EmailMessage(string to, string subject, string message) {
        this.sendTo = to;
        this.subject = subject;
        this.message = message;
        }
        public void SendMessage() {
        // sends message using sendTo, subject and message
        }
        public void Login(String username, String password) {
        this.username = username;
        // code to login
        }
}
```

Answer :

Question 5 : Write a skeletal code, showing as much information possible, for the following model. **8 marks**

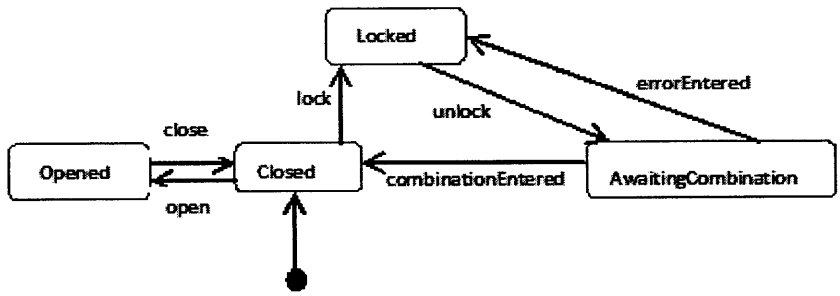


Answer :

{space for answer}

Question 6 : **(4+6) marks**

Given following state diagram for an auto-gate.



Your task :
(i) Model above using a state-pattern.

(ii) Write skeletal implementation for only the classes which represent states. Include only the state specific behavior, as available from the above diagram, in the code you provide.

Answer :

{space for answer}

Question 7 : **(9 + 6) marks**

(a) Given following code, The statements are numbered as s1, s2 etc. for reference purpose.

```
public static int calculate(int x, int y)
  {    int      a, b;
    do {
        a=1 ;                  // s1
        if (x > y)             // s2
         {
            a= 2;              // s3
         }
        x++;                   // s4
        b = x*a;               // s5
    }  while ( b <=0 ) ;       // s6
 return b;                     // s7
}
```

(a) Develop test data that provides 100% Statement coverage.

(b) Develop test data that provides 100% Decision coverage.

(c) Develop test data that provides 100% Path coverage.

For each test data, also include the statement(s) or decision or path for which it applies.

Answer :

	Test Data	Path/Decision/ Statement(s)
(a)		
(b)		
(c)		

Question 7 (b)
Identify a set of equivalence classes for testing Date of Birth input in the format yyyy/mm/dd, where year, month, and date values are integers. Assume people whose date of birth is recorded are born between 1880 and 9999, both inclusive.

Answer :

Equivalence Class(es)	YEAR	MONTH	DATE
Valid range / value(s) ;			
Invalid range/value(s)			

{Extra space for answers}

{Extra space for answers}

{Extra space for answers}

END OF PAPER