CS2103

NATIONAL UNIVERSITY OF SINGAPORE

SCHOOL OF COMPUTING

SPECIAL TERM (2007/2008)

EXAMINATION FOR

CS2103 – SOFTWARE ENGINEERING

JUNE 2008 **Time Allowed: 2 Hours**

INSTRUCTIONS TO CANDIDATES

1. This examination paper contains **SEVEN (7)** questions and comprises **TWELVE (12)** 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 (14)		
Q3 (10)		
Q4 (10)		
Q5 (9)		
Q6 (11)		
Q7 (6)		
Total (max 70)		

Question 1 **(5 + 5) marks**

(i) (a) What are the two characteristics common to the Spiral and Unified Process of software development ?

(b) Did the development process you followed for CS2103 project shared the same characteristics ? Give justification of your answer.

(ii) One of the benefits of reusing components is the cost savings from not having to write that component. Therefore, the larger the component, the greater should be the cost saving, if it is reused. That implies that cost savings are simply proportional to the size of the components that are reused. Do you agree with the implication above? Provide reasons to support your answer.

ANSWER :

Question 2 **(9 + 5)marks**

(i) Encapsulation, inheritance and polymorphism are three basic guiding principles of object-oriented development.

(a) Briefly state the meaning of each of these principles?

(b) Construct an example UML class diagram to demonstrate the use of these principles in modeling and explain the benefits arising from their use.

ANSWER :

(ii) Read the following code fragment .

```
public class Main {
        public static String NAME = "MAIN";

        public Main() {
                System.out.println("Name is  " + NAME);
        }
}

public class SubMain{
        public SubMain() {
        System.out.println("Establishing name to " + Main.NAME);
        }
}
```

(a) Use UML notation to illustrate dependency relationship between classes Main and SubMain.

(b) Do you notice any violation of an O-O guiding principle ? If yes, briefly state what is violated and how can it be corrected by redefining the dependency between class Main and class SubMain.

ANSWER :

Question 3 **10 marks**

A software house wishes to automate its T&M division. Following is summary of requirements.

The system is to be used by Testers, Programmers and System Administrators. Only an administrator can create new users and assign task to programmers. Any tester can create as well as close a fault . Only a programmer can set a state of a fault to be fixed, but a programmer cannot close a Fault. Each tester is assigned just one task at a time. A task involves test of a particular component for a particular customer. As the tester finds a fault , it must be documented. Each fault is given a unique identifier. Other information recorded about the fault is component identification, severity, date and time reported, programmer who is assigned to fix it, date fixed, date retested and date closed. The system keeps track of which faults are assigned to which programmer at any given time . It should be able to generate reports on number of faults found, fixed and closed e.g. number of faults per component and per customer; number of faults found by a particular tester ; number of faults awaiting to be fixed; number of faults awaiting to be retested; number of faults awaiting to be assigned to programmers etc.

Develop a Use Case diagram to capture the above requirements.

ANSWER (Use this space and/or space on the next page) :

ANSWER (for Question 3)

Question 4 **10 marks**

Identify possible classes with attributes and methods for the following system, and use UML class notation to represent the same. You may make reasonable assumptions from your own domain level experience . You may omit visibility of attributes and methods. You need not provide return type of methods or type of attributes.

At an unattended fuel pump station that includes a credit card reader, a customer swipes the card through the reader then specifies the amount of fuel required. The fuel is delivered and the customer's account is debited. If the card is invalid, it is returned by the card reader and fuel is not dispensed.

ANSWER :

Question 5 **9 marks**

Read following code fragment for a function which attempts to own an item of choice when landed on a specific square on a game board.

(i) Draw a flowgraph for the given method code.
(ii) Based on the flowgraph, find the Cyclomatic Complexity and list all the executable independent paths.

Note : Methods `isItemOwned(..) , isItemValuable(..) , isItemOnWishList(..)` return a boolean value.

```
void OwnItem(Item K) {

 if ( isItemOwned(K))  {

          if (isItemValuable(K.getValue())) {
              payValue(K.getValue());
              addToItemList(K) ;
             }
   }

 else  {

         if (isItemOnWishList(K) )   {
              if (isItemValuable(K.getValue()) {
                 payValue(K.getValue()) ;
                 addToItemList(K) ;
              }
         }
 }
}
```

ANSWER (Use this space and/or space on the next page) :

ANSWER (for Question 5):

Question 6 **(5 + 6) marks**

(i) Consider two classes MilkVendingMachine and Cow. Cow inherits from class Animal. MilkVendingMachine inherits from class VendingMachine. Both MilkVendingMachine and Cow are required to implement two methods getMilk () and setMilk(int qty) with identical method signatures. Provide a skeletal code fragment which ensures to meet this requirement.

(ii) Consider an operation Milk associated with class MilkableAnimal which when invoked takes amount of milk as input.. The purpose of Milk is to deduct the requested milk amount from the availableMilk. For a SpecialCow, which is a type of MilkableAnimal, there is no limit on the amount of milk which can be requested. For all other types of MilkableAnimal objects , however, there is a maximum.

(a) Write a pre-condition and a post-condition for the operation Milk held by MilkableAnimal and a pre-condition and a post-condition for the overridden version of it held in SpecialCow . Invariant for MilkableAnimal is the availableMilk of an animal is never less than the a minimumSetValue. SpecialCow inherits this invariant.

(b) Which of the Milk methods will require more testing, and why ?

ANSWER :

Question 7 **6 marks**

Examine the following Java classes A, B and C.

```
public class A
{
   private C t;
   private B g;

   public static void main(String args[]){
      // Creates t and g.
      t = new C();
      t.init();
      g = new B();
      g.init();
      g.start(this);
   }
   pubic void update(Event e)
   {
      ... // Performs updating of t based on event
   }
}

public class C
{
   public C() { ... }
   public void init() { ... }
}

public class B
{
   public B() { ... }
   public void init() { ... }
   public void start(A s){
      e = getNextEvent();
      while (e.type != Quit)
      {
         if (e.type == updateB)
            update(e);
         else
            s.update(e);
         e = getNextEvent();
      }
   }
   public void update(Event e) { ... }
}
```

(i) State your comments on the cohesion for the class methods `A.main` and `B.start`, and rank them in order from more cohesive to less cohesive.

(ii) Rank the coupling , from most to least, between the classes
A and B
A and C
B and C

(iii) Suggest ways to improve cohesion and coupling of these classes.

ANSWER (for Question 7) :