NATIONAL UNIVERSITY OF SINGAPORE

CS3219 – SOFTWARE ENGINEERING PRINCIPLES and PATTERNS

(Semester 1 AY2017/2018)

Time Allowed: 2 Hours

INSTRUCTIONS TO CANDIDATES

1. Write your Student Number only. Do not write your name.
2. This assessment paper contains **TEN questions** and comprises **EIGHTEEN** printed pages.
3. Answer **ALL** questions within the space in this booklet.
4. Use a pen to write descriptions. You can use a pencil to draw and label diagrams.
5. This is a CLOSED book assessment. An A4 size help-sheet is allowed.

STUDENT NO: ____________________________________

This portion is for examiner's use only

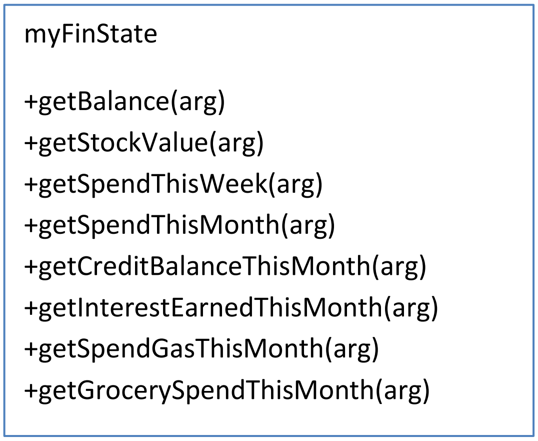
Question	Marks	Remarks
Section A	/20	
Section B	/25	
Section C	/35	
Total	/80	

Section A 20 marks

Question 1 (10 marks)

Let’s say you are given an assignment to develop a finApp that can communicate with user’s financial data (through other apps of financial institutions user transacts with e.g. bank accounts), to give her an overview of her finances. For example it can show her balance and transactions of her saving account, or show her prices of stocks she owns.

What is designed, so far, is a class that can return these values for the finApp. Let’s call this class **myFinState**. At present, you don’t need to care how it retrieves the information. Given below is the illustration of identified behavior and a pseudocode of the class myFinState.



myFinState

+getBalance(arg)
+getStockValue(arg)
+getSpendThisWeek(arg)
+getSpendThisMonth(arg)
+getCreditBalanceThisMonth(arg)
+getInterestEarnedThisMonth(arg)
+getSpendGasThisMonth(arg)
+getGrocerySpendThisMonth(arg)

```
public class myFinState {
// instance variable declaration
//screen initializations

public void stateChanged() {
float balance = getBalance(…);
balancescreen.updateBalance(balance);

float stockvalue= getStockValue(…);
stockScreen.update(stockValue);

float weekSpend= getSpendThisWeek(..);
float monthSpend= getSpendThisMonth (..);
spendScreen.update(weekSpend, monthSpend);

// other similar screen updates

}
```

a) Based on design principles learnt in CS3219 module, find flaws in above design and clearly write about them in your answer. Your answer need not list violation of specific design principles. The answer instead should point to the problems with such a design approach.

b) How do you propose to improve the design? You could write a pseudo code, or draw a diagram or write a short description to explain the improvement in above case.

Answer 1(a)

Answer 1(b)

Blank page

Question 2 (10 marks)

Let’s say you are dealing with a requirement for a software from a robot company which builds various types of robots, that can operate on land, air, or water. To start with the work, company has built prototypes of a cat-robot, a fish-robot and a bird-Robot. All robots are able to greet, “Hello everyone!”. The behaviors e.g. ‘Walk’, ‘Swim’, and ‘Fly’ will typically change from robot to robot. Some robots will have only one of the above behaviors while others may exhibit two or more such behaviors. In future, more behaviors could be added e.g. ‘crawl., ‘jump’.

Follow the design principles you learnt in this module and suggest class design of a robot and its behaviours. In future, your design should be able to easily add behaviors, with minimum changes to the existing design.

a) Use a diagram to illustrate it.
b) Which design principle(s) did you follow?

Answer 2

Answer 2

Section B 25 marks

Question 3 (9 marks)

In an observer pattern, change propagation is typically designed by one of the two popular methods – pull and push method.

In your answer below, illustrate the ‘push’ change propagation through an appropriate diagram. Show various components of the pattern and their interfaces through which they communicate.

Answer 3

Blank page

Question 4 (8 marks)

Compare and contrast the use of Mediator and Façade patterns

Your answer description should refer to contexts in which these patterns are used (or problem(s) they address) and various components of these patterns to clearly provide evidence of your understanding of these patterns. In addition, use diagrams or examples to illustrate your understanding.

Answer 4

continue… Answer 4

Question 5 (8 marks)

Memento pattern is often used in the case of state capture/restoration requirement for an object.

Give one other reason(or context) for the use of Memento pattern.

Your answer description should clearly give the context (or problem it addresses) to clearly provide evidence of your understanding. Use diagram or example to illustrate your understanding.

Answer 5

SECTION C **35 marks**

Question 6 (9 marks)

Imagine you are asked to build an application which also requires data querying and visualization similar to the CIR application you developed in the CS3219 module this semester. Give 3 questions you would ask your client to gather specific requirements which will help you take decisions for building architecture of the application.

Answer 6

Question 7 (5 marks)

Quality could be of concern at all stages of project plans and execute. Answer with reason, which stage(s) in CIR app development did it matter most to you and why?

Answer 7

Question 8 (6 marks)

Define one quality attribute(non-functional requirement) you considered while designing CIR app.

What would you measure if you are asked to measure the quality attribute you have selected?

Your answer need not provide any metric formula.

Answer 8

Question 9 (5 marks)

How would you use MIF metric value to comment on the quality of the class hierarchy design? The metric definition is given below for your reference.

Method Inheritance Factor $MIF = \frac{\sum_{i=1}^{TC} M_i(C_i)}{\sum_{i=1}^{TC} M_a(C_i)}$

- $M_{\mathbf{i}}(C_i)$ is the number of methods inherited and not overridden in C_i
- $M_{\mathbf{d}}(C_i)$ is the number of methods declared in C_i
- $M_{\mathbf{a}}(C_i)$ is the number of methods that can be invoked with C_i

Answer 9

Question   10 (10 marks)

Which quality attributes are traded off based on

a) NOC(Number of children) and

b) Depth of Inheritance(DIT) metrics.

Justify your answer.

Answer 10(a)

Answer 10(b)

(Blank Page)

--- End of paper---