University of Glasgow

Friday, 19 May 2017

2.00 pm – 3.30 pm

(Duration: 1 hour 30 minutes)

DEGREES of MSc in Information Technology, MSc in Software Development

Software Engineering (M)

Answer All Questions

This examination paper is worth a total of 60 marks

The use of a calculator is not permitted in this examination

INSTRUCTIONS TO INVIGILATORS

Please collect all exam question papers and exam answer scripts and retain for school to collect. Candidates must not remove exam question papers.

1. This question is about *design patterns* and *testing*.

Scenario: You are developing software for a pollution monitoring device. The device measures the pollution level once daily, stores this value, and broadcasts the result to all of the pollution services that have subscribed to updates from the device.

a) What design pattern should be applied to represent the relationship between the **pollution monitoring device** and the **pollution services.** Please provide the name of the pattern and a description of the problem this pattern solves.

[6]

b) Give a UML class diagram for the proposed system. Ensure you include all the required methods and multiplicities.

[10]

c) The system needs to be tested to ensure that pollution services can subscribe and unsubscribe to updates from the pollution device. Write a JUnit test case that tests how pollution services can subscribe to updates.

[4]

2. This question is about *software architectures.*

a) Model View Controller is a software architecture pattern. Give a graphical representation and a description of the role/responsibilities of the three components of this pattern.

[8]

b) Describe how Model View Controller supports software engineering design principles with three examples. For each example, provide a distinct design principle and give a brief description of how Model View Controller adheres to that design principle.

[6]

c) The Multilayer software architecture pattern is related to Model View Controller. Describe a key difference between these two patterns.

[2]

d) Procedural and Sequential actions are a kind of cohesion. Describe how each type of action increases cohesion and identify the key difference between these two types of cohesion.

[4]

3. This question is about *coupling* and *refactoring.*

a) Software designers should aim to reduce coupling where possible. What are two challenges of working with software that is highly coupled?

[4]

```
1  public class Student {
2        public int enrolledCredits;
3        public string name;
4        public string email;
5        public boolean fullTime;
6        public string address;
7        public string advisor;
8        public string degreeProgramme;
9
10       //  Constructors and other methods…
11 }
12
13 public class GlobalVs {
14       public MAX_CREDITS = 10;
15       public MAX_YEARS = 5;
16 }
17
18 public class StudentController {
19
20       public void enrol(Student student) {
21
22             if (student.fullTime && students.credits < GlobalVs.MAX_CREDITS ) {
23
24                   credits += 1
25
26                   //  Notify Student of successful enrolment
27                   String header = generateEmail();
28                   String emailLog = prepareEmailLog("Successful Enrolment");
29                   String signature = addEmailSignature();
30                   String email = header . emailLog . signature;
31
32                   emailStudent(Student student, String email);
33
34             } else {
35
36                   String header = generateEmail();
37                   String emailLog = prepareEmailLog("Unsuccessful Enrolment");
38                   String  signature = addEmailSignature();
39                   String email = header . emailLog . signature;
40
41                   emailStudent(Student student, String email);
42
43             }
44       }
45 }
```


b) Review the partial code sample above. Identify four examples of coupling by providing the **type of coupling** present, a **description** of what the coupling is, and the **line numbers** where it is present in the code.

[12]

c) Select two of your examples from part b of this question and describe how you would reduce this kind of coupling.

[4]