Software Engineering Overview

Date: Friday 24th January 2014
Time: 14:00 - 16:00

Please answer Question 1 and two other Questions

This is a CLOSED book examination

The use of electronic calculators is NOT permitted
Question 1

This question is COMPULSORY

a). State two ways in which Software Engineering is different from Physical Engineering disciplines such as bridge-building. (2 marks)

b). In an agile process, users and stakeholders are expected to review partial versions of the system at the end of each iteration, and give feedback. State two other things they are expected to do. (2 marks)

c). State a simple test for determining whether a candidate use case is of appropriate size, giving one example of use case which passes the test and one which fails. You only need to state the names of the use cases, not any details. (2 marks)

d). You have drawn a domain model and as a result have questions for your customer. State two different ways you could prepare for a meeting with the customer, depending on his/her background. (2 marks)

e). Give two examples of Pure Fabrications (other than UI classes) which would probably be useful in an aircraft design application. Hint: such an application would need to deal with a large number of parts, many of which would be similar to each other. (2 marks)

f). Briefly explain what a statechart is, and how one could be used in the application of part e). (2 marks)

g). There are many factors which influence the bug density of an application, The amount of testing done is one; the nature of the application (e.g. whether it is reactive/concurrent) is another. State two other factors which are likely to increase bug density. (2 marks)

h). How is Design By Contract related to testing? (2 marks)

i). State two properties which dependencies between layers should have if possible in a layered application (2 marks)

j). Briefly explain with an example the problem which Aspect Oriented Programming is designed to solve. (2 marks)
Question 2

a). State four specific agile practices which you followed in your team project.  

(4 marks)

b) State two specific agile practices which you did not follow in your team project.  

(2 marks)

c). Consider the statement: “In writing a use case, it’s important not to be too specific”. To what extent is this accurate?  

(2 marks)

d). You have been hired by the University of Mancunia to implement a University-wide timetabling system, to go on line for the start of the next academic year, in 9 months time. Currently, timetabling is done in various different ways in different schools, and over 200 admin staff and academics are involved. Under the new system everybody will use the same software and the timetable information will be stored in a central database which will form the “single point of truth” for all timetable information in the University. The software will be based on an existing system, which has only been used by two schools so far.

What will be the main risks associated with this development, as perceived by the following groups of stakeholders?:

i). Students  

(1 mark)

ii). IT support staff  

(1 mark)

iii). University management  

(1 mark)

iv). Admin staff responsible for timetabling (hint: consider both short-term and long-term risks from their perspective).  

(3 marks)

e). Of the four groups of stakeholders mentioned above, briefly state for each whether it would be important to have a representative interacting frequently with the development team.  

(4 marks).

f). What would be an ideal system test for this system, and why?  

(2 marks)
Question 3

a). Explain what ceremony is, and give three specific examples of how the effort spent on it can be reduced in an agile project compared to a traditional one.  

(4 marks)

b). State four different ways in which a domain model can be useful.  

(4 marks)

c). As part of designing a timetabling system for a University, you are interviewing an administrator, focusing on what is considered important from their point of view about rooms. She tells you:

“For every room we have its location, and how many seats it has. Otherwise, the information we hold is different for each type of room. For a lecture theatre, we record what kind of equipment it has (e.g. blackboard, data projector). For a computer lab we record how many computers it has, and for a tutorial room, since such a room may be a staff office, we record what member of staff, if any, occupies that office. Finally, we have a category of “special” rooms, e.g. biology labs, for which we just have a note of what they are, as we’re not involved in timetabling them.

i). List the important domain classes implied by this description.  

(4 marks)

ii) Draw a domain class diagram which shows the relationships between these classes.  
You may assume that a room serves only one function at any one time, and if the function of a room does change, it is treated as a completely new room.  
Note: if there is no enough information in the above description to model a concept in detail, do not attempt to do so.  

(5 marks)

d). Give three follow-up questions you would need to ask the administrator in order to turn the domain model into a concrete design.  

(3 marks)
Question 4

a). Throughout the course, the importance of communication in Software Engineering was stressed. Give three different examples of techniques for communication between developers and stakeholders taught in the course.

(3 marks)

b). Give three different examples of techniques for communication among developers taught in the course.

(3 marks)

c). Briefly explain the GRASP principles of Polymorphism and Protected Variations, using an example not covered in the course or elsewhere in this exam.

(4 marks)

d). Explain, giving specific examples, how your MELT design conformed to six different GRASP principles. You may count the two kinds of coupling as different principles provided you distinguish clearly between them. If your design did not conform to six, state how it should have been improved to do so.

(6 marks)

e). Explain the relationship between the GRASP Creator principle and the use of a Factory.

(2 marks)

f). Suggest how a factory could be used in MELT (other than the example given in the lectures).

(2 marks).
Question 5

a). Briefly state the difference between integration testing and system testing, according to the terminology used in the lectures, and give three examples of things which need to be done in system testing but not necessarily in integration testing.

(4 marks)

b). Explain the term “bug density” as used in the lectures, and state how bug density is related to the total size of the code, and why.

(3 marks)

c). Estimate how many bugs there are likely to be left in your MELT implementation. Explain your reasoning, taking into account the estimates of bug density given in the lectures, and the factors relating to bug density in your project.

(5 marks)

d). For each of the following, explain its purpose in JUnit testing, and outline how it expressed in JUnit code (exactly correct syntax is not required).

i). An assertion.

(2 marks)

ii). A fixture

(2 marks)

ii). A test suite

(2 marks)

e). State two limitations of JUnit testing, giving examples from using JUnit on your MELT project.

(2 marks)