Two hours - on line

The exam will be taken on line.
This is the paper format, which will be available as a backup
and to be handed out to students for reference immediately AFTER the examination starts

Please do NOT use the exam paper to write your answers

UNIVERSITY OF MANCHESTER
SCHOOL OF COMPUTER SCIENCE

Software Engineering Overview

Date: Thursday 27th January 2011
Time: 14:00 - 16:00

Please answer Question A1 in Section A and
ONE Question each from Section B and Section C

This is a CLOSED book examination

The use of electronic calculators is NOT permitted
Section A

This section is COMPULSORY

Question A1.

a) How can UML diagrams be used in the context of Agile development? Your answer should mention at least two different uses. (4 marks)

b) State two similarities between the agile UP and Scrum (2 marks)

c) State two differences between the agile UP and Scrum (2 marks)

d) The University of Southwest England is a fairly small university with a highly distributed campus and many distance learning students. Existing student records systems are expensive and insufficiently flexible for their purposes, so the University wishes to develop a new system and your team has provisionally been awarded the contract. The final go-ahead for the project will be given by the University Senior Management Team (SMT) based on the recommendation of the University’s Head of IT. Of course you intend to use agile development.

i. You have a problem. The head of IT is only familiar with Waterfall development, and when he consults some Computer Science academics he discovers that they are sceptical of agile methods (which they refer to as “fragile methods”). How would you convince him that agile development is indeed a good way of going about the project? (3 marks)

ii. Apart from the SMT, name four groups of stakeholders, and what the principal concern of each group would be (4 marks)

iii. Would you be willing to have a single stakeholder representative work with this project development team? Briefly explain why or why not (2 marks)

iv. Together the Head of IT and the Computer Science academics are not convinced by the idea of an agile method such as Scrum. They are prepared to accept the use of the agile UP. Name, and motivate the choice of, three UP artefacts that you would like to use in the project. (1 mark for each named AND motivated choice) (3 marks)
Section B

Answer ONE question from this section

Question B1

Note: in answering this question you should ignore any actual knowledge you may have about the domain and work purely from the question text.

a) Briefly explain how the Requirements discipline in the Agile UP fits into the process overall. In this respect is there any significant difference between the Agile UP and Scrum? (3 marks)

b) You have been hired to develop a system which will help with the teaching of Biology in secondary schools (ages 11-16). You have a 20 page “requirements specification” written by a junior government minister. It includes contact details for an experienced Biology teacher who has agreed to help in the project (in a way not yet specified). None of your team have any significant knowledge of biology or teaching experience. Describe the first few steps you would take in determining the requirements for the system (before writing any use cases or drawing any UML diagrams). (5 marks)

c) It is agreed that the Biology teacher will be seconded to you for 50% of her time for the duration of the project. However, her salary for that time will come out of the project budget, which means that you cannot afford to pay for your team members to work overtime. Briefly discuss the advantages and disadvantages of this arrangement. (3 marks)

d) The teacher tells you:

“One aspect of Biology we want the system to help with is Phylogeny, the study of relationships between different species, the ‘tree of life’. Each species is related to every other species by a common ancestor if you go back far enough. We want to be able to display and manipulate these ‘phylogenetic trees’. Any such tree will contain at least three species, a common ancestor and two descendents. The way I think about it, there are three kinds of species: modern ones like Humans, extinct ‘dead end’ species like Dodos, and common ancestors such as whatever was the common ancestor of Humans and Dodos about 200 million years ago.”

Draw a domain class diagram which shows the important concepts in this description. (5 marks)

Question B1 continues over the page.
e) You ask what information needs to be recorded about individual species. The answer is

“Well that depends on the species - different species have different properties. For example for birds we might want to know the wingspan, for a fish the kind of water they live in. I imagine the database will contain lots of properties for each species, and we won’t want to show them all to the students.”

As a result of this information you might add a Database class to the domain class diagram. What other addition would you make? (2 marks)

f) Suggest two Pure Fabrications which might be added when you design this part of the system. (2 marks)

Question B2.

a) What is the fundamental relationship between a domain class diagram and a design class diagram? (1 mark)

b) State three things which are shown on design class diagrams which do not appear on domain class diagrams. (3 marks)

c) Explain, with an example, the GRASP principle of Polymorphism. For full marks you should use an example which has not been given in the course, and state the kind of application for which such use of polymorphism would be appropriate. (3 marks)
d). You are working on a Computer-assisted assessment project. Like ABC and MELT, your software has different kinds of questions – for now just multiple choice questions and text questions. Also, like ABC but unlike MELT, questions can have sub-questions and sub-sub questions nested to any depth. This is achieved by having the notion of a composite question which contains other questions.

A junior developer joins your team. You know nothing about him, so to test his ability you set him the task of designing the classes representing questions; (You won’t be using his code because those classes are already written.) You are rather surprised when he comes back with a single class, which called Questions, which he explains as follows:

“I chose to make it a single class to minimise coupling – the rest of the code has only one class to interact with. Also, I found some nice opportunities for code reuse; for example this list contains sub-questions if it’s a composite question and the options if it’s an MCQ. This public instance variable QT shows what kind of question it is.”

i. Explain, in terms of GRASP principles, why this is a poor design. Your answer should include an explanation why this design does not minimise coupling. (4 marks)

ii. What would be the practical consequences of implementing this design? (2 marks)

iii. Draw a UML class diagram which shows a set of classes and representing a much better design. You do not need to need to show any attributes or operations, but you do need to show the relationships between the classes clearly. Hint: you need a CompositeQuestion class which is related to the Question class in two different ways. (4 marks)

iii. Briefly explain why this design really does exhibit low coupling. (2 marks)

iv. Explain how a method to get the marks allocated to a question would be implemented (only an explanation is required, not the code). (1 mark)
Section C

Answer ONE question from this section

Question C1

a) In agile approaches individuals and interactions are valued more than processes and tools. Discuss.

(5 marks)

b) In the course retrospective someone wrote, on a sticky, words to the effect of “The course was about not coming to the point” (i.e. a single conclusion) Explain why one valid view of an agile development course is that it should not reach such a point?

(5 marks)

c) Name ten things that must happen in a pair programming situation.

(5 marks)

d) Burndown charts are used in Scrum. Draw a burndown chart (labelling the axis) for a team that has underestimated its velocity. In such a situation what should the team ask/do, and why?

(5 marks)
Question C2

a) In the course retrospective someone wrote, on a sticky, words to the effect that “The course was about not coming to the point.” However, the thinking student attending the course would be able to give several learning outcomes of importance from the course. Give three examples of learning outcomes (i.e. topics in agile development) to reach in such a course, and reasons why these outcomes are valuable.

The examples used in your answer should be non-trivial. Thus “learning about TDD” is not acceptable, a deeper understanding of the role TDD plays is required (6 marks)

b) Discuss the stages in a sprint retrospective, stating why each stage is important in the process. Note this is the team’s retrospective, not one involving the customer, focused around acceptance testing and learning about the product. (10 marks)

c) Name what you personally think of as the most important contributing factor in successful teamwork, and motivate this choice, indicating why it is a better choice than at least two competing choices (4 marks for the motivation)

END OF EXAMINATION