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 Design using Patterns

Date: Tuesday 25th January 2011
Time: 14:00 - 16:00

Please answer Question 1 and two other questions

The questions are based on the online assessment software case study used throughout the course. You should use your knowledge of the domain to make reasonable assumptions as necessary. If in doubt, state those assumptions. For full marks your answers should be concise as well as accurate.

This is a CLOSED book examination

The use of electronic calculators is NOT permitted
Question 1. This question is **COMPULSORY**

a) State four reasons why design patterns are important in object-oriented software development.  
   (4 marks)

b) “The server returns copies of the question paper created by a Factory which is a Singleton”. Explain this statement and relate it to your answer to question 1a.  
   (4 marks)

c) Show the important elements of this class in Java syntax  
   (4 marks)

d) Suppose the application is being extended so that it will accept question papers written in a variety of different formats and convert those to the format used by the exam software. Draw a UML class diagrams showing how the Adapter pattern can be used to organise this part of the application.  
   (4 marks)

e) Explain how the Factory and Adapter patterns are related to GRASP principles. For full marks you should include four different GRASP principles in your answer.  
   (4 marks)

Question 2

a) State four important principles of Agile software development  
   (4 marks)

b). Briefly explain the relationship between the Unified Process and Agile development  
   (2 marks)

c) State four different groups of stakeholders, other than students, in the exam software, and what their principal concerns will be.  
   (4 marks)
d). A change in University management has resulted in a drastic scaling down of your project. Instead of the team you were expecting you have one full time software developer (from a country where the higher education system is very different from that in the UK) and your contribution will be limited by other duties. You still have to produce working software though. In this situation, which of the following artifacts would you choose to produce, and which would you omit? Your choices do not have to match those made in the real project so long as you justify them.

(2 marks each = 10 marks)

i A vision document
ii A domain model
iii A glossary
iv Casual format use cases
v Fully dressed use cases

Question 3.

a) Explain why and when use cases are typically used in an iterative software development process such as the UP. Explain the role of use case diagrams in developing use cases.

(4 marks)

b) Suppose that the exam software has an administration tool which has a number of functions, including ones in the following three categories:

- File management: upload and download of exam papers, standard answers and student answers to/from the server.
- User management – adding and amending user details, registering students for exams etc.
- Exam setup: setting parameters such as whether a test is timed or untimed, formal or informal, how often backups are made etc. For each assessment, an HTML “entry page” is generated which encodes these parameters.

For each of these functions, describe a relevant use case in brief format (no more than 50 words). Note: you will not be penalised if you make reasonable assumptions about the operation of the tool which happen to be incorrect.

(4 marks each = 12 marks)

c) Suggest four important non-functional requirements related to this tool, in at least three “URPS+” categories.

(4 marks)
Question 4

a) What is the purpose of domain modelling? Your answer should include the relationship between domain classes and design classes, and the factors which influence the amount of effort worth spending on domain modelling. (5 marks)

b) Consider the following description of the process which is being used to prepare traditional paper exams in the current academic year.

“The course lecturers prepare questions using e.g. Word or LaTeX, and compose them into draft question papers in a standard format. They provide marking schemes which give the standard answers and a very detailed description of how the marks will allocated. (The extra detail in the marking schemes is an attempt to compensate for the impracticality of giving individual feedback on paper scripts)

The office staff prepare a rubric sheet for each exam paper which is prepended to the document provided by the lecturers. The paper is then sent with the marking scheme to an internal moderator for review. Once the internal review process is complete, the exam and marking scheme are sent to an external examiner who also reviews them. All the documents are kept in a pack which includes a cover sheet recording signatures and dates to show that the steps in the process, including modifications to the exam or marking scheme, have been completed.”

Draw a class diagram to represent the significant domain classes suggested by this description and their important relationships and attributes. (7 marks)

c) To what extent would these domain classes correspond to design classes in an online examination system? (4 marks)

d) Suggest four ways in which the dynamic aspects of the process could be improved in an online examination system (4 marks)
Question 5

a). Briefly explain the role of GRASP patterns in object-oriented software development.  

(3 marks)

b). Questions in the exam software may have sub-questions and sub-sub questions nested to any depth, and individual part-questions may be of various types (e.g. multiple choice, text, diagrams). Explain how the Composite design pattern can be used to organise the classes representing questions.  

(3 marks)

c). For each of the following GRASP principles, explain how the use of Composite described above is consistent with it. (2 marks each = 10 marks)

i. High Cohesion
ii. Low Coupling
iii. Information Expert
iv. Polymorphism
v. Protected Variations

d). Explain how a Controller could be used to present student answers to a marker. Your answer should suggest what kind of controller would be appropriate.  

(4 marks)