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

Pattern-based Software Development

Date: Friday 20th May 2011
Time: 14:00 - 16:00

Answer ALL Questions in Section A
and
ONE question from EACH of Sections B and C

This is a CLOSED book examination

The use of electronic calculators is NOT permitted
Section A: Answer All the questions in this section

**A1:** What are the key participants in business interactions? From each participant’s viewpoint, concisely describe its business patterns and illustrate each pattern with one example. (4 marks)

**A2:** What is the main fundamental assumption of the Patterns for e-business approach? What are the main steps in this approach? Concisely explain the correspondence between these steps and their target architectural layers. (6 marks)

**A3:** Explain why design patterns are a tool for communication. Your answer should state who is doing the communicating and should include two specific examples of design patterns. (4 marks)

**A4:** Explain how the Visitor design pattern works (4 marks)

**A5:** Under what circumstances is it appropriate to use the Visitor pattern? (2 marks)
Section B: Read the following description carefully and then answer ONE question in this section.

Nowadays most retailing shops have their online e-commerce systems. Typically, an e-commerce system would provide the following functions for its customers: Select a Product, Place the Order, Track the Order, and Cancel the Order. Usually, the Place the Order function is supported by some external services, such as payment authorisation services and banking services. In addition, the shop who owns the e-commerce system would also provide an accounting system to update the number of the orders placed or cancelled and the shop’s inventory controller would update its inventory in order to ensure that the supply meets the demand. With the widespread use of mobile computing, customers can now use their mobile device as well as home computer to do their online shopping. Usually, e-commerce systems would accept three types of payment method: by credit card, debit card and store card. And there is normally a charge associated with the credit card payment.

B1: According to the above description, use the user-centric view to identify ALL the business interactions and the actors supported by a typical e-business system. For each interaction, select an appropriate business pattern. Critically and concisely justify your choice of patterns. Identify integration needs for this system. For each integration need, select an appropriate integration pattern. Critically and concisely justify your choice of patterns.

(20 marks)

B2: According to the above description, use the process-centric view to represent the following business processes: Select a Product and Place the Order. For each process, describe the actors involved and the interactions between them. Based on these two processes, critically and concisely discuss the limitations of Patterns for e-business and the role of business process modelling in the development of e-business systems.

(20 Marks)
Section C: Answer ONE question in this section.

The questions in this section relate to the design of an online assessment system such as the one you are using.

Question C1

a) “The exam server returns copies of the question paper created by a Factory which is a Singleton”. Explain this statement and how it relates to the use of design patterns for communication. 

b) Show the important elements of this class in Java syntax

c) 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.

d) Given an example (not one given in the course) of another application in which the adapter pattern could play a useful role.

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.
Question C2

When an exam is taking place, student activity is monitored by a tool, which shows a dynamically updated table of the students taking the exam, with information such as when the most recent backup occurred for each student, and whether any students have attempted to cheat by accessing applications or web pages other than the exam. The monitoring tool works by sending HTTP messages to the server, receiving data in response, so to a firewall it looks just like a web browser. In other words, the tool is polling the server at intervals for batches of information, rather than the server providing each piece of information as soon as it’s available.

a) In the first version of the monitoring tool, there was a 1-1 mapping between exams and invigilator tool instances. It was not possible for one exam to be monitored by many tools, or many exams to be monitored by one tool. Also, we expect in the future to have different types of tools for different users, e.g. invigilators in a room vs. managers overseeing the whole exam process. We might even have different types of servers, e.g. local vs. remote. Explain how the Observer design pattern can be used to remove these restrictions and provide the basis of future developments. (4 marks)

b) Draw a UML diagram to illustrate the Observer pattern as applied to this situation. (6 marks)

c) In what way does the method of communication between the tool and the server described above require changes to the standard Observer pattern? (2 marks.)

d) Suggest another way in which the Observer pattern could be used in the monitoring tool. (2 marks.)

e) Briefly suggest how two other design patterns might be used in the monitoring process. (2 marks)

f) Explain how the Observer pattern is related to GRASP principles. For full marks you should include four different GRASP principles in your answer. (4 marks)

END OF EXAMINATION