Two hours

UNIVERSITY OF MANCHESTER
SCHOOL OF COMPUTER SCIENCE

Pattern-based Software Development

Date: Tuesday 24th May 2016
Time: 09:45 - 11:45

Answer ALL of Section A
Answer ALL of Section B

This is a CLOSED book examination
The use of electronic calculators is NOT permitted

[PTO]
Section A
Answer All Questions

a) What is a software design pattern? Name *three types of design pattern* and briefly explain the purpose of each type.

(5 marks)

b) What are domain objects? Briefly explain *any three types of things* that you have learned from this course that can be candidates for domain objects, illustrating each type with an example.

(5 marks)

c) If you encounter two domain objects “Cashier” and “Basket” in your software analysis, what will make you decide if you should or should not include these objects in your design?

(5 marks)

d) State two different situations in which *design patterns can serve as a tool for communication*. Use an example to illustrate each situation and name the actors involved in the communication.

(5 marks)
Section B

Answer ALL Questions

You are developing a Computer Assisted Design (CAD) system for Steelworks Ltd, a civil engineering company, which specialises in large steel-framed buildings. The CAD system is for the management of the products made by the company. The main products are frames, which are constructed from steel bars by using a combination of nuts and bolts and welding. Larger frames are constructed from smaller frames and so on to complete the framework for a building. The company also makes other large structures (e.g. air conditioners, lifts), which are likewise constructed from smaller ones. Answer the following questions:

a) Draw a UML class diagram which shows how the Composite design pattern could be applied to model structures as described above. The diagram should indicate how the weight of a structure would be calculated.

(6 marks)

b) The company has a large numbers of small items, such as bolts. Briefly explain what a factory is and describe two advantages of using one in this situation.

(3 marks)

c) Your system should be able to keep track of every single bolt it possesses. A bolt can be in a number of states, e.g. in storage (at some place), used or damaged. You should design your system in a way that minimises the amount of storage required to represent bolts. Answer the following questions:

i) You could use the State pattern to represent the states of bolts, but briefly explain why this may not be necessary, and what you could do instead without using a pattern.

(2 marks)

ii) Or you could use the Flyweight pattern. Explain how Flyweight could be applied to this particular situation, in a way that minimises the amount of storage required to represent bolts.

(3 marks)

iii) Briefly explain the principle behind the Flyweight pattern.

(2 marks)

d) The company regularly orders shipments of structures from suppliers, where a shipment may involve several different container loads. A shipment can be in several different states, e.g. ordered, partially delivered (some containers have arrived but not others). Explain how the Observer pattern can be used to help in the tracking of shipments.

(4 marks)

END OF EXAMINATION