

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

