BSc Computer Science

Year 4

Examination 2007

Distributed Systems

Mr. Ciarán O'Leary

3 Hours

Attempt **4 Questions**

All questions carry equal marks

1 (a) Present an argument for or against the dependence of a distributed system on a shared understanding of *time*.

(6 marks)

(b) Outline the operation of the *network time protocol*. Outline the strengths and weaknesses of the protocol as you see them, and suggest modifications which may address the weaknesses.

(9 marks)

(c) Provide a design for an algorithm to ensure *mutually exclusive*, *safe*, *live* and *totally ordered* access to a shared resource.

(10 marks)

2 (a) What is necessary to ensure that two concurrent transactions are *serially equivalent*?

(6 marks)

(b) Define *two-phase locking* and *strict two-phase locking* as they apply to transactions. Clearly justify the requirement for strict two-phase locking. Use examples where necessary.

(9 marks)

(c) Demonstrate clearly how conflict between concurrent transactions can be managed without employing locking. Present an argument for or against the employment of this / these method(s).

(10 marks)

3 (a) Describe the role of the *proxy objects* in a distributed object system.

(6 marks)

(b) Clearly demonstrate the important differences between the passing of primitive types (int, float etc), objects and remote objects as parameters to remote methods.

(9 marks)

(c) Demonstrate clearly the differences between a distributed object system and a multi-agent system. Describe clearly, using sample code and diagrams where necessary, the JADE platform for multi-agent systems.

(10 marks)

4 (a) What is meant by the *publish-subscribe* interaction pattern for distributed objects? Use examples to illustrate your answer.

(6 marks)

(b) Describe clearly the architecture and operation of the CORBA Event Service.

(9 marks)

(c) Provide a filtering algorithm for a *blog* or *discussion board* which operates with all the standard functionality of an event-based system.

(10 marks)

5 (a) Identify and briefly describe the three main technologies used in *Web Services*.

(6 marks)

(b) Provide the code necessary to implement a simple web service and client using the JEE JAX-WS API. What important consideration must the developer be aware of when selecting parameter and return types? Clearly explain.

(9 marks)

(c) Describe the important differences between the JAX-WS API and the SAAJ API and provide client code using the SAAJ API for the web service from part (b) above.

(10 marks)

6 (a) Clearly explain the important differences between enterprise beans and ordinary remote objects.

(6 marks)

(b) Provide *all* the code for a *stateful session bean* and a *stateless session bean*. From the perspective of both the client and the server, what are the important differences between the two types of bean?

(9 marks)

(c) Using diagrams, examples and sample code, demonstrate the operation of the Java Persistence API for entity beans.

(10 marks)