DUBLIN INSTITUTE OF TECHNOLOGY

BSc. (Honours) Degree in Computer Science (Infrastructure)

Year 4

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SUPPLEMENTAL EXAMINATIONS 2015/2016

Distributed Systems [CMPU4021]

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Time allowed: 2 hours

Attempt **3 questions**
All questions carry **equal** marks
One complimentary mark is available

1. (a) A distributed system is defined as one in which hardware or software components located at networked computers communicate and coordinate their actions only by passing messages.
Discuss *two* consequences of defining a distributed system in this manner.

(8 marks)

(b) With the aid of a diagram describe the *mobile code* architectural model. Explain advantages and disadvantages of using mobile code.

(12 marks)

(c) Provide a design for a generic distributed *event based framework* using object oriented concepts.

(13 marks)

2. (a) Explain what is meant by the term *serialisation*, in relation to Java objects. Give sample code.

(8 marks)

(b) Explain the *lost update* problem using an illustrative code fragment.

(12 marks)

(c) Consider a design for an application that would need to be distributed across at least three computers.

Discuss which *middleware* products would be suitable for linking the distributed parts.

(13 marks)

3. (a) Explain the responsibilities and actions of the RMI *Remote Reference Module*.

(8 marks)

(b) A *shared whiteboard* is a distributed program that allows a group of users to share a common view of a drawing surface containing graphical objects, each of which has been drawn by one of the users.

A server maintains the current state of a drawing by providing an operation for clients to inform it about the latest shape the users have drawn and keeping a record of all the shapes drawn so far. The server also provides operations for clients to *add* a shape, *retrieve* a shape and *retrieve all* the shapes.

The server has a version number (an integer) that it increments each time a new shape arrives and attaches it to the new shape. The server provides operations allowing clients to retrieve *its version number* or the *version number of a shape*, so that they may avoid fetching shapes they already have.

Define the *shared whiteboard* interfaces in *Java RMI*.

(12 marks)

(c) Compare and contrast *web services* and the *distributed object model*. Use examples where necessary.

(13 marks)

4. (a) Outline a scenario that may lead to thread *deadlock* in a distributed system and show how Java allows programs to run its concurrent threads of execution, yet still access shared data safely.

(8 marks)

(b) Explain the operation of a *distributed garbage collection* algorithm based on reference counting. Discuss how it handles failures.

(12 marks)

(c) Suggest a design for *a notification mailbox service* which is intended to store notifications on behalf of multiple subscribers, allowing subscribers to specify when they require notifications to be delivered.

Evaluate the strengths and weaknesses of your design.

(13 marks)