



THE UNIVERSITY
of LIVERPOOL

SUMMER 2002 EXAMINATIONS

Master of Science : Year 1
Master of Science : Year 2

DISTRIBUTED INFORMATION SYSTEMS

TIME ALLOWED : Two Hours

INSTRUCTIONS TO CANDIDATES

Answer **THREE** questions

If you attempt to answer more than the required number of questions (in any section), the marks awarded for the excess questions will be discarded (starting with your lowest mark).



THE UNIVERSITY
of LIVERPOOL

Answer **THREE** out of the four questions listed.

1. (a) What is a distributed system? (3 marks)
- (b) Processes in a distributed systems are often divided into two groups: clients and servers.
- Describe the client-server model.
 - Give a graphical representation of the request-reply interaction between a client and a server.
- (5 marks)
- (c) In client-servers applications supporting user access to databases we can usually distinguish the following three levels:
- user-interface level;
 - processing level;
 - data level.
- Describe the services offered by each of the three levels. Describe also how the three levels are distributed between clients and servers in the (physically) two-tiered architecture and in the (physically) three-tiered architecture. (12 marks)
- (d) What is the role of the RMI compiler `rmi.c`? (5 marks)
2. (a) What is a socket? (4 marks)
- (b) Facilities for programming client server communication via sockets in Java can be found in `Java.net`. The main classes are `Socket` and `ServerSocket`.
- Describe:
- a constructor for defining the client sockets in the client Java program.
Write a line of Java code that uses this constructor to create a socket `ClientSocket` on the machine “`chiara.csc.liv.ac.uk`” at port 4444.
 - a constructor for defining the server sockets in the server Java program.
Write a line of the Java code that uses this constructor to create a socket `ServerSocket` that listens at port 4444.
 - what is the role of the `accept()` method.
- (8 marks)
- (c) In Java RMI, what is the role of the RMI registry? How is it provided?
The methods `naming.rebind` and `naming.lookup` can be used by the server and the client, respectively, to communicate with the RMI registry. Describe the activity performed by the two methods. Give examples to illustrate your answer. (9 marks)
- (d) In Java RMI what is the role of the remote interface. (4 marks)



THE UNIVERSITY
of LIVERPOOL

3. (a) The concept of transparency can be applied to several aspects of Distributed Systems. List and describe the 8 different forms of transparency standardized by ISO in 1995. (12 marks)
- (b) In client-servers applications supporting user access to databases we can usually distinguish the following three levels:

- i. user-interface level;
- ii. processing level;
- iii. data level.

Describe the typical processing level of an Internet search engine. (5 marks)

- (c) A simple `ComputerScienceModule` interface provides
- two read only instance values `name` and `lecturer` containing the name of the course and the lecturer assigned to the course, respectively;
 - a method `StudentEnrolled` which enables to set the current number of students taking the module

Define the interface `ComputerScienceModule` in CORBA IDL (8 marks)

4. (a) Give a diagram showing the architecture of CORBA. (4 marks)

(b) Describe the components of the architecture of CORBA. (8 marks)

- (c) Assume we have two different JAVA implementations of a client-server pair where the server provides the service of returning the current time in milliseconds since 1 January 1970.

The first implementation uses sockets in order to implement client-server communication, while the second uses remote method invocation. Describe what is, in your opinion, the main advantage of the implementation that uses Java RMI over the one that uses sockets.

(8 marks)

- (d) Describe the enum facility provided by CORBA IDL.

Give an example of usage of enum. (5 marks)