

DUBLIN INSTITUTE OF TECHNOLOGY
KEVIN STREET, DUBLIN 8

BSc APPLIED SCIENCES & COMPUTING

YEAR 4

SUPPLEMENTAL EXAMINATIONS 2005

COMPUTER NETWORKS AND DISTRIBUTED SYSTEMS

MR. CIARÁN O'LEARY

DR. BRENDAN O'SHEA

MR. J. W. McCAGUE

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Answer
Two Questions from Section A
and
Two Questions from Section B

All questions carry equal marks

Section A

1. (a) “Whereas the Internet is defined by the TCP/IP protocols, the World-Wide-Web (WWW) is defined by the delivery of both static and dynamically generated documents over HTTP.”

Discuss the above statement, taking care to distinguish clearly between the Internet and the WWW.

(5 marks)

- (b) Using the Java packages, show how it is possible to open a connection to a URL and send arguments to that URL using both HTTP GET and HTTP POST.

(10 marks)

- (c) You are required to design and implement a simple online bookstore incorporating the following features:

- i. Login
- ii. View products
- iii. Add product to basket
- iv. View basket
- v. Checkout

Clearly identify the key software components of this system, and providing sample code, show how such a system could be implemented using the web and database technologies you are familiar with.

(Note that you do not have to provide the entire code, but use clear code samples from the important parts of the system.)

(10 marks)

2. (a) “The *write once, run anywhere* philosophy makes Java the ideal environment for networked applications, although it also introduces security problems.”

Discuss the above statement, by clearly explaining what is meant by the italicised term and illustrating with examples the types of security problems faced in a networked Java environment.

(6 marks)

- (b) Describe clearly the role played by the *verifier*, the *class loader* and the *security manager* in ensuring the security of Java applications.

(9 marks)

- (c) Using an example scenario of your choice, demonstrate how authenticated communication can be provided in a Java implementation of a standard client server system.

(10 marks)

3. (a) Outline the function of the `rmic` tool and the `rmiregistry` tool as used for Java RMI?
(5 marks)
- (b) Using sample code, diagrams and a clear discussion show how a distributed multi-player game could be implemented in Java RMI, and outline the key implementation differences from CORBA.
(10 marks)
- (c) Using a clear example, show how a system implemented using session and entity EJB has significant advantages over a system implemented using only Java RMI and the standard Java packages.
(10 marks)
4. (a) Show how it is possible to pass a copy of a Java object from one Java environment to another using only the `java.lang`, `java.net` and `java.io` packages.
(8 marks)
- (b) Show how the receiving side from part (a) above could be modified to handle multiple clients concurrently.
(7 marks)
- (c) Use an example to give a clear demonstration of how multi-threaded Java applications protect shared data from corruption by concurrent access. You must provide sample code and you should use diagrams in your answer.
(10 marks)

Section B

5. (a) Describe what is meant by the term *transaction* and explain each of the ACID properties of transactions. **(6 marks)**
- (b) Using examples, demonstrate how each of the following three problems can arise when transactions are not correctly managed:
- i. Lost update
 - ii. Inconsistent retrieval
 - iii. Dirty read
- (9 marks)**
- (c) Contrast distributed transactions with non-distributed transactions, and using an example provide a detailed demonstration of the operation of the two-phase commit protocol. **(10 marks)**
6. (a) Drawing on your experience of both using and developing computer software in stand-alone and networked environments, provide five examples of transparencies you encountered. Accompany each choice with a brief explanation. **(5 marks)**
- (b) What are the key characteristics of distributed systems? Provide at least five characteristics with justifications for your choices. **(10 marks)**
- (c) Develop and describe the architecture for a *distributed electronic voting system* for use at national elections in Ireland. Contrast your architectural choices with alternatives, outlining their relative merits. **(10 marks)**
7. (a) The failure model for distributed object systems provides three alternative guarantees for method invocation. Describe, compare and contrast *maybe*, *at-least-once* and *at-most-once* invocation semantics in this context. **(6 marks)**
- (b) Compare and contrast Java RMI and CORBA under at least five different headings. **(9 marks)**
- (c) Describe what is meant by the term *garbage collection*.

Demonstrate an algorithm that can be used to perform garbage collection in a non-distributed object system, and demonstrate how the algorithm must be modified in order to perform garbage collection in a distributed object system. **(10 marks)**

8. (a) Distinguish between *authentication* and *encryption*, and describe in detail one method that is used for each.

(8 marks)

- (b) Show the main weakness in each methods described in part (a). How would you address this problem?

(6 marks)

- (c) Design and provide a pseudo-code implementation of your own encryption algorithm.

Evaluate the algorithm based on its strengths and weaknesses.

(11 marks)