INSTITUTE OF TECHNOLOGY BLANCHARDSTOWN

Year	Year 3
Semester	Semester 2
Date of Examination	Tuesday 21st May 2013
Time of Examination	12.30pm – 2.30pm

Prog Code	BN311	**Prog Title**	Bachelor of Science in Computing in Information Security and Digital Forensics	**Module Code**	ISDF H3013

Module Title	Distributed Systems

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External Examiner(s): *Mr Michael Barrett and Dr Tom Lunney*

Instructions to candidates:

1) **To ensure that you take the correct examination, please check that the module and programme which you are following is listed in the tables above.**
2) **Answer Question 1 and <u>any two</u> of the other questions.**
3) **Question 1 is worth 50 marks and other questions are worth 25 marks each.**

DO NOT TURN OVER THIS PAGE UNTIL YOU ARE TOLD TO DO SO

Question 1 **(50 marks)**

Answer **all** parts of this question.

i. Give five types of hardware resource and five types of data or software resource that can usefully be shared. Give examples of their sharing as it occurs in practice in distributed systems. ch1 1.1 (10 marks)

ii. A user arrives at a railway station that she has never visited before, carrying a PDA that is capable of wireless networking. Suggest how the user could be provided with information about the local services and amenities at that station, without entering the station's name or attributes. What technical challenges must be overcome? ch1 1.3 (5 marks)

iii. An open distributed system allows new resource sharing services to be added and accessed by a variety of client programs. Discuss with the use of examples, to what extent the needs of openness differ from those of heterogeneity. ch1 1.8 (5 marks)

iv. Describe and illustrate the client-server architecture of one or more major Internet applications (for example, the Web, email or net news). ch2 2.1 (10 marks)

v. Explain how it is possible for a sequence of packets transmitted through a wide area network to arrive at their destination in an order that differs from that in which they were sent. Why can't this happen in a local network? ch3 3.8 (5 marks)

vi. What are sockets? Explain with the aid of a diagram how they are used in end point communication between processes. (5 marks)

vii. How does a kernel designed for multiprocessor operation differ from one intended to operate only on single-processor computers? ch 18 18.1 (5 marks)

viii. Describe the ways in which the request-reply protocol masks the heterogeneity of operating systems and of computer networks. ch 4 4.18 (5 marks)

Question 2 **(25 marks)**

Answer **all** parts of the question (all parts are worth 5 marks each)

i. Use the World Wide Web as an example to illustrate the concept of resource sharing, client and server. Resources in the World Wide Web and other services are named by URLs. What do the initials URL denote? Give examples of three different sorts of web resources that can be named by URLs ch1 1.5

ii. Give an example of a URL. List the three main components of a URL, stating how their boundaries are denoted and illustrating each one from your example. To what extent is a URL location transparent? ch1 1.6

iii. List the three main software components that may fail when a client process invokes a method in a server object, giving an example of a failure in each case. To what extent are these failures independent of one another? Suggest how the components can be made to tolerate one another's failures. ch1 1.11

iv. A server process maintains a shared information object. Give arguments for and against allowing the client requests to be executed concurrently by the server. In the case that they are executed concurrently, give an example of possible 'interference' that can occur between the operations of different clients. Suggest how such interference may be prevented. ch1 1.12

v. A service is implemented by several servers. Explain why resources might be transferred between them. Would it be satisfactory for clients to multicast all requests to the group of servers as a way of achieving mobility transparency for clients? ch1 1.13

Question 3 **(25 marks)**

Answer **all** parts of the question.

i. Give some examples of faults in hardware and software that can/cannot be tolerated by the use of redundancy in a distributed system. To what extent does the use of redundancy in the appropriate cases make a system fault-tolerant? ch2 2.10 (5 marks)

ii. Define the integrity property of reliable communication and list all the possible threats to integrity from users and from system components. What measures can be taken to ensure the integrity property in the face of each of these sources of threats ch2 2.17 (5 marks)

iii. Compare connectionless (UDP) and connection-oriented (TCP) communication for the implementation of each of the following application-level or presentation-level protocols: (5 marks)

- virtual terminal access (for example, Telnet);
- file transfer (for example, FTP);
- user location (for example, rwho, finger);
- information browsing (for example, HTTP). ch3 3.7

iv. Discuss each of the tasks of encapsulation, concurrent processing, protection, name resolution, communication of parameters and results, and scheduling in the case of a file service. ch 6 6.1 (10 marks)

Question 4 **(25 marks)**

Answer **all** parts of the question.

i. Describe some of the physical security policies in ITB. Express them in terms that could be implemented in a computerized door locking system (e.g. access for staff, students, visitors, etc.). ch7 7.1 (5 marks)

ii. Describe some of the ways in which conventional email is vulnerable to eavesdropping, masquerading, tampering, replay, denial of service. Suggest methods by which email could be protected against each of these forms of attack. ch7 7.2 (10 marks)

iii. What data must the NFS client module hold on behalf of each user-level process? ch8 8.7 (5 marks)

iv. How many lookup calls are needed to resolve a 5-part pathname (for example, /usr/users/jim/code/ xyz.c) for a file that is stored on an NFS server? What is the reason for performing the translation step-by-step? ch 8 8.12 (5 marks)