

OLLSCOIL NA hÉIREANN
THE NATIONAL UNIVERSITY OF IRELAND, GALWAY

SUMMER EXAMINATIONS 2000

MASTERS IN INFORMATION TECHNOLOGY

CT502 COMPUTER HARDWARE AND COMMUNICATIONS

Professor. D. Bell
Dr. G. Lyons
Mr. A. Reilly
Mr. H. Melvin

Time allowed: THREE hours

Answer 5 questions. All questions carry equal marks

At least **two** questions must be answered from each section.

Question 5 from section B must be attempted.

Please use a separate answer book for each section

SECTION A

- Q1. (a) Describe in brief a top-level view of a computer system and use a sketch to illustrate the connection between the main components (6)
- (b) Distinguish between internal and external memory, giving two examples of each. (4)
- (c) (i) Explain the function of data, address, and control lines within a bus structure. (4)
- (ii) Describe and sketch a typical high-performance bus architecture and distinguish it from traditional bus architectures. (6)

Q2. Describe briefly, using diagrams where appropriate, any 3 of the Following: (20)

- (a) Cache Memory
- (b) CPU instruction sets
- (c) Programmed I/O, Interrupt driven I/O and DMA
- (d) RAID Architecture

Q3. (a) Show how to convert the following numbers to the indicated base: (6)

- (i) Decimal to Binary: 37,145, 0.0625
- (ii) Hexadecimal to Decimal: 14,3A, 7

Note: A calculator may only be used to check the answers.

- (b) (i) Describe briefly sign magnitude representation in computer arithmetic, mentioning the 2 main problems associated with it. (4)
- (ii) Calculate the two's complement binary representation of -5. (2)

(c) Calculate the 32 bit floating point representation of 7.5×2^{-73} (8)

Q4. (a) Explain how *sequential* circuits differ from combinational circuits and outline where sequential circuits might be used. (4)

(b) Use logic diagrams and truth tables to express the following Boolean relationships: (8)

- (i) $(A \text{ AND } B) \text{ XOR } (A \text{ OR NOT } B)$
- (ii) $\text{NOT}((A \text{ OR } B) \text{ AND } (\text{NOT } A \text{ XOR } B))$

(c) Describe the operation of the half adder. Indicate how it can be expanded to perform full addition (8)

SECTION B
Question 5 must be attempted.

- Q5.** (i) What are the advantages of a layered approach to a network architecture ? (3)
- (ii) Whilst surfing the web from home via an Internet Service Provider (ISP), you download a page from a web server in the US. Outline and explain briefly, the contribution of the various TCP/IP protocols that collectively carry out this task. (17)
- Q6.** (i) Distinguish between circuit and packet-switched networks. (3)
- (ii) Explain briefly and generally how modems are used to transmit data over the analogue local loop in the POTS (Plain Old Telephone System). (6)
- (iii) Domestic users are demanding increasing levels of bandwidth from the local loop of the POTS. Discuss the present limitations and evaluate some possible solutions. (11)
- Q7.** (i) Outline in brief the essential functions of the Data Link Layer. (3)
- (ii) Evaluate the IEEE 802.3 standard focusing in particular on the environments to which it is **both** suited and non-suited. (7)
- (iii) The continuous upgrading of network infrastructure to provide higher bandwidth connections is a challenge faced by many network administrators.
Within this context, briefly evaluate the following high-speed alternatives available to network administrators:
- FDDI
 - Gigabit Ethernet
 - Fast Ethernet
 - ATM
- If transmission of delay-sensitive data is a further requirement, which of the above would you recommend and why? (10)

PTO

- Q8.** (i) Outline the need for **and** the operation of the *3-way handshake* connection establishment protocol. (4)
- (ii) *Most of the Internet's end-user applications that require reliable service utilise TCP over IP.* Discuss this statement focusing on how the TCP segment header is designed to deliver such service. (8)
- (iii) Answer any two (2) of the following:
- Discuss the need for **and** operation of DNS (Domain Name System).
 - Show how TCP congestion control policy alleviates Internet congestion.
 - Evaluate briefly the role of Public key algorithms in Internet security. (8)