

OLLSCOIL NA hEIREANN
THE NATIONAL UNIVERSITY OF IRELAND, GALWAY

SEMESTER 2 EXAMINATIONS 2000-2001

HIGHER DIPLOMA (SOFTWARE DESIGN AND DEVELOPMENT)

CT861 COMPUTER ARCHITECTURE AND OPERATING SYSTEMS

Professor D. Bell
Professor G. Lyons
Mr. A. Reilly

Time allowed: THREE hours
Answer 5 questions. All questions carry equal marks
At least two questions must be answered from each section.
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. (5)
- (b) (i) Explain the Locality of Reference principle and how it can be used to enhance the performance of computer memory. (3)
- (ii) Distinguish between static and dynamic RAM, mentioning the advantages and disadvantages of both. (6)
- (c) Describe 2 methods of mapping blocks of main memory to lines of a cache. (6)

- Q2. Describe briefly, using diagrams where appropriate, any 3 of the following (20)
- (a) CPU Addressing Modes
 - (b) Bus Architectures
 - (c) Direct Memory Access
 - (d) RAID Architecture
- Q3. (a) Compare and contrast RISC and CISC processors. (6)
- (b) Perform the following arithmetic in 4 bit binary using two's complement: (6)
- (i) $-6 + 1$
 - (ii) $-3 - 4$
 - (iii) $2 + 5$
- (c) Calculate the 32 bit floating point representation of 1.25×2^{-32} . (8)
- Q4. (a) State De Morgan's Rule in Boolean algebra and show using a truth table how an AND gate can be simulated using a NOR gate and NOT gates. (6)
- (b) Use logic diagrams and truth tables to express the following Boolean relationships: (8)
- (i) $\overline{\overline{(A \text{ XOR } B)} \text{ OR } (\overline{\overline{A}} \text{ AND } \overline{\overline{B}})}$
 - (ii) $\overline{\overline{(A \text{ AND } B)} \text{ XOR } (A \text{ OR } \overline{B})}$
- (b) Describe the operation of the half adder. Indicate how it can be expanded to perform full addition. (6)

SECTION B

- Q5. (a) In terms of Operating Systems, describe what is meant by a process, specifying how it differs from a program. (4)
- (b) Describe with the aid of a block diagram, the process life cycle, showing the various queues and states a process may enter. (10)
- (c) Outline 2 approaches to OS design from a process handling standpoint. (6)

- Q6. (a) Describe process synchronisation using semaphores. (10)
- (b) (i) Explain what is meant by deadlock in process management, outlining the necessary conditions for it to occur. (7)
- (ii) List the 3 methods for handling deadlocks in an Operating System. (3)

- Q7. Write notes on 3 of the following (20)

- (a) Process Scheduling
- (b) Disk Space Allocation Methods
- (c) Protecting an OS from Unauthorised Access
- (d) Simple Paging Memory Management
- (e) Remote Procedure Calls

- Q8. (a) Outline the 2 main objectives for I/O design in an operating system. (4)
- (b) Distinguish between programmed I/O and interrupt driven I/O. (4)
- (c) Given an I/O request queue for the following disk cylinders: (12)

128, 43, 77, 11, 112, 57

and an initial disk head position on cylinder 78, determine the average seek lengths for the C-SCAN, SSTF and FCFS disk scheduling algorithms.

Note: For the C-SCAN algorithm, assume the head is moving towards the last cylinder on the disk (cylinder no. 140).