GX2547

OLLSCOIL NA hÉIREANN
THE NATIONAL UNIVERSITY OF IRELAND, GALWAY

SEMESTER 2 EXAMINATIONS 2000

HIGHER DIPLOMA (SOFTWARE DESIGN AND DEVELOPMENT)

CT861 COMPUTER ARCHITECTURE AND OPERATING SYSTEMS

Professor. D. Bell
Dr. G. Lyons
Mr. A. Reilly
Mr. B. Wall

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) Name the main components of a computer system giving a brief outline of their function. (6)

(b) (i) Describe, with the aid of a block diagram, the Von Neumann machine. (7)
(ii) What advancement did the Von Neumann machine represent over existing computers at the time? (3)
(iii) Describe the major bottleneck associated with the Von Neumann machine and mention how it is overcome in modern computer systems. (4)

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

(a) Error correcting code functions (as used with memory)

(b) CPU instruction sets

(c) Bus Architectures

(d) Computer hard drives

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

(i) Binary to Hexadecimal: 1100,10011110, 11110011

(ii) Hexadecimal to Decimal: 64, F1, 10

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

(b) Perform the following arithmetic in binary using two's compliment: (6)

(i) -5 +3

(ii) 7- 2

(iii) -3- 4

(c) Calculate the number, in the format m x 2^e, represented in 32 bit floating point notation by 11100110101000000000000000000000 (8)

m=mantissa, e= exponent

Q4. (a) Describe briefly, using truthtables, the following logic gates: (6)

(i) OR

(ii) NAND

(iii) XOR

(b) Use logic diagrams and truth tables to show how the AND and OR gates can be build using NAND gates only (8)

(b) Explain briefly the function of Multiplexers and Decoders and outline where each might be used. (6)

SECTION B

Q5. (a) Semaphores are operating systems mechanisms that provide concurrency. Explain the *wait(s)* and *signal(s)* semaphore operations. (6)

(b) Illustrate how the semaphore operations can solve the mutual exclusion problem that arises when Process A and Process B, below, require the same critical resource. (8)

Process A	Process B
start	start
wait(s);	wait(s);
<critical section>	<critical section>
signal(s);	signal(s);
<remainder>	<remainder>

(c) Describe two other approaches in which the requirements for mutual exclusion can be satisfied. (e.g. hardware, software or OS based) (6)

Q6. Write short notes (with examples where appropriate) on four of the following topics: (20)

(a) The Process Control Block
(b) Deadlock.
(c) Process scheduling strategies.
(d) File allocation management.
(e) Viruses and other software threats.
(f) I/O Buffering

Q7. (a) Briefly explain the following requirements of an operating system with regard to memory management: *relocation, protection, sharing.* (6)

(b) Explain why memory compaction is required with dynamic partition programming (4)

(c) In the context of file organisation explain the difference between a sequential file organisation and a multiple level indexed sequential file organisation. Using an example of a file with 1,000,000 records illustrate how a record search would be carried out in these two organisations. (5)

(d) Explain the use of hash tables in file organisation. Take the following example: There are 7 items that need to be stored in a hash table. The labels on these items are as follows: 6, 12, 16, 22, 24, 29 and 31. Illustrate how the hash and overflow tables can be used to store these records. (5)

Q8. (a) What are the main reasons that would lead to the suspension of a process? Where appropriate, illustrate your answer with examples. (8)

(b) What is the difference between the states "Blocked, Suspend" and "Ready, Suspend"? Draw a state transition diagram to illustrate your answer (4)

(c) Within the general framework of client/server, there is a spectrum of implementations that divides the work between the client and server differently. Describe the classes involved in a typical database application. (8)