

U2143

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THIS IS NOT AN OPEN-BOOK
EXAMINATION – CANDIDATES MAY
NOT CONSULT ANY REFERENCE
MATERIAL DURING THE SITTING.

THE UNIVERSITY OF BIRMINGHAM

Degree of B.Sc. with Honours

Artificial Intelligence and Computer Science. Second Examination
Computer Science/Software Engineering. Second and Final Examinations
Computer Science/Software Engineering with Business Studies. Second and Final
Examinations

MSc in Computer Science

06 02500

SEM 234
Operating Systems

May 1999 2 hours

[Answer ALL Questions]

Turn Over

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- 1) a) Explain the role of interrupts in handling I/O-requests in an operating system [4%]
b) Consider the following I/O-scenarios.
A mouse used with a graphical user interface
A tape drive on a multitasking operating system
A disk drive containing user files
A graphics card with direct bus connection, accessible through memory-mapped I/O.
For each of these I/O-scenarios, would you design the operating system to use buffering, spooling, caching or a combination? Justify your answer. [12%]
c) Why is it necessary to use kernel memory for data transfer from I/O-devices in an operating system which implements swapping? [4%]
- 2) a) Explain the Round-Robin Scheduling method. [4%]
b) For the two following two scenarios, which of the First-Come, First-Served (FCFS) Round-Robin or multilevel queue scheduling is most appropriate? If you choose multilevel queue scheduling, indicate also the relative priorities. Justify your answer.
(i) Two editor processes, a process which rotates a graphics display, a compilation of a long program and a process which factorises large numbers (CPU-intensive, but with little I/O)
(ii) two editor processes and many compilations of long programs [12%]
c) Suppose there are three processes in the ready queue, with burst time of 10ms, 1ms and 6ms. For each of the FCFS, Round-Robin (time quantum = 2ms) and Shortest-
Job First algorithms write down when the processor is assigned to each process and calculate the average waiting time. [9%]
- 3) a) Explain the execution of a remote procedure call. [5%]
b) For the following scenarios which communication mechanism (client-server model or remote procedure call) would you use? Justify your answer.
(i) Transferring data to a remote printer
(ii) Controlling a graphics display on a different host
(iii) Reading the password database from a different host [9%]
For a remote procedure call with a graph as an argument, why would it be much more efficient for the argument to be held as an array rather than as a list of edges? [5%]

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- 4) a) Describe the bully algorithm for electing a new coordinator. [5%]
 b) Suppose that two processes detect the demise of the coordinator simultaneously, and both decide to hold an election using the bully algorithm. What happens? [5%]
 c) Consider the following schema for ensuring atomic transactions in a network:
 (i) Elect a coordinator via the bully algorithm
 (ii) Ask coordinator for permission to do transaction
 (iii) Do transaction
 (iv) Notify coordinator that transaction has happened
 Assume that the coordinator has a way of ensuring that it gives permission to only one host at a time. Does this schema ensure that transactions are atomic? Justify your answer. [7%]

- 5) a) Describe access matrices as models of protection. [4%]
 b) Consider the three protection mechanisms: capabilities, access matrices and the UNIX protection bits (For UNIX, assume that groups are pre-defined categories such as staff, students, secretaries etc.) For the following three protection problems, which of the above three protection mechanisms can be used? Justify your answer.
 (i) Ken wants his files readable by everyone except his office mate.
 (ii) Mitch and Steve want to share some secret files.
 (iii) Linda wants some of her files to be public. [9%]
 c) Capability lists are usually kept within the address space of the user. How does the operating system ensure that the user cannot modify the contents of the list?

[6%]