A06470

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NO CALCULATOR PERMITTED IN THIS EXAMINATION

THE UNIVERSITY OF BIRMINGHAM

Degree of B.Sc. with Honours
Computer Science/Software Engineering. Second Examination.
Computer Science/Software Engineering with Business Studies. Second Examination.
Artificial Intelligence and Computer Science. Second Examination.

Joint Degree of B.Sc. with Honours
Mathematics and Computer Science. Second Examination.

Degree of MSc in Computer Science.

06 02500

Operating Systems

May 2001 2 hours

[Answer ALL questions]

Turn Over

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1. (a) Describe the possible states of a process and the transitions between them. **[6%]**

   (b) Consider the following set of processes, with the length of the CPU-burst time given in milliseconds:

Process	Burst Time	Priority	Arrival time
P_1	10	3	0.5
P_2	1	1	0.5
P_3	2	3	0.5
P_4	1	4	0
P_5	5	2	0

   The processes are assumed to have arrived in the order P_4 and P_5 at time 0 and P_1, P_2 and P_3 at time 1.5ms.

   - Illustrate the execution of these processes using First-Come-First-Served, Shortest-Job-First, a non-preemptive priority (a smaller priority number implying a higher priority), and Round-Robin (quantum = 1ms) scheduling. When you have to decide which process runs, consider only the processes which are in the ready-queue at that time.
   - What is the waiting time of each process for each of the above scheduling algorithms?
   - Which of the these schedules results in the minimal average waiting time (over all processes)?

   [15%]

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2. (a) Define the working set of a process. **[6%]**

   (b) You have devised a new page-replacement algorithm that you think may be optimal. In some contorted test cases, Belady's anomaly occurs. Is the new algorithm optimal? Explain your answer. **[6%]**

   (c) A multi-user system has been running with satisfactory performance so far. Now more users are added, and suddenly the performance decreases dramatically: the hard disk is in constant use, and response time has increased significantly. Give a possible cause for this behaviour and suggest a remedy. **[8%]**

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3. (a) Explain the SCAN-algorithm for disk scheduling. **[6%]**

   (b) When the average queue length is only one, all the disk-scheduling algorithms reduce to FCFS scheduling. Explain why this assertion is true. **[5%]**

   (c) Why is it important to try to balance file system I/O among the disks and controllers on a system in a multitasking environment? **[5%]**

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4. (a) Describe the bully algorithm for electing a new co-ordinator. **[7%]**

   (b) Assume the network has become partitioned and is now reconnected. Does the Bully algorithm suffice to ensure that there is one co-ordinator in the new network? Justify your answer. **[7%]**

   (c) Consider the following protocol:

   - Client asks Server for permission to do transaction;
   - Server grants permission if no Client currently executing transaction;
   - Client executes transaction;
   - Client tells Server completion of transaction.

   Assume the server grants permission to only one client at a time. Does this schema ensure atomicity in the presence of client or server failures? Justify your answer. **[7%]**

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5. (a) Describe UNIX file protection bits. **[6%]**

   (b) A team is working on a software project. Team members have to have read access to all files created but only one team member should be able to modify a particular file at a time. This person should be able to transfer the permission to modify these files to someone else. The manager should have full control over all files. Describe how to implement such a system using access control lists and UNIX protection bits as far as possible. **[10%]**

   (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%]**
