U2147

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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

(SEM234)

Operating Systems

May 2000 2 hours

[Answer ALL questions]

Turn Over

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1. (a) Explain the differences in the degree to which the following scheduling algorithms discriminate in favour of short processes:

   - FCFS
   - Round Robin
   - Multilevel feedback queues

   9%

   (b) A mono-processor has several processes in the ready-queue:

   - one process plays computer music via the sound card;
   - four processes perform a long compilation;
   - one process is an editing process.

   The process playing the music needs the processor 75% of the time for the music to be of high quality. Assume further that the compilation process and the editors access different disks. Describe the effects of Round-Robin, Shortest-Job-First and priority scheduling (with suitably chosen priorities) on the response time of these processes. **[9%]**

   (c) Assume the music playing process requires a response time of 1ms. Can we use virtual memory for the memory assigned to this process? **[4%]**

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2. (a) What is Belady's anomaly with respect to page replacement algorithms? **[5%]**

   (b) Consider the following page reference string:

   $$1, 2, 3, 4, 7, 5, 1, 6, 2, 4, 3$$

   List the page faults that would occur for the first-in, first-out algorithms and the optimal algorithm assuming four frames. All frames are initially empty, so your first access to each page will cost one fault. **[8%]**

   (c) Consider a monoprocessor system with the following programs running: one process displaying a rotating graphics, several editing processes and some processes compiling programs. Assume that all editing and compilation processes use data stored on a remote fileserver. Now addition of more compilation processes leads to a drastic fall in performance: the rotating graphics starts to stutter, and the paging disk is in constant use. Explain what is happening and suggest a remedy. **[7%]**

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3. (a) Describe the LOOK-algorithm for disk scheduling. **[5%]**

   (b) Explain the behaviour of the disk scheduling algorithms LOOK, SCAN and FCFS if on average there is only one request in the queue. **[6%]**

   (c) Describe the effect on performance of balancing file system I/O among the disks in a multitasking environment. **[6%]**

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4. (a) Describe the execution of a remote procedure call. **[5%]**

   (b) Can DMA (Direct Memory Access) improve the response time of an RPC? Justify your answer. **[6%]**

   (c) For each of the following applications, do you think at-least-once semantics or at-most-once semantics is better? Justify your answer.

   - Reading and writing files from a server.
   - Compiling a program.
   - Remote banking.

   [9%]

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5. (a) Describe access control lists as a model of protection. **[5%]**

   (b) Assume that the following access rights are available for a directory: read a file, create a file, append data to a file and remove a file. File creation is only allowed if the file does not exist already. Describe how to use access control lists to model electronic submission of homework by creating a single directory and setting the access control lists appropriately. **[9%]**

   (c) The Dearing report on higher education suggested that every student would very soon have a laptop, which could be connected to the University network. In this way expenditure on Computer Labs could be significantly reduced. In our School, all file systems are mountable via NFS from all computers on the School network. Is Dearing's suggestion feasible for our School from a security point of view? **[7%]**
