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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.

Artificial Intelligence and Computer Science. Second Examination

Computer Science/Software Engineering. Second Examination

Mathematics. Second Examination

SEM234

Operating Systems

January 1998 2 hours

[Answer **ALL** Questions]

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1. (a) Describe the possible states of a process and the transitions between them. **[7%]**

   (b) A mono-processor system has several processes in the ready-queue. One process displays a rotating graphics on the screen, four processes perform a long compilation and finally there is an editing process in the queue. The graphics process needs the processor 75% of the time to run smoothly. Assume further that the compilation processes and the editors access different disks. Describe the effects of Round-Robin, Shortest-Job-First and priority scheduling on the response time of these processes. **[10%]**

   (c) Suppose that a scheduling algorithm favours those processes that have used the least processor time in the recent past. Why will this algorithm favour I/O-bound programs and yet not permanently starve CPU-bound programs? **[8%]**

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2. (a) What is thrashing and why is it detrimental to system performance? **[6%]**

   (b) Consider the following page reference string:

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

   List the page faults that would occur for the first-in, first-out algorithm and the optimal algorithm assuming four frames. Remember that all frames are initially empty, so your first access to each page will cost one fault. **[10%]**

   (c) Consider a demand-paged computer system with a given degree of multiprogramming. The system was recently measured to determine utilisation of CPU and paging disk. The results are one of the following alternatives. For each case, what is happening? Can the degree of multiprogramming be increased to increase the CPU-utilisation? Is the paging helping?

   - CPU utilisation 13%, disk utilisation 97%
   - CPU utilisation 87%, disk utilisation 3%
   - CPU utilisation 13%, disk utilisation 3%

   [9%]

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3. (a) Explain the LOOK-algorithm for disk scheduling. **[8%]**

   (b) Suppose that the head of a moving-head disk with 200 tracks is currently serving a request at track 144 and has just finished a request at track 126. The queue of requests is kept in FIFO-order:

   87,148,92,178,95,151,103,176,131.

   After serving which requests does the head change direction under the following disk-scheduling strategies? **[9%]**

   (i) FCFS-scheduling

   (ii) Shortest-seek time first-scheduling

   (iii) LOOK-scheduling

   (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? **[8%]**

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4. (a) Compare the effects of a failure of a single node in a fully connected network, a partially connected network and on Ethernet. **[6%]**

   (b) Explain why a doubling of the speed of the systems on an Ethernet segment may result in decreased network performance. How could you ameliorate the problem? **[7%]**

   (c) Consider a distributed system with two sites, A and B. Can site A distinguish the following:

   (a) B goes down.

   (b) The link between A and B goes down.

   (c) B is extremely overloaded and response time is 100 times longer than normal.

   What implications does your answer have for recovery in distributed systems? **[12%]**
