BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF SCIENCE AND ENGINEERING

DEPARTMENT OF ENGINEERING AND PHYSICS

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FINAL Examination [2]

EEN5104/EEE3206 COMPUTER ARCHITECTURE AND OPERATING SYSTEMS

Duration of Examination - 3 Hours

INSTRUCTIONS TO CANDIDATES

1. This question paper consists of 3 printed pages and 6 questions
2. Answer any FOUR questions only
3. Each question carries 25 marks
4. Show your steps clearly in any calculation
5. Start the answers for each question on a fresh page

Question 1

a) Operating Systems needs 400Kbytes, each process needs 200Kbytes and the input/output blocking time is 90%. Calculate CPU utilization for:

   i. 1MB RAM and 4 processes

   ii. 4MB RAM and 10 processes.

   iii. 2MB RAM and 9 processes.

   NB show all calculations and tabulated summary of results with reasons whether it is possible to run the number of given processes. [12]

b) Five processes A,B,C,D, and E require the following amount of CPU time respectively: 1 sec, 0.5 sec, 0.2 sec, 0.6 sec and 0.3 sec. the processes are run using multiple queue scheduling algorithm, where one quantum is 200mSec, and context switching time is 30mSec. Calculate the elapsed runtimes of each process. [13]

Question 2

a) Explain how the presence of CACHE memory improves the speed of a computer system. [4]

b) What do you understand by the term "Hit Ratio" as used with respect to CACHE memory, also define the meaning of CACHING. Explain why the Hit Ratio cannot be 100% and the three possible sources for the Hit Ratio not to be 100%. [4]

c) What is the difference between writing and reading from a memory location in a computer system with CACHE memory? Explain the two methods used to write to CACHE memory. [5]

d) A memory uses a six-bit TAG in direct mapping system. If the blocks are eight bit words in size, and the Block part of the address is seven bits.
   i. Show the direct-mapping diagram for the cache memory system.
   ii. Calculate the main memory and cache memory sizes. [12]

Question 3

a) Explain the functions of an operating system with aid of diagrams and examples where possible. [6]

b) Describe how the file allocation table (FAT) system of storing files on disk works. [7]

c) Disk requests come into a disk driver for cylinders in the following order:
2, 6, 30, 21, 19, 36, 32, 12, 4. If it takes 5mSec to move from one cylinder to the next, and it is initially at cylinder 18, calculate the total time to service all the requests for:
   i. The first come first served algorithm.
   ii. The shortest seek first algorithm.
   iii. The elevator algorithm. [12]

Question 4

a) Explain the following LAN topologies:
   i. Bus Topology
   ii. Ring Topology
   iii. Star Topology [12]

b) A computer system has a cache memory with access time t_1 micro seconds per byte and s1 bytes, main memory with access time t_2 micro seconds per byte and s_2 bytes. If the cost per byte is c_1 dollars for cache memory and c_2 dollars for main memory.
   i. For cache memory hit ratio of H_1, what is the average time for the CPU to access a byte?
   ii. What is the average cost per byte for the whole memory system? [13]

Question 5

(a) Explain the difference network classes as specified by IP addressing identifying the IP address range and the default subnets for each class. [12]

(b) Explain the reason for performing subnetting? [8]

(c) What is a subnet mask? [5]

Question 6

a) What is a DEADLOCK in computer systems? [6]

b) State and explain the conditions that promote the occurrence of a deadlock. [7]

c) Describe the various strategies that can be used to prevent the occurrence of deadlocks in computer systems. [12]

END OF PAPER