Sri Lanka Institute of Information Technology

B.Sc. Honours Degree

in

Information Technology

(Specialized in Cyber Security)

Final Examination

Year 2, Semester 1 (2019)

IE2032 – Secure Operating Systems

Duration: 2 Hours

June 2019

Instructions to Candidates:

◆ This paper has 4 questions. Answer all questions.
◆ Total marks 100.
◆ This paper contains four pages including the cover page.
◆ Electronic devices capable of storing and retrieving text, including calculators and mobile phones are not allowed.
◆ This paper proceeded by a 10 mints reading period. Supervisor may indicate when answering may commence.

Question 1   [25 marks]

a) Explain steps in machine cycle? You may use diagrams in your answer.   (6 marks)

b) What are the three types of interrupts generated in operating systems? Explain each with examples.   (6 marks)

c) "Multiprocessor systems are used in server-side computing now a days heavily"

     I.   What are the two types of multiprocessor systems?   (3 marks)
     II.   Describe the advantages of multiprocessor systems.   (5 marks)

d) Compare and contrast the layered approach and module approach in operating systems development.   (5 marks)

Question 2   [25 marks]

a) Briefly explain the following terms in relation to the process synchronization:

     i.   Critical Section   (3 marks)
     ii.   Monitors   (3 marks)

b) List the tree requirements that must be satisfied by solution to critical section problem.

    (3 marks)

c) List the names of two atomic instructions and explain the use of those instructions in an operating system.   (2 marks)

d) Consider the online system which records daily sales in a fast-moving consumer goods shop. This system is directly connected with the supplies and buyers and each product should maintain a stock file as StockStatusLog file.

Sales team

StockStatus
System 01

Buyes

StockStatus
System 02

Suppliers

StockStatus
System 03

StockStatus

Log file
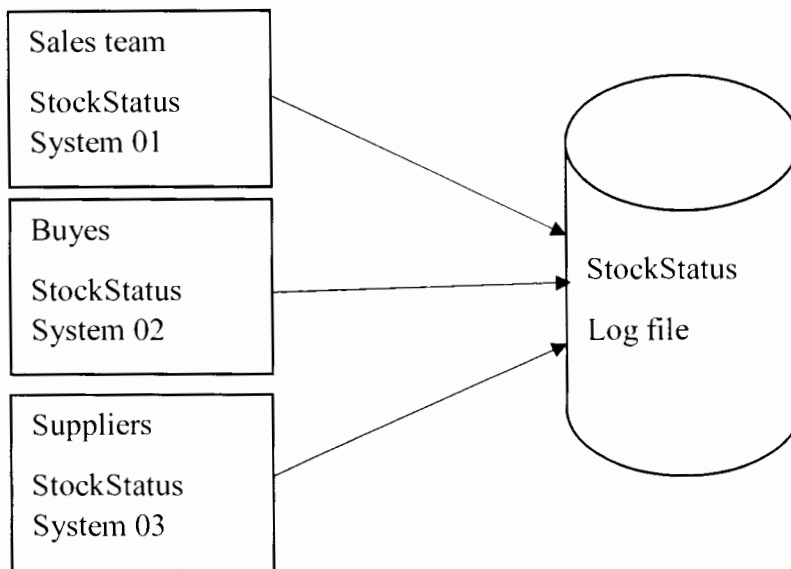
 i. Find the critical section of the above system   (4 marks)

 ii. Design a solution for the above critical section problem. (10 marks)

Question 3   [25 marks]

a) Briefly explain the following terms in relation to the memory management:

   i. Compile time address binding   (3 marks)
   ii. Base register   (3 marks)

b) There is a potential problem in the swapping if the swapped-out process is in the middle of doing I/O. Describe why and provide one possible solution to fix the problem.

                           (3 marks)

c) If an instruction takes 100 nsec, and a page fault takes an additional 20 msec, what is the effective instruction time if page faults occur every 1 million instructions? (4 marks)

d) Assume a system uses 20-bits address space (0 to 1048575) and let a user program be allowed to access only addresses 0 to 40000. Assuming a page size of 8KB, answer the following questions.
    I. How many pages are there in the system?   (3 marks)
    II. How many entries of the process page table (for that program) will be set as valid pages by the operating system?   (3 marks)
    III. Is there any internal fragmentation? Justify your answer. If there is internal fragmentation, compute the size of the fragmentation.   (3 marks)
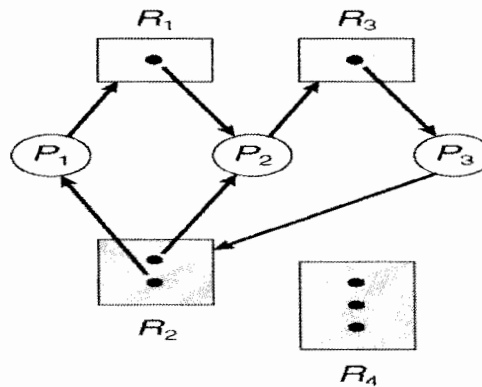
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IV. What would happened if the corresponding process requests for access to
1) a memory location 40001? (2 marks)
2) a memory location 48000? (1 mark)

Question 4 [25 marks]

a) Consider the following resource allocation graph for a system

  i. Why do we draw the resource allocation graph? (3 marks)
  ii. Does the system is in a deadlock situation? Explain. (3 marks)

b) Briefly explain the following terms in relation to the virtual memory management:
  i. Demand Paging (3 marks)
  ii. Valid/ Invalid bit (3 marks)

c) Compare and contrast the link list file allocation and indexed file allocation techniques. (4 marks)

d) For I/O to memory data transfer, consider the polling, interrupt driven, and DMA approaches.
  a. Describe how the polling technique works. (3 marks)
  b. Describe why using polling can be more efficient than using interrupt driven I/O. (3 marks)
  c. Describe why using DMA is more efficient than using interrupt driven I/O. (3 marks)

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