Sri Lanka Institute of Information Technology

B.Sc. Honours Degree in Information Technology

Specialized in Computer Systems and Network Engineering

Final Examination
Year 2, Semester II (2019)

IE 2050 – Operating Systems

Duration: 2 Hours

October 2019

Instructions to Candidates:

- ♦ This paper is preceded by 10 minutes reading period. The supervisor will indicate when answering may commence.
- ♦ This paper has 4 questions.
- ♦ Answer all questions in the booklet given.
- ♦ The total marks for the paper is 100.
- ♦ This paper contains 4 pages, including the cover page.
- ♦ Electronic devices capable of storing and retrieving text, including calculators and mobile phones are not allowed.

Question 1   [25 marks]

a) Explain steps in machine cycle? You may use diagrams in your answer.   (4 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) Write a system call sequence for copying a content of one file to another file.
    (Hint: State any assumptions you make)   (4 marks)

e) Compare and contrast the layered approach and module approach in operating systems development.   (3 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)
    iii.   Memory Management Unit.   (2 marks)

b) List the three 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) You have been asked to come up with plan to develop an online car auction systems. The system is access by Buyers, Seller and Administrators of the systems. Seller can set the minimum price and car will be sold to the highest bidding price. Once a buyer open a car detail page for viewing, price of the car should be locked 180 seconds. A car will be listed in the action for 48 hours and highest bidder will buy the car at the end 48 hours. This is shown in Figure A.
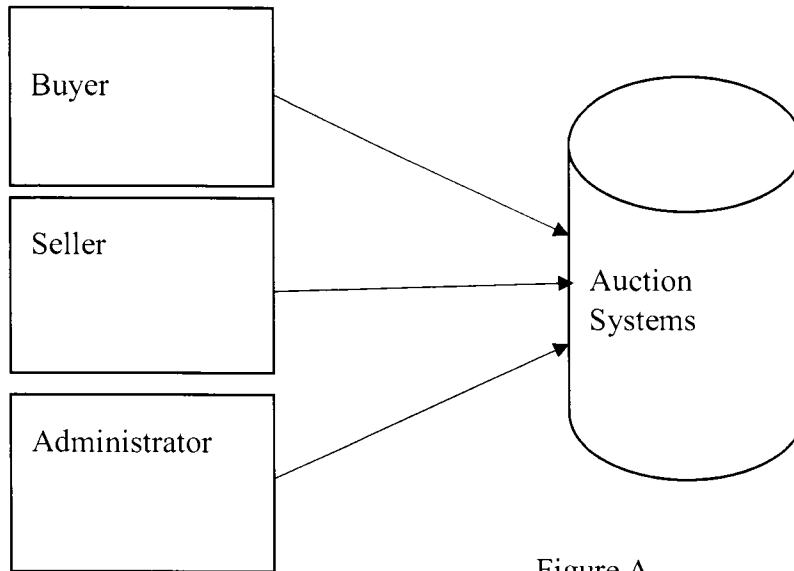
Figure A

i. Find the critical section of the above system. State any assumption you made.

(4 marks)

ii. Explain how you define the role and functions of each user in the systems (Shown in the figure A) a solution for the above critical section problem.

(8 marks)

Question 3 [25 marks]

a) Briefly explain the function of followings in relation to the memory management:

    i. Execution time address binding   (2 marks)
    ii. Base register   (2 marks)
    iii. Memory Management Unit.   (2 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.

(4 marks)

c) Assume a system uses 20-bits address space and let a user program be allowed to access only addresses 0 to 40000. Assuming a page size of 2KB, 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)
    IV. What would happened if the corresponding process requests for access to?
        I. a memory location 40001?   (1 mark)
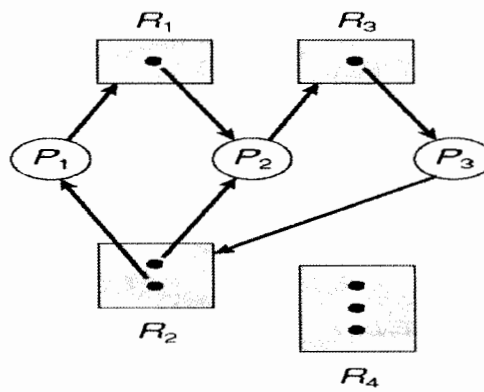   II. a memory location 48000?   (1 mark)

V. What is the use of inverted page table in memory management, briefly explain. (4 marks)

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 with details. (5 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) 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. (4 marks)
    c. Describe why using DMA is more efficient than using interrupt driven I/O. (4 marks)