Sri Lanka Institute of Information Technology

B.Sc. Honours Degree in Information Technology

Specialized in Information Technology

Final Examination
Year 2, Semester 1 (2019)

IT2060 – Operating System and System Administration

Duration: 2 Hours

May 2019

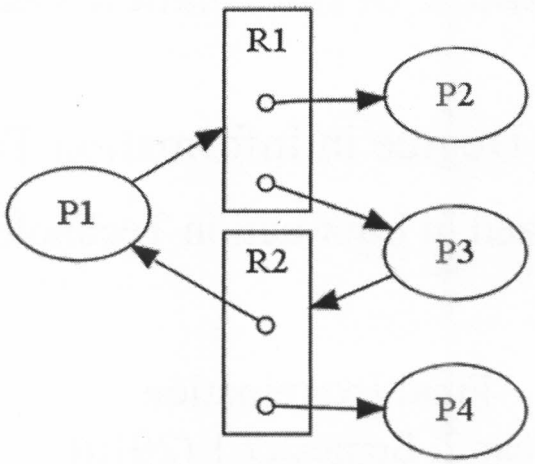
Instructions to Candidates:

- 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 80.
- This paper contains 5 pages, including the cover page.
- Electronic devices capable of storing and retrieving text, including calculators and mobile phones are not allowed.

Question 1 (20 marks)

a) Compare and contrast the '*deadlock prevention*' and '*deadlock avoidance*'. (2 marks)

b) Consider the following resource allocation graph for a system with two resources and four processes. (10 marks)



i. How do you identify whether the system is in deadlock situation using a resource allocation graph?
ii. Is the system single instance or multiple instances?
iii. Is the system in deadlock situation? Justify your answer.
iv. How does a modern operating system handle the deadlock problem?
v. Why do we need the wait for graph in detecting deadlock in a system?

c) Consider the following resource allocation graph for answering the questions. The system has ten resources and four processes. (8 marks)

Process	Current Allocation	Maximum Need
A	2	8
B	1	3
C	1	2
D	2	9

i. Is the current system in safe state? Justify your answer
ii. If the process D requests two resource instances, will the system accept the request or reject the request? Justify your answer.

Question 2 (20 marks)

a) Briefly describe the following terms: (3 marks)

i. Busy waiting
ii. Atomic instruction
iii. Semaphore

b) Compare and contrast '*semaphore with busy waiting*' and '*semaphore with block and wake up*'. (4 marks)

c) List the programming error that can be occurred when using the semaphore in developing the programs. How to solve the above problem? (3 marks)

d) A server can handle a maximum of 1000 client connections concurrently using separate threads. When the server receive a client request it is accepted if the available client connection is less than 1000 otherwise it is rejected the *accept* () function of the server. The number of client connection is represented by the shared variable *count* and updated by the client when making request from the server. Client will increment the count by one before make the request from the server and decrement by one when the service is completed. An incomplete client pseudo code which does not include the synchronization is given below. (10 marks)

Client Process

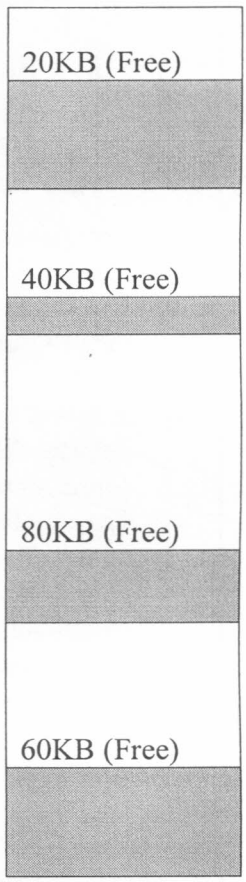
```
                                count = 0

count ++

      Request the service

      Receive the service

      ..................

      ..................

count --
```

i. Identify the critical section of the above code segment.
ii. Solve the access control problem of the above code using the semaphore and clearly indicate the initial value of the semaphore.

Question 3 (20 marks)

a) Compare and contrast the physical memory and virtual memory. (2 marks)

b) Consider the following physical memory segment, where shaded area represents utilized memory segments and the size of free memory segments are indicated. (6 marks)



i. If the worst fit allocation strategy is used, which free block will be allocated to a process with the size of 40 KB.

ii. Describe the external fragmentation problem in contiguous memory allocation.

iii. List the two technique that can be used to solve the external fragmentation problem.

c) A system has 512MB physical memory and 4GB virtual memory with the page size of 8KB. (8 marks)

i. Find the number of bits for the physical address and the virtual address.

ii. Find the number of pages and the number of frames.

d) Briefly explain the external fragmentation problem in memory. (2 marks)

e) Briefly explain the compaction in contiguous memory allocation. (2 marks)

Question 4 (20 Marks)

a) Briefly explain the following terms in a file system: (4 marks)

   i. Seek Time

   ii. Shortest Seek Time First Algorithm

a) Disk requests come in the disk driver (0 to 999 cylinders) for cylinders 400, 200, 100, 500, 800, and 300, in that order. A seek takes 10 msec per cylinder moved. Assuming that the arm is initially at cylinder 600, and moving toward larger cylinder number for a disk with 1000 cylinders, how much seek time is needed for: (10 marks)

   i. SCAN algorithm.

   ii. LOOK algorithm

b) Compare and contrast the Trap door and the Trojan horse issue in security. (6 marks)