EASTERN UNIVERSITY, SRI LANKA

SECOND EXAMINATION IN SCIENCE 2001/2002

FIRST SEMESTER (April, 2002)

CS 202 - Operating Systems



Answer All Questions

Time: 2 Hours

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Q1

(a) Describe the difference between a process and a program.

(b) Describe the various states that a process can take during its lifetime, from the time the process is created to its eventual departure from the system.

(c) Describe why synchronization between processes, executing in a shared address space is needed. State the constraints that are required to meet by an acceptable solution to critical section problem.

(d) Define the P and V operations of **Dijkstra's Semaphore** and explain their functions. Use **P** and **V** operations to solve the producer consumer problem with finite buffer.

Q2

(i) With the aid of a diagram, describe the scheduling mechanism employed by a scheduler of the operating system.

(ii) Describe the Shortest Job Next (SJN) and Round Robin (RR) scheduling algorithms.

(iii) Five processes are to be executed on a processor using:

(a) SJN
(b) RR with a time slice of 50

The execution requirements of the processes are defined in the following table:

| Process | Service time |
|---|---|
| $P_1$ | 350 |
| $P_2$ | 125 |
| $P_3$ | 475 |
| $P_4$ | 250 |
| $P_5$ | 75 |

In each case, identify the schedules for these processes, showing how many iterations through the system these processes would take.

In each case, calculate the Turn around time and average turn around time and comment on the performance of these algorithms.

(i) Briefly describe the **Paging** approach to memory management with reference to how the **virtual address** 10001010 would be translated to a real memory address (NB: The part of the above address in **bold** indicates the page number and the other part indicates the displacement)

(ii) Describe the demand paging system and describe a procedure for handling **page fault.**



(iii) Describe the following page replacement algorithms:

(a) FIFO
(b) LRU

Given that main memory is composed of four frames and that a program has been divided into eight pages (numbered 0 through 7).

How many page faults will occur using LRU with a request list of :0, 1, 7, 2, 3, 2, 7, 1, 0, 3 if the four page frames are initially empty.

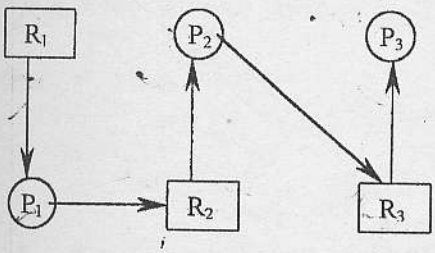
Q4

Describe the necessary conditions under which a deadlock can occur in an operating system.

Describe the three strategies used by an operating system to handle deadlocks.

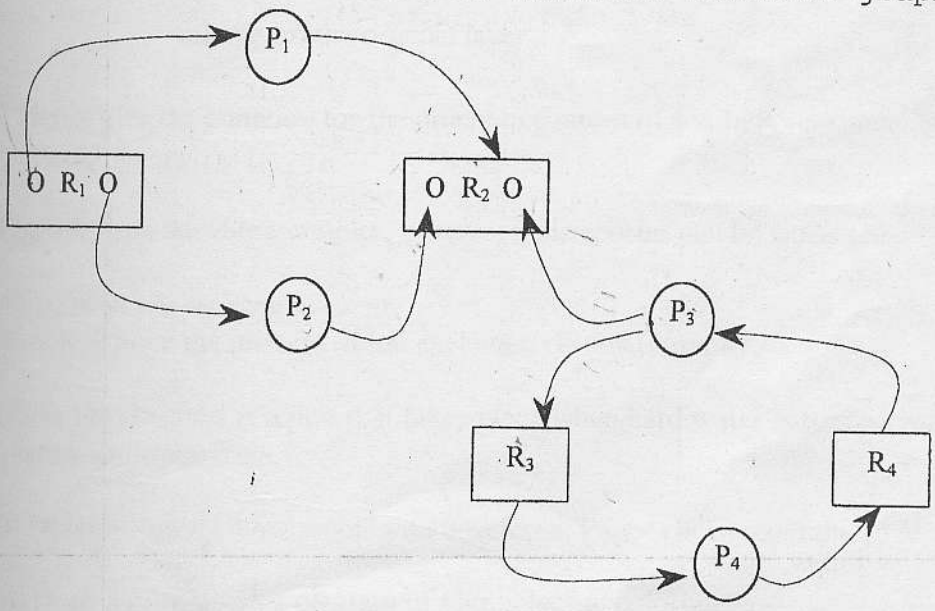
Give a deadlock detection algorithm based on resource graphs.

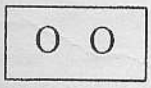
(i) Show that the following system is deadlock free:




$P_1$, $P_2$, and $P_3$ are processes.
$R_1$, $R_2$, and $R_3$ are resources.

Consider the following directed resource graph:




indicates that there are two resources of the same type are available.

(a) Is the system as a whole, deadlocked?

(b) Three processes- $P_1$, $P_2$, and $P_3$ - are requesting resources from $R_2$. Which requests would you satisfy to minimize the number of processes involved in the deadlock?

(c) Can the graph be reduced partially or totally?