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EASTERN UNIVERSITY, SRI LANKA

SECOND EXAMINATION IN SCIENCE - 2004/2005

FIRST SEMESTER (Jan./Feb., 2006)

CS 202 - OPERATING SYSTEM

Answer all questions **Time allowed: Two hours**

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1. (a) Provide definitions for the following terms:

   i. Program

   ii. Process

   iii. Process state

   (b) What are the advantages of multiprogramming systems over non-multiprogramming systems?

   (c) What is PCB (Process Control Block)? Why is it used for?

   (d) Can a process make a transition from the Ready state to the Blocked state? Why or why not?

   (e) What are race conditions? How can they be prevented?

(f) Describe the operations P(s) and V(s) on a semaphore s.

i. What does P do?

ii. What does V do?

iii. What is special about the way P and V are performed that enable them to solve the "race conditions" problem?

2. (a) Define/Describe the following terms:

i. Context switch

ii. Scheduler

(b) Discuss/explain the following scheduling methodologies:

i. First Come First Serve (FCFS)

ii. Non preemptive Shortest Job First(SJN)

iii. Round Robin(RR)

(c) Explain the difference between preemptive and non preemptive scheduling.

(d) Suppose the following jobs are to be executed in a uniprocessor system

Job Number	Arrival Time	Service Time
1	0	4
2	1	8
3	3	2
4	10	6
5	12	5

Ignore process switching overhead. For each of the following sched methods determine the turnaround time for each process, and average turnaround for all jobs.

i. FCFS

ii. SJN

iii. RR, quantum = 3

3. (a) Describe the necessary conditions under which a deadlock can o in an operating system.

(b) What condition for deadlock does the following solution attack? process must wait for a needed resource, it drops all of its previo held resources and tries to acquire all resources again."

(c) Consider a system consisting of four resources of the same type tha shared by three processes, each of which needs at most two resou Show that the system is deadlock free.

(d) Consider the following resource-allocation policy. Requests and leases for resources are allowed at any time. If a request for resou cannot be satisfied because the resources are not available, then check any processes that are blocked, waiting for resources. If t have the desired resources, then these resources are taken away f them and are given to the requesting process. The vector of resou for which the process is waiting is increased to include the resou that were taken away.

For example, consider a system with three resource types and the vector Available initialized to (4,2,2). If process P0 asks for (2,2,1), it gets them. If P1 asks for (1,0,1), it gets them. Then, if P0 asks for (0,0,1), it is blocked (resource not available). If P2 now asks for (2,0,0), it gets the available one (1,0,0) and one that was allocated to P0 (since P0 is blocked). P0's Allocation vector goes down to (1,2,1), and its Need vector goes up to (1,0,1).

i. Can deadlock occur? If your answer is "yes", give an example. If your answer "no", specify which necessary condition cannot occur.

ii. Can indefinite blocking occur? Explain your answer.

(e) A system has four processes, P1 through P4, and three types of resources,

Total system resources: R1 (1 unit), R2 (1 unit), R3 (3 units).

P1 holds 1 R3 and requests 1 R1.

P2 holds 1 R1 and 1 R3 ,requests 1 R2.

P3 holds 1 R2 and requests 1 R3.

P4 holds 1 R3.

i. Draw the resource allocation graph.

ii. Is there a deadlock? Why or why not?

4. (a) Define or explain each of the following:

i. Paging

ii. virtual memory

iii. Page Frame

(b) Explain, compare, and contrast the advantages and disadvantages of the following resource allocation policies:

i. First-fit

ii. Best-fit

(c) Discuss the differences between logical and physical addresses.

(d) Under what circumstances do page faults occur?

(e) Given a system with page size of 1k (k = 1024), virtual memory size of 32k, and physical memory of 8k. A process running in an OS with paging has the following page table. All numbers are in decimal.

Virtual Page No.	Physical Page No.
0	6
1	2
2	1
3	5
...	

i. How many bits are there in the logical address?

ii. How many bits are there in the physical address?

iii. What is the exact physical address for virtual address 3247?

iv. What is the exact physical address for virtual address 2012?

v. What is the exact physical address for virtual address 1925?

vi. What is the exact virtual address for physical address 1049?

(f) Given the reference string 7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1 for a memory with 3 frames, show the memory allocation pattern for each of the following replacement algorithms:

i. FIFO

ii. LRU