HOMEWORK 3

CSE 120 OPERATING SYSTEMS
FALL 2006

DUE ON 11/09/2006 (THURSDAY) AT 12:30 PM

INSTRUCTIONS FOR TURN-IN:

- Assignment is due at 12:30pm
- Any turn-in *after* 12:30pm will be marked "LATE"
- Please place the hardcopy of your assignment in Vikram's mailbox
    - Where is the mailbox room?
        - EBU3B (CSE) Building 2nd Floor, next to the copy machine
        - Place the hardcopy of your assignment in the mailbox labeled "Mavalankar Vikram" (Mailboxes are sorted last name wise)

QUESTIONS:

1.a) Assume a user process P1 of 5 MB in size. A standard hard disk is used as a backing store. The given transfer rate of the hard disk is 20 MB per second. Assuming that the file is stored contiguously, and assuming an average seek latency of 5 milliseconds, what is the swap-in time for the process P1?

1.b) Now, consider a round-robin CPU-scheduling algorithm for long-term scheduling. What constraint would you impose on the time quantum for this RR algorithm, having computed the total swap time in (1.a)?

2) Why is it a good strategy to ensure that a process is completely idle (does not have any pending I/O – in particular) before swapping it out?

3.a) One possible solution to the problem of external fragmentation is compaction – where the goal is to shuffle the memory contents so as to place all free memory together in one large block. However, compaction is not always possible. Mention one situation where compaction would not be possible.
3.b) What could be another possible solution to the problem of external fragmentation?

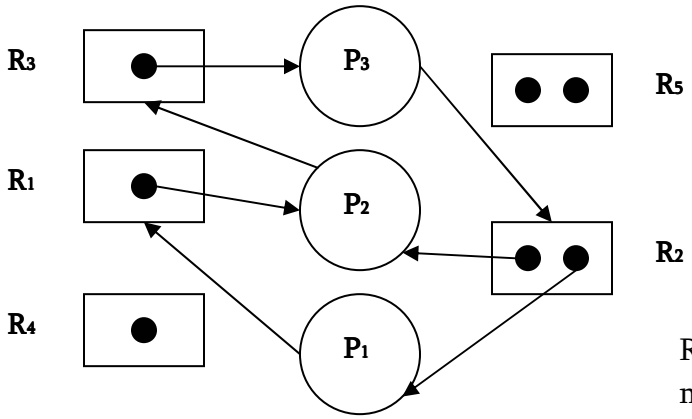
4) Some TLBs store address-space identifiers (ASIDs) or TLB tags in each TLB entry. What could be one advantage of using TLB tags with TLB entries?

5) The percentage of time that any page number is found in the TLB is called the hit ratio. Assume a TLB hit ratio of 92% and a single-level page table. If it takes 15 nanoseconds to lookup the TLB, and 120 nanoseconds to access memory, calculate the effective memory-access time.

6) Explain how the use of a global page replacement algorithm can lead to thrashing. What would be one solution to limit the effects of thrashing in this case?

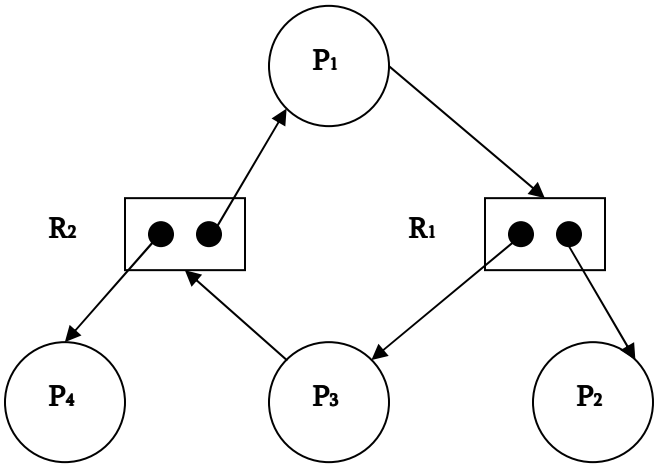
7) To keep track of free disk space, the system maintains a free-space list. Give 3 common methods of implementing a free-space list in a system. What are the pros and cons of each approach?

8) Look at the resource allocation graphs below. Point out the cycles that exist in each of the graphs and demonstrate if they have a possible deadlock or not.



Graph 1

Resources R_2 and R_5 have multiple instances



Graph 2

Resources R_1 and R_2 have multiple instances

9) [Silberschatz Galvin Gagne – 7th Edition – Chapter 8 – Problem 8.3] Given 5 memory partitions of 100 KB, 500 KB, 200 KB, 300 KB, 600 KB (in order), how would each of the first-fit, best-fit and worst-fit algorithms place processes of 212 KB, 417 KB, 112 KB, and 426 KB (in order)? Which algorithm makes the most efficient use of memory?
(Assume searching always starts at the beginning of the set of partitions)

10) Assume that in a system with a 32-bit address space, the page size is 4KB. How many bits are required for representing the page-offset and the virtual page number? Consider the following page table entries:

VPN	Frame Number
0x7	0x0005
0x8	0x0002
0x9	0x0001
0xA	0x0007
0xB	0x0003
0xC	0x0006
0xD	0x0004

What would be the physical address for the virtual address 0x0000A579?