**CIS 25 Test 2 Spring, 2009 Name**_____

**1.a.** What is the purpose of virtual memory? (3 pts)

**b.** Briefly define each of the following terms:

**i.** page fault **ii.** thrashing **iii.** working set (6 pts)

**c.** Explain the difference between demand paging and anticipatory paging. (4 pts)

**d.** Explain what happens between the time a program page faults and the time the program can resume execution. Be specific about the steps. (5 pts)

**2.** A computer has four page frames. The table below shows the information in the page table. The "Loaded" column contains the time the page was loaded into memory. The "Referenced" column contains the time the page was last referenced. The times are measured in clock ticks. "R" and "M" are the reference (use) and modified (change) bits respectively.For the following replacement algorithms, first **explain** how the algorithm works and then indicate which page will be selected for replacement using that algorithm:

**i. Clock** (Second Chance) **ii. FIFO** **iii. LRU** **iv. Optimal** (5 pts apiece)

| Page | Loaded | Last Referenced | Next Referenced | R | M |
|---|---|---|---|---|---|
| 0 | 126 | 279 | 295 | 1 | 1 |
| 1 | 120 | 272 | 294 | 1 | 0 |
| 2 | 230 | 260 | 293 | 0 | 1 |
| 3 | 160 | 280 | 290 | 0 | 0 |

**3.a.** What is a critical section? (3 pts)

**b.** What is Dekker's algorithm? (3 pts)

**c.** Why is a semaphore the solution to the critical section problem? That is, how is the semaphore solution different from any other attempt to solve the problem with flags? (5 points)

**d.** Name and define in pseudocode the two operations (other than initialization) that can be performed on a semaphore. Is there a limit on either operation, and if so, what is it? (6 points)

**4.** Which kind of semaphore would you use for each of the following tasks? Draw a diagram showing how the semaphore will be initialized and when and how its value will be changed. (12 pts)

**a.** Several processes are accessing a shared data base of student grades; whenever a process changes a grade in the data base, it must update shared variable GPA.

**b.** In order to forward a packet, router1 must wait for the packet to arrive. The packet is delivered to router1 by router2.

**c.** The system has four tape drive units, which must be shared by all processes in the system.

**5.a.** Does the following resource allocation graph represent a system in deadlock? Explain why or why not. (5 points)

**a.** What are the four necessary conditions for deadlock? (8 pts)

**b.** Explain what is meant by "deadlock prevention," and give and explain one example of how to prevent deadlock. (6 pts)

**c.** Identify and explain two problems that can occur during deadlock recovery. (6 points)

**d.** Draw a diagram to explain the relationship between a safe state, an unsafe state, and deadlock. (3 pts)

**e.** Suppose that a system has 10 tape drives. The following chart shows 3 jobs, with the number of tape drives each currently holds and the maximum number of tape drives each could need to run to completion. Is the system in a safe state? Prove your answer. (5 pts)

| job | holds | max needs |
|---|---|---|
| 0 | 4 | 8 |
| 1 | 1 | 2 |
| 2 | 3 | 6 |