

NAME: _____ (First name first) TOTAL: _____

COSC 4330

FINAL

DECEMBER 14, 1999

Closed Book. You can have *one page* of notes.

1. For each of the statements below, indicate in one sentence whether or not the statement is true or false, and why (5 points each):

- a) There are some problems that can be solved using monitors and cannot be solved using semaphores.

FALSE. We can, if we need it, implement semaphores on the top of monitors.

- b) Memory protection is always done by the computer hardware.

TRUE. This is the only way to do it fast enough.

- c) We can prevent deadlocks in message-passing systems by denying the *hold-and-wait* condition.

FALSE. This would require each process to receive all its messages at once.

- d) We can prevent deadlocks in message-passing systems by denying the *mutual exclusion* condition.

FALSE. This would require processes to "receive" messages that were not yet sent.

2. A computer has 512 Megabytes of main memory, 32 bit addresses and a page size of eight kilobytes.

- a) How many page frames are there in main memory? (5 points)

512MB/8K = 64K frames

- b) How many bits are there in the page offset? (5 points)

13 bits (because $2^{13} = 8K$)

3. Given the six following page replacement policies:

Global FIFO Clock Denning's Working Set

Global LRU OPT VMS/Windows

indicate the policy or the policies:

- a) that performs worse than all other five policies (5 points):

Global FIFO

- b) that handle real-time processes best (5 points):

VMS/Windows

4. Complete the following monitor code to implement a binary semaphore. (20 points)

```
Class binary_semaphore {  
  
    private condition go;  
  
    private int a;  
  
    public void synchronized P(){  
  
        if (a == 0) // WAIT IF VALUE IS ZERO  
  
            go.wait;  
  
        a = a - 1;  
  
    } // P  
  
    public void synchronized V() {  
  
        a = 1; // THAT'S WHAT MAKES IT A BINARY SEMAPHORE  
  
        go.notify;  
  
    } // V  
  
    binary_semaphore(int initVal){  
  
        a = initVal;  
  
    } //constructor  
  
} // Class semaphore
```

5. Given the following result for the "ls -lg a.ps" Unix command

```
-rw-r----- 1 paris faculty 341993 Dec 13 18:23 a.ps
```

- a) Which users can modify the file a.ps? (5 points)

paris

- b) Which users can read it? (5 points)

paris and all members of the "faculty" group

6. What are the major advantage and disadvantage of the VMS/Windows page replacement policy? (10 points)

❖ Major advantage: The policy can allocate to each real-time a process enough page frames to hold all its pages, thus guaranteeing that the process will never experience a page fault

❖ Major disadvantage: It is not always easy to allocate the right number of page frames to each new process.

7. A 32-bit Berkeley UNIX file system has 16 kilobyte blocks. How many bytes of any given file can be accessed:

a) Directly from the i-node (5 points): 12×16KB = 192MB bytes

b) With one level of indirection (5 points): (16KB/4B)×16KB = 64MB bytes

c) With two levels of indirection (5 points): 4GB – 64MB – 192KB bytes

8. What is the difference between *internal fragmentation* and *external fragmentation*? (5 points)

❖ Internal fragmentation occurs in storage management techniques that allocate storage space in fixed-size units, such as virtual memory systems and block-oriented file systems. It happens because the last page of a process or the last block of a file is on the average only half-full.

❖ External fragmentation occur in memory management techniques that allocate contiguous memory space to processes of different sizes.