| COSC 4330 | FINAL EXAMINATION | DECEMBER 13, 2007 |

*This exam is **closed book**. You can have **one page** of notes.   UH expels cheaters.*
I may miss the Monday night grade reporting deadline to give your finals and assignments the attention they deserve.

1. A virtual memory system has a virtual address space of 4 Gigabytes and a page size of 1024 bytes. (2×5 points)

  a) How many bits of the virtual address will remain ***unchanged*** by the address translation process?

  _____ 10 ____***bits***

  b) On the average, how much memory is lost to ***internal fragmentation?***

  ___ half a page = 512 ___ ***bytes per process***

2. Give examples of ***access control lists*** and ***tickets*** in the UNIX file system. (2×5 points)

The nine protection bits associated with each file constitute its access control list while file descriptors are capabilities.

3. *Answer in one or two sentences to the following questions* (6×5 points)

  a) What is the major disadvantage of letting the kernel handle ***TLB misses***?

  Each TLB miss will occasion two context switches.

  b) What is the major advantage of ***contiguous file allocation***?

  Contiguous file allocation provides the fastest disk accesses of all file allocation policies.

  c) How does Berkeley UNIX simulate the ***page referenced bit***?

  It uses the valid bit to simulate the missing page referenced bit.

  d) What is the major advantage of ***inverted page tables***?

  Their size is function of the size of the system's physical memory instead of being a function of the sizes of the virtual address spaces of each process.

  e) What is the function of the ***dirty bit***?

  I tell the virtual memory manager whether a page to be expelled is dirty and must be saved in the swap area before being expelled or can be immediately expelled

  f) What is the main advantage of the VMS/Windows page replacement policy compared to the BSD Clock policy or the Mach policy?

  Unlike the BSD Clock policy and the Mach policy, the VMS/Windows page replacement policy can allocate fixed partitions to real-time applications.

4. What does the BSD file system do to reduce ***internal fragmentation***? (5 point) Why was it an important issue? (5 points)

To reduce internal fragmentation in the file system, the BSD file system, allocate block fragments equal to ½ or ¼ of a block to small files and to the tail end of larger files. This was an important issue in the eighties because most Unix files were much smaller than the propose block size of the BSD file system (4 kilobytes).

5. An store has all shoppers waiting in a single waiting line for one of their check-out clerks. Complete the following class skeleton to represent this behavior (5×4 points).

```
class mystore {
        private int nclerks, nbusyclerks;
        private condition freeclerk;
        start_checkout() {
                if (__ nbusyclerks == nclercks _____)
                ____ freeclerk.wait _____
                nbusyclerks++ _____
        } //start_checkout
        end_checkout() {
                nbusyclerks-- _____
                freeclerk.signal _____
        } // end_checkout
        mystore (int howmany) {
                nclerks = howmany; nbusyclerks = 0;
        } // constructor
] // class mystore
```

6. Is it easier to prevent deadlocks by denying the ***hold and wait condition*** or the ***circular wait condition***? Why? (5 points)

NO, the contrary is true. It is easier to prevent deadlocks by denying the circular wait condition than by denying the hold and wait condition because denying the circular wait condition is much less restrictive than denying the hold and wait condition.

7. A 32-bit Berkeley UNIX file system has a block size of 8 kilobytes. How many ***bytes*** of a given file can be accessed :

a) Using the block addresses stored in the i-node? (5 points) _____ 12 x 8 KB = 96k **bytes**

b) With one level of indirection? (5 points) _____ 8K/4x 8KB = 16M **bytes**

c) With two levels of indirection? (5 points) _____ 4 GB – 16MB – 96K **bytes**