# COSC 4330 FINAL EXAMINATION MAY 5, 2003

This exam is closed book. You can have one page of notes. UH expels cheaters.

**1.** For each of the statements below, indicate in one sentence whether the statement is true or false (2 points), **and why** (3 points).

a) UNIX stores all file attributes in the file ***inode***.

False, the file name is stored in the directory entry pointing to the inode.

b) The ***VMS page replacement policy*** assumes the existence of a page-referenced bit.

False, it uses a local FIFO page replacement policy and puts all victims of the FIFO policy at the end of a global queue from where they can be reclaimed.

c) In UNIX, each disk partition has a fixed number of ***inodes***.

True, this number is selected when the partition is created.

d) Increasing the ***page size*** of a computer system will also increase the size of its ***page tables***.

False, increasing the page size of a computer system will decrease the size of its page tables.

e) When a process gains control of the CPU of a virtual memory system, its ***entire page table*** is loaded into the system's TLB.

False, the TLB is not big enough.

f) Some page replacement policies are much easier to simulate than to implement.

True, this is the case for the Local LRU, Global LRU and Working Set policies.

**2.** *Answer the following questions in one or at most two sentences:* (6×5 points)

a) Can you prevent deadlocks in ***client/server systems***? Why?

No, as it would require to have all messages moving in the same direction.

b) What is the main function of the ***dirty bit***?

To tell the page fault handler if a given page must be written back to disk before being expelled.

c) What is the main disadvantage of the ***FIFO*** page replacement policy?

It often expels the wrong page.

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

Half a page frame per process.

e) What is the main function of a ***UNIX group***?

To specify a group of users that are given special access rights to some files.

f) What is the cost of a ***TLB miss*** when it is handled by the computer firmware?

Two context switches.

**3.** You are to design a two-level page table for a computer having 32-bit addresses. Assuming that the memory is byte addressable,

a) What ***page size*** should you pick? (5 points) _____4,096 **bytes**

b) What should be the size of your ***master index***? (5 points) _____4,096 **bytes**

c) What should be the size of ***subindexes***? (5 points) _____4,096 **bytes**

**4.** A Berkeley UNIX file system has a block size of four kilobytes. How many indirect blocks will it allocate: (2×5 points)

a) For a 40 kilobyte file? _____0 **block(s)**

b) For a 2 megabyte file? _____1 **block(s)**

**5.** What is the minimum block size that would allow UNIX to access 4 megabyte files with a ***single level of indirection***? (5 points)

_____4 kilo **bytes**

*Explain your calculations for possible partial credit:*

Neglecting the contributions of the twelve direct blocks, we see that the minimum block size b_min must satisfy the inequality:

(b_min/4)x bmin ≥ 4 MB

6. What are the advantages and disadvantages of ***access control lists*** compared ***to tickets***? (2×5 points**)**

Access control lists are more flexible and let the owner of the file revoke the access rights of individual users.

Tickets only let the owner of the file revoke the access rights of all the users having a specific ticket. On the other hand verifying a ticket takes much less time that consulting an access control list.