NAME: _____ (FIRST NAME FIRST) **SCORE**: _____

COSC 4330/6310 FINAL MAY 9, 2011

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

1. A small coffee shop has a maximum occupancy of 25 people and a single door allowing one person to go through at a time. Complete the following template to ensure that (a) the shop will never contain more than its maximum occupancy, (b) people will enter and leave the shop in an orderly manner and (c) no deadlock will be created. (5 points per correct line for a total of 20 points)

```
semaphore mutex = 1;

semaphore occupancy = 25;

shop(){

    P(&occupancy); P(&mutex); // ORDER MATTERS

    enter_the_shop();

    V(&mutex);

    spend_time_inside();

    P(&mutex);

    exit_the_shop;

    V(&occupancy); V(&mutex); // IN ANY ORDER

} // shop
```

2. What are the two possible effects of a ***signal*** call in a monitor procedure? (2×5 points)

a) If one or more processes are waiting on the condition that is signaled _____

then the procedure issuing the signal immediately releases the monitor and one of the waiting processes is allowed to proceed. _____

_____

b) **If** no process is waiting on the condition that is signaled _____

then the signal has no effect. _____

T: _____

3. Questions with short answers (6×5 points)

a) Give one example of a ***consumable resource*** in a computer system.

A message.

b) List the contents of a ***UNIX directory entry***.

A file name and an i-node number.

c) What would happen to the performance of the UNIX file system if ***i-nodes*** were ***not cached*** in main memory?

Each block read or write will now require at least two disk I/Os.

Also acceptable: file system would be much slower.

d) How does a ***TLB entry*** differ from a regular ***page table entry***?

In addition to the usual contents of a page table entry, a TLB entry also contains a page number.

Also acceptable: TLB entries are stored in high-speed registers; TLB contains the most recently used page table entries.

e) Give one example of a system where deadlocks cannot be prevented by denying the ***circular wait condition***.

A client server system (because messages go from the client to the server anfd from the server to the client).

f) What is the major advantage of ***tickets*** over ***access control lists***?

They are much faster.

4. A netbook has two Gigabytes of main memory, 32-bit addresses and a page size of four kilobytes.(4×5 points)

a) How many page frames are there in main memory? $2^{31}/2^{12} = 2^{19}$ (= 512K) _____ frames

b) How many bits of the virtual address are taken by the byte offset? 12 _____ bits

c) How many bits of the virtual address are taken by the page number? 20 _____ bits

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

2 kilo (= 2^{11}) _____ ***bytes*** per program segment

5. The windows page replacement policy allocates a specific number of page frames to each process. Under which conditions is this number increased or decreased. (2×5 points)

a) It is increased when the main memory is not full _____

_____

b) It is decreased when the main memory becomes full _____

_____

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

a) For a 80-kilobyte file? none _____ indirect blocks

b) For a one-megabyte file? one _____ _____ indirect blocks.

You may use the available space below to detail your computations for ***potential partial credit****. .*

This Berkeley UNIX file system can access

a) 12 blocks or 92 KB directly from the i-node

b) 8 K/4 =2 K blocks or 16 MB with a single indirect block