NAME: ______________________________ (FIRST NAME FIRST)     SCORE: ______

COSC 4330               FIRST MIDTERM              SEPTEMBER 26, 2006

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

1. Short questions. Answer in a single sentence to each of the following questions: (6×5 points)
   • What is the main advantage of dual-mode CPUs?
     They prevent users’ processes from directly accessing the secondary storage.
   • What is the function of the UNIX kill() system call?
     It sends a signal to another process.
   • What is one of the main purposes of timer interrupts?
     They prevent computationally-intense processes from monopolizing a processor.
   • What is the main advantage of delayed writes?
     They reduce the number of disk accesses.
   • What is the main advantage of the symmetric organization for multiprocessor operating systems?
     They are bottleneck-free.
   • Which feature of UNIX makes it more portable than previous operating systems?
     It was written in a high-level language.

2. Which of the following statements apply to (a) kernel-supported threads, (b) user level threads and (c) all threads? (5 points per correct line)

<table>
<thead>
<tr>
<th></th>
<th>Kernel-supported</th>
<th>User-level</th>
<th>Both types</th>
</tr>
</thead>
<tbody>
<tr>
<td>They do not require kernel modifications.</td>
<td>_____</td>
<td>YES</td>
<td>_____</td>
</tr>
<tr>
<td>They share the address space of their parent.</td>
<td>_____</td>
<td>_____</td>
<td>YES</td>
</tr>
<tr>
<td>They allow the use of blocking system calls.</td>
<td>YES</td>
<td>_____</td>
<td>_____</td>
</tr>
<tr>
<td>They allow the kernel to allocate several processors to the threads sharing an address space.</td>
<td>YES</td>
<td>_____</td>
<td>_____</td>
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</tbody>
</table>

3. How many lines will the following program print out? (5 points)

```c
main() {
    fork();
    printf("Hi!\n");
    fork();
    printf("How are you?\n");
} // main
```

The program will print out exactly $2 + 4 = 6$ lines.

T: ______
4. What is the purpose of the `dup(pd[0])` system call in the following code sequence? (5 points)

```c
int pd[2];
pipe(pd);
close(0);
dup(pd[0]);
```

It ensures that all reads from standard input will not be read from the pipe `pd`.

5. Which are the two states that can be reached by a process leaving the running state and which events or actions may occasion these transitions? (2×5 points)

- The process will go to the **WAITING/BLOCKED** state when it does a system call.
- The process will go to the **READY** state when it is preempted by another process.

6. **Explaining why** (5 points each).

- Why do most operating systems on the market continue to use **monolithic kernels**?
  They are faster than microkernels.

- Why should we **prevent** users of a multi-user system from **rebooting** the OS from a CD-ROM?
  A user could reboot the system with a rogue OS.

- Why are **layered kernel organizations** impractical?
  There is no good way to decompose the functionality of a modern OS into distinct layers.

- Why will we never see hard drives with access times **below one millisecond**?
  It would require the hard drive to do half a rotation in less than one millisecond and spin at 30,000 rpm.

7. Explain why we need to have both a dual-mode CPU and memory protection to be able to build a secure operating system? (2×5 points)

- **We need a dual-mode CPU to prevent unauthorized users to access and tamper with the files of the operating system and other users.**

- **We need memory protection to prevent unauthorized users to access and tamper with the address spaces of the operating system and other users.**