COP 5614 Operating Systems
Exam I (Guide)
Fall 2024

Your Name (Print): _____

Instructions. You have 75 minutes to complete this exam. For each short answer question, write your answer in the space beneath the question.

Problem 1 True/False

For each of the following, Circle **True** if the statement is correct, or **False** if it is not. Incorrect answers are worth 0 points.

(1) Performing a syscall requires a transfer from user mode to kernel mode

True   False

(2) A system call allows a process to execute certain instructions in the kernel's code in user mode.

True   False

(3) An operating system is interrupt driven

True   False

(4) Context of a process is represented in the PID

True   False

Problem 2 Multiple Choice

(1) A ____ can be used to prevent a user program from never returning control to the operating system.
A. portal
B. program counter
C. firewall
D. timer

(2) Embedded computers typically run on a ____ operating system.

A. real-time
B. Windows 7
C. network
D. clustered

(3) When a child process is created, which of the following is a possibility?
A. The child process runs concurrently with the parent.
B. The child process has a new program loaded into it.
C. The child is a duplicate of the parent.
D. All of the above

(4) Which of the following correctly describe the instruction to return from an interrupt (iret)?
A. Is executable in user mode
B. Is used in kernel mode transfer or user mode transfer
C. May modify data on the user stack.
D. None of the above

Problem 3 Short Answers
(1) What is an operating system? What are the three goals of an operating system?

(2) What is a trap?

(3) List 3 UNIX system calls that deals with the following aspects of the operating system:
(a) Files Manipulation

(4) The output on the next page is from a moderately busy Linux system. Use the output and your knowledge of Linux systems to answer the following questions:

```
[carey@csl ~]$ w
 11:38:22 up 89 days, 52 min,  5 users,  load average: 2.01, 2.02, 2.00
USER     TTY      FROM              LOGIN@   IDLE   JCPU   PCPU WHAT
jsmith   pts/1    s0106001b11691c1 10:00    1:09m  0.03s  0.00s ./a.out
jsmith   pts/2    s0106001b11691c1 10:13    1:10m  0.02s  0.00s ./a.out
carey    pts/3    csg               11:38    0.00s  0.01s  0.00s w
bushay   pts/9    agren             06Oct08 20:54m  0.03s  0.03s -bash
bushay   pts/13   agren             Sat13   20:37m  0.01s  0.01s -bash
```

```
[carey@csl ~]$ ps -l -u jsmith
F S   UID    PID  PPID  C PRI  NI ADDR SZ WCHAN   TTY          TIME CMD
5 S  2548 25055 25051  0  75   0 -   2544 -       ?        00:00:00 sshd
0 S  2548 25056 25055  0  75   0 -   1406 -       pts/1    00:00:00 tcsh
5 S  2548 25528 25526  0  75   0 -   2544 -       ?        00:00:00 sshd
0 S  2548 25529 25528  0  75   0 -   1390 -       pts/2    00:00:00 tcsh
0 S  2548 26065 25056  0  75   0 -    380 -       pts/1    00:00:00 a.out
0 S  2548 26068 25529  0  75   0 -    381 -       pts/2    00:00:00 a.out
```

(a) What is the PID of the most recently created process for user jsmith?

(5) As a process executes, it changes state.
(a) Complete the diagram of process state

(6) What is the output of the following program if executed as:

```
main ()
{
int i;
for (i=0; i < 3; i++)
    if (fork() == 0) {
        printf ("I am %c\n", i+'A');
        exit(0);
    }
}
```