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CSC 360: Written Assignment

1.

a. In user mode the running software has no ability to access the hardware or memory, whereas in kernel mode the software has unrestricted access to the hardware. In order for a program running in user mode to access the hardware, it must use system API's.

b. Kernel mode is reserved for the most trusted, low level operating system instructions. Crashes while in kernel mode could crash the entire computer, which is why most programs run in user mode. While in user mode, if the program were to crash, only the program running would be affected. By having a user mode, the operating system can prevent many computer crashes.

c. Mode switch refers to switching the bit from 1 for user mode to 0 for kernel mode, and vice versa. Context switch refers to storing the state of a process for when it will be executed in the future (e.g. after an interrupt is handled).

d. **Pros:**

   i. Smaller and more simple than the monolithic kernel.
   ii. Can extend the operating system easier by adding new services in the user space.
   iii. Higher security and reliability because most services are running in user mode.
   iv. Easier to port from one hardware architecture to another than a monolithic system.

   Cons:

   i. Performance can suffer due to high system overhead.
   ii. Sometimes slower due to message passing between services.

2.

a.

   i. 0, 3, 1
   ii. 0, 1, 3
   iii. 0, 3 (if fork() fails)

b.

```
#define OUTPUT printf("%d\n", i)

main() {
      int i = 0; OUTPUT;

      if(fork()) {
         wait(NULL);
         i += 3; OUTPUT;
      } else {
         i += 1; OUTPUT; return(0);
      }
}
```

3.

a. Feasible: Happens when the process is running and then receives input or wait() is called.
b. Not feasible: A process must go from blocked to ready and then running.
c. Feasible: Happens when the I/O or event is completed in the blocked/waiting state.
d. Not feasible: The process must have begun execution in order to be blocked.
e. Feasible: Happens when the scheduler dispatches the process.
f. Feasible: Happens when an interrupt is thrown, pausing execution of the process.