Spring 2015 COMP 3511 Homework Assignment #1

Handout Date: Feb. 13, 2015 Due Date: Feb. 27, 2015

Name: _____ ID: _____E-Mail: _____

Please read the following instructions carefully before answering the questions:

- You should finish the homework assignment **individually**.
- There are a total of **4** questions.
- When you write your answers, please try to be precise and concise.
- Fill in your name, student ID and email at the top of each page.
- Please fill in your answers in the space provided, or you can type your answers in the MS Word file.

- **Homework Collection: the hardcopy** is required and the homework is collected in collection box #16. The collection boxes locate outside Room 4210, near lift 21 (there are labels attached on the boxes).

1. (20 points) Multiple choices

   1) A(n) _____ is used to prevent a user program from getting stuck in am infinite loop or never returning control to the OS.

      A) Program counter
      B) Timer
      C) Interrupt
      D) CPU scheduler

   2) Which of the following statements is TRUE?

      A) In an SMP-type system, there is one master CPU and the remainder CPUs are slaves.
      B) A Web browser is a system program.
      C) A trap can be used to call operating system routines or to catch arithmetic errors.
      D) The two separate modes of operating in a system are supervisor mode and system mode.

   3) Which of the following statements is NOT TRUE about DMA (Direct Memory Access)?

      A) DMA is used for high-speed I/O devices in order to avoid increasing the CPU's execution load.
      B) CPU initiates a DMA controller, which instructs a device controller to move data between the devices and main memory.

C) After the completion of the DMA transfer, the CPU is notified by interrupt signal.
D) The CPU is not allowed to execute other programs while the DMA controller is transferring data.

4) Which of the following should NOT be part of a microkernel?

A) File system service
B) Inter-process communication
C) CPU scheduling
D) Address space management

5) Which of the following is NOT contained in a Process Control Block (PCB)?

A) The process ID
B) The process state
C) The scheduler ready queue
D) The location of the process in memory

6) Which of the following methods is used for passing parameters to the operating system?

A) Registers pass starting addresses of blocks of parameters.
B) Pass parameters in registers.
C) Parameters can be placed or pushed onto the stack by the program, and popped off the stack by the operating system.
D) All of the above.

7) Long-term scheduler (or job scheduler) _____.

A) selects which processes should be executed next and allocate CPU
B) is invoked very frequently, in milliseconds
C) is sometimes the only scheduler in a system
D) controls the degree of multiprogramming

8) A zombie process is _____.

A) a process that has terminated, but whose parent has not yet called wait()
B) a process whose parent terminates without first calling wait()
C) a process that periodically calls wait(), which allows any resources allocated to terminated processes to be reclaimed by the operating system
D) a process that terminates the execution of its children processes

9) What are the two basic models of inter-process communication?

A) Message-passing model and shared-memory model.
B) Direct communication model and indirect communication model.
C) User model and system model.
D) Physical model and logical model.

10) Which of the following statements is NOT true about pipes?

A) Name pipes do not require parent-child relationships.
B) An ordinary pipe can be accessed from outside the process that created the pipe.
C) Name pipes allow multiple processes to use it for communications and multiple processes can write to it.
D) Ordinary pipes allow two processes to communicate in a standard producer and consumer fashion.

2. (20 points) Simple C programs on fork().

1) Consider the following code segments, what is the total number of processes (including the initial process)? Please elaborate. (10 points)

```
#include <stdlib.h>
#include <stdio.h>
#include <unistd.h>

int main() {
    pid_t pid;
    pid = fork();
    if (pid == 0) {
        fork();
        fork();
    }
```

2) Consider the following code segments, what is the total number of processes (including the initial process)? Please elaborate (10 points)

```
#include <stdlib.h>
#include <stdio.h>
#include <unistd.h>

int main() {
    int i;
    for (i = 0; i < 10; i++)
        if (fork()>0)
            fork();
}
```

3. (30 points) Please answer the following questions in 3-4 sentences

1) (6 points) Describe the differences between symmetric and asymmetric multiprocessing. What are the advantage and disadvantage in multiprocessor systems?

2) (6 points) What is the purpose of interrupts? What are the differences between a trap and an interrupt? Can traps be generated intentionally by a user program? If so, for what purpose?

3) (6 points) What are the memory components in memory hierarchy? Briefly describes property of each memory components (e.g. size, volatility, implementation technology).

4) (6 points) Describe the relationship between an API, the system-call interface, and the operating system.

5) (6 points) What are the advantages of using loadable kernel modules?

4. (30 points) Process

1) (6 points) List all possible states of a process. What are the 4 main steps in creating a process?

2) (6 points) Describe the actions taken by a kernel to context-switch between processes.

3) (6 points) What do we mean by concurrency in a uniprocessor system? How is that different from a parallel system with multiple processors?

4) (6 points) What is an orphan process? How does UNIX handle that?

5) (6 points) What is the primary distinction between short-term scheduler and long-term scheduler? Please briefly explain the reason.