CS 423/523 Assignment 2

Published: Feb. 16, 2016
Due: Feb. 25, 2016 (11:59pm)

Total: 30 points

Please upload your solutions to classes*v2. To do so, please enter classes*v2, then click the “Assignment” button on your left-hand toolbar, and finally click “Assignment2” to upload your assignment.

If you know you are going to submit your assignment late, please let us know in advance (send an email to cs423ta@cs.yale.edu). Solutions will be posted 10 days after the deadline.

Any and all resources may be used as long as you cite them, with the exception of collaborating with other people. Please do not copy pasta your definitions from Wiki. We do not really care if you do this, but you are not really learning anything.

If you have ANY questions, please do not hesitate to let us know (email, office hours, etc.)
Part 1: OS definitions (1-3 line answers, 5 x 2 points each = 10 points)

1. Process
   A process is an instance of a program that is being executed.

2. Thread
   Minimal block of code that can be managed independently by the OS scheduler. It is like a lightweight process -- there may be multiple threads (each with their own program counter) within a single process which share various resources such as memory.

3. Pipe
   A software construct that acts as a conduit which allows two processes to communicate. It may be unidirectional or bidirectional.

4. Concurrency
   Concurrency is the interleaving of processes in time to give the appearance of simultaneous execution.

5. Multi-core system
   Multiple computing cores are placed on a single processing chip where each core appears as a separate CPU to the operating system.

Part 2: Multiple choice (7 x 2 points each = 14 points)

1. Which of the following is the model of IPC:
   a. Shared memory
   b. Message passing
   c. Both of the above
   d. None of the above

2. If a parent process never invokes the “wait” command, then the child process is:
   a. A zombie
   b. An orphan
   c. Both of the above
   d. None of the above

3. Which of the following is not the result of concurrency:
   a. Shared data may result in inconsistent value
   b. Process interleaving
   c. Sensitive information leakage
d. None of the above

4. Which of the following is not shared by threads in a multithread process:
   a. Code
   b. Data
   c. Stack
   d. Files

5. A job scheduler
   a. Controls the degree of multiprogramming
   b. Selects the process that is going to be executed next
   c. None of the above
   d. Both of the above

6. A heap stores
   a. Function parameters
   b. Status parameters
   c. Dynamically allocated memory
   d. Return addresses

7. Which of the following is correct:
   a. On a system with a single core, concurrency means that the program executions will be interleaving overtime.
   b. On a system with multi-core, concurrency means all the threads can run in parallel
   c. Both of the above
   d. None of the above

Part 3: A longer question (2 x 3 points each = 6 points)

The above program is running in a single core system. P1 and P2 are two concurrent processes, and share a block of memory, \( m \). Before running P1 and P2, the value of \( m \) is 5. For a given process \( i \), \( \text{Read}(x) \) means this process \( i \) reads the value of \( m \) and assigns this
value to $i$'s local variable $x$; $Update(x)$ means the process $i$ writes the value of $x$ to the memory $m$. Assume all the commands are atomic.

Please answer the following questions:

1. After P1 executes $Update(x)$, what's the value on the shared memory? Why?

   The value should be 0, since P1 reads $x=5$, and writes $0 = 5 - 5$ back to the shared memory.

2. After P2 executes $Update(x)$, what's the value on the shared memory? Why?

   The value should be 10, since P2 reads $x=5$ (at that time, the value of $m$ was not changed by P1), and writes $10 = 5 + 5$ back to the shared memory.