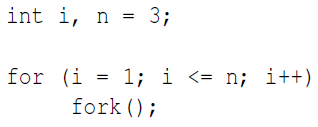
Exam 1 Spring 2016

1. Explain what are CPU modes. Explain their uses. How does the CPU know what mode it is in?
2. What is an atomic instruction? What would happen if multiple CPUs/cores execute their atomic instructions?
3. Draw the state diagram of a process from its creation to termination, including all transitions. Make sure you will elaborate every state and every transition in the diagram.
4. Explain the one-to-one, many-to-one, and many-to-many thread models.
5. Define the meaning of a race condition? Answer the question first and use execution sequences with a clear and convincing argument to illustrate your answer.
6. A computer system has two CPUs that share the same memory. All processes are stored in the shared memory but can be run on either CPU. To gain efficiency, the designers choose the following CPU scheduling policy:
   1. There is only one ready queue and is stored in the shared memory.
   2. Each CPU has its own CPU scheduler.
   3. When a CPU is free, the scheduler of that CPU picks up the first process in the ready queue to run on the same CPU.

Do you think this policy works well? State your claim first and justify your claim step-by-step with execution sequences.

1. Consider the following program segment. Suppose all fork() calls are successful. Answer the following questions: (1) Draw a diagram showing the parent-child relationship of all involved processes, the main program included, and provide an explanation how this relationship is obtained.



1. Consider the following two processes, A and B, to be run concurrently using a shared memory for variable x. Assume that x is initialized to 0, and x must be loaded into a register before further computations can take place. What are all possible values of x after both processes have terminated. Use a step-by-step execution sequence of the above processes to show all possible results.

