CSI3131 Assignment 1, Mahyar Gorji 8135109

1. Describe the actions taken by the kernel to context-switch between two processes:

Ans: kernel saves program counter and stack pointer, while the interrupt handler saves all of the registers inside the PCB. Short-term scheduler selects next process to be run (ready → run), and retrieves state of the next process from its respective PCB, and restores register values, and continues operations with this restored process.

2. When a process creates a new process using the fork() operation, which of the following states is shared between parent and child?
  a) *Stack*
  b) *Heap*
  c) *Shared memory segments*

Ans: C) shared memory segments. Stack and heap and cloned during fork and are belonging solely to their respective processes.

3. Describe the differences among short-term, medium-term, and long-term scheduling

Ans:
Long term scheduler selects which new processes should be brought into memory (new → ready), and is invoked infrequently.
Short term scheduler selects which process to execute (ready → running), and is invoked frequently.
Medium term scheduler looks for performance degradation in processes, and context-switches them to maximize efficiency.

4. What are the benefits and the disadvantages of each of the following? Consider both the system level and the programmer level.
a. Synchronous and asynchronous communication
b. Automatic and explicit buffering
c. Send by copy and send by reference
d. Fixed-sized and variable-sized messages

Ans:
  a. Synchronous and asynchronous communication
       i. Pros and Cons:
              1. Provides a rendezvous/acknowledgement between sender and receiver. Rendezvous communication is difficult to implement within a distributed environment. Rendezvous communication may not be necessary, and may provide excess overhead.
  b. Automatic and explicit buffering

          i.   Pros and Cons:
- 1. Automatic buffering ensures that the sender will never have to block while waiting to copy a message as the queue is provided with infinite length, but could have large amounts of memory waste.
Explicit buffering defines the queue length so memory isn't wasted, but the sender can be blocked.

c. Send by copy and send by reference
          i.   Pros and Cons:
- 1. Sending by copy does not allow the receiver of that element to alter the state of the parameter, whereas sending by reference does.

d. Fixed-size and variable-sized messages:
          i.   A buffer can hold a known quantity of fixed-size messages, but variable-sized message quantity would be unknown. This is granted that the buffer size is known to begin with.

5. The Sun UltraSPARC processor has multiple register sets. Describe what happens when a context switch occurs if the new context is already loaded into one of the register sets. What happens if the new context is in memory rather than in a register set and all the register sets are in use?

Ans: The CPU points to the new set of registers already holding the new context, which takes little time. If the context was loaded in memory rather than a register set, you would need to load the context already in the set back to memory, and load a new context from memory to the registers, which takes a little more time.