Process Synchronization

Review Questions

Section 5.1

5.1 If the current value of counter = 5, what are its possible values if the producer and consumer processes run concurrently?

5.2 What is the term for describing the situation where shared data may be manipulated concurrently and the outcome of the execution depends upon the order of access?

Section 5.2

5.3 What is the term used to describe the segment of code where shared data is accessed and possibly manipulated?

5.4 What are the three requirements a solution to the critical-section problem must satisfy?

5.5 True or False? A nonpreemptive kernel is essentially free from race conditions.

Section 5.3

5.6 True or False? There are no guarantees Peterson's solution works correctly on modern computer architectures.

Section 5.4

5.7 True or False? All solutions to the critical section problem are based on the premise of locking.

5.8 What are the two general hardware instructions that can be performed atomically?

Section 5.5

5.9 What are the two functions used with mutex locks?

5.10 True or False? A spinlock is a type of mutex lock.

Section 5.6

5.11 True or False? Semaphores can provide the same functionality as mutex locks.

5.12 What are the two operations that can be performed on a semaphore?

5.13 True or False? A binary semaphore is functionally equivalent to a mutex lock.

Section 5.7

5.14 What are the names of the two processes associated with the bounded-buffer problem?

5.15 How many writers may concurrently share the database with the readers-writers problem?

5.16 What is the problem if all philosophers simultaneously pick up their left fork?

Section 5.8

5.17 What are the two operations that can be performed on a condition variable?

5.18 Name at least one modern programming language that has incorporated the idea of a monitor.

Section 5.9

5.19 What are the two states of a Windows dispatcher object?

5.20 What is available in Linux for updating an integer variable without having to use locks?

5.21 True or False? Linux uses spinlocks for both single and multiple processor systems.

5.22 What are the Pthreads operations for locking an unlocking a mutex lock?

Section 5.10

5.23 Provide at least one alternative to mutex locks, semaphores, reader-writer locks, and monitors that provide support for concurrent programming.

Section 5.11

5.24 True or False? The system model for deadlocks first requires a process request a resource, then use the resource, and finally release the resource.

5.25 What are the four necessary conditions for characterizing deadlock?

5.26 Describe one strategy for dealing with deadlocks?

5.27 What is the only reasonable condition that can be used to prevent deadlocks from occurring?

CPU Scheduling

Review Questions

Section 6.1

6.1 What are the two bursts that CPU schedulers are designed around?

6.2 True or False? Under preemptive scheduling, when a process switches from the running to the ready state, it may lose control of the CPU.

Section 6.2

6.3 List at least three different criteria for designing a CPU scheduling algorithm.

Section 6.3

6.4 What scheduling algorithm assigns the CPU to the process with the highest priority?

6.5 True or False? The multilevel feedback queue scheduling algorithm allows processes to migrate between different queues.

6.6 What scheduling algorithm assigns the CPU to the process that first requested it?

6.7 What scheduling algorithm assigns the CPU to a process for only its time slice (or time quantum?)

6.8 What scheduling algorithm assigns the CPU to the process with the shortest burst?

Section 6.4

6.9 What are the two types of contention scope for thread scheduling?

6.10 What are the two general hardware instructions that can be performed atomically?

Section 6.5

6.11 What is more common on current systems, asymmetric or symmetric multiprocessing?

6.12 What are the two forms of processor affinity?

6.13 What are the two general approaches for load balancing?

6.14 What are the two ways to multithread a processing core?

Section 6.6

6.15 What are the two general types of real-time scheduling?

6.16 What real-time scheduling algorithm uses deadline as its scheduling criteria?

6.17 What real-time scheduling algorithm is used for scheduling periodic tasks with static priorities?

Section 6.7

6.18 What is the name of the default scheduling algorithm for current Linux systems?

6.19 True or False? A Windows thread is assigned both a priority class and a relative priority within that class.

6.20 If a thread on a Solaris system exhausts its time quantum, will it later be assigned a higher or lower priority?

Section 6.8

6.21 True or False? Deterministic modeling and simulations are similar strategies for evaluating scheduling algorithms.

Deadlocks

Review Questions

Section 7.1

7.1 True or False? The system model for deadlocks first requires a process request a resource, then use the resource, and finally release the resource.

Section 7.2

7.2 What are the four necessary conditions for characterizing deadlock?

Section 7.3

7.3 Describe one strategy for dealing with deadlocks.

Section 7.4

7.4 What is the only reasonable condition that can be used to prevent deadlocks from occurring?

Section 7.5

7.5 What is the name of the state of the system if resources can be allocated to all processes in some order and deadlock can still be avoided?

7.6 What is the name of the classic deadlock avoidance algorithm?

Section 7.6

7.7 True or False? The wait-for graph can only be used for deadlock detection when there is a single instance of each type.

Section 7.7

7.8 Provide at least one method for recovering from deadlock.

Main Memory

Review Questions

Section 8.1

8.1 What two registers can be used to provide a simple form of memory protection? (

8.2 List the three different times at which address binding may occur.

8.3 True or False? An address generated by the CPU is also referred to as a physical address.

8.4 What is the hardware device that maps virtual to physical addresses?

Section 8.2

8.5 What is the backing store?

8.6 True or False? Mobile systems typically use swapping.

Section 8.3

8.7 What are the three strategies for selecting a free hole from the set of available holes?

8.8 What are the two forms of fragmentation?

Section 8.4

8.9 List at least two possible parts of a program that may be assigned separate segments.

Section 8.5

8.10 What are the two parts of an address generated by the CPU?

8.11 What does each entry in the page table contain?

8.12 True or False? Fragmentation can still occur in paging systems.

8.13 What is the term that describes when a page number is not present in the TLB?

Section 8.6

8.14 If a page offset is 13 bits, how large (in bytes) is the page?

8.15 How many entries are in a two-level page table with a 20-bit page number?

8.16 What is an alternative to hierarchical paging for large (> 32 bits) address sizes?

Section 8.7

8.17 True or False? IA-32 address translation involves both paging and segmentation.

8.18 True or False? In practice, all 64 bits are used with IA-64 addressing.

Section 8.8

8.19 What are the three components of a 32-bit ARM address?

Virtual Memory

Review Questions

Section 9.1

9.1 True or False? A program does not need to be stored in memory in its entirety.

9.2 True or False? A physical address space is at least as large as a virtual address space.

Section 9.2

9.3 When does a page fault occur?

9.4 True or False? In a pure demand paged system a page is never brought into memory until it is needed.

Section 9.3

9.5 What system call initiates copy on write?

9.6 True or False? The `vfork()` system call does not use copy on write.

Section 9.4

9.7 What is the simplest page replacement algorithm?

9.8 What is the name of the page replacement algorithm that operates by replacing the page that will not be used for the longest period of time?

9.9 What page replacement algorithm could be implemented using a stack or counters?

9.10 True of False? Approximation algorithms are almost always used when implementing LRU.

Section 9.5

9.11 What is the fundamental difference between global and local page replacement?

Section 9.6

9.12 What term is used to describe the situation where a process spends more time paging tha n executing?

9.13 What term is used to describe the set of pages a process is currently referencing?

9.14 True or False? With pure demand paging, the page fault rate is initially very high.

Section 9.7

9.15 True or False? Shared memory is typically not implemented using memory mapping.

Section 9.8

9.16 Using the buddy system, if a request for 200 KB of kernel memory is made, how much is actually allocated?

9.17 What is one benefit of using slab allocation.

Section 9.9

9.18 What is the TLB reach of a system with 4 KB page sizes and 32 entries in the TLB?

9.19 True or False? 4 KB is a typical page size.

9.20 True of False? Some systems support page sizes up to 4 MB.

Section 9.10

9.21 What page replacement algorithm is used by Windows?

9.22 Solaris uses the clock algorithm variation of LRU. How many hands does this algorithm employ?