Chapter 4 – Threads, SMP, and Microkernels

True / False Questions:
1.   The basic unit of dispatching in an operating system is usually referred to as a thread or lightweight process.
2. An example of a system that implements a single process with multiple threads is MS-DOS.
3.   In a multithreaded environment, a process is defined as the unit of resource allocation and a unit of protection.
4. The concept of thread synchronization is required in multithreaded systems because threads of a single process share the process's process control block (PCB).
5. In a pure User-Level Thread (ULT) facility, all of the work of thread management is done by the application, but the kernel is aware of the existence of threads.
6. In the field of distributed operating system design, the One-to-Many (Thread-to-Process) relationship is particularly interesting because it involves the concept of thread migration.
7. One disadvantage to the master/slave shared-memory multiprocessor architecture is that the failure of the master brings down the whole system.
8. In a symmetric multiprocessing (SMP) system, each processor has access only to a private main memory area.
9. An SMP O/S manages processor and other resources so that the user may view the system in the same fashion as a multiprogramming uniprocessor system.
10. The primary advantage of the basic microkernel design over layered kernel designs involves increased performance.
11.   The philosophy underlying the microkernel is that only absolutely essential core operating system functions should be in the kernel.
12.   The basic form of communication between processes or threads in a microkernel O/S is messages.
13.   Linux makes no distinction between a process and a thread.
14. Windows 2000 is an object-oriented O/S, but only processes (not threads) are implemented as objects in the WIN2K O/S.
15. In the Solaris O/S, a User-Level Thread (ULT) in the active state is assigned to a Light-Weight Process (LWP) and executes while the underlying kernel thread executes.

Multiple Choice Questions:
1. The concept of a process in an operating system embodies two primary characteristics, one of which is:
    a. Multithreading
    b. Resource ownership
    c. Symmetric multiprocessing
    d. None of the above
2. An example of a system that implements a single process with multiple threads is:
    a. WIN 2000
    b. Solaris

      c. Java
      d. All of the above

3. Which of the following is true regarding the relationship between processes and threads:
      a. It takes far less time to create a new thread in an existing process than to create a new process
      b. It takes less time to terminate a process than a thread
      c. It takes less time to switch between two different processes than to switch between two threads within the same process
      d. All of the above

4. The basic thread operation related to the change in thread state that occurs when a thread needs to wait for an event is referred to as the:
      a. Unblock operation
      b. Spawn operation
      c. Block operation
      d. None of the above

5. One of the disadvantages of User-Level Threads (ULTs) compared to Kernel-Level Threads (KLTs) is:
      a. Scheduling is application specific
      b. When a ULT executes a system call, all threads in the process are blocked
      c. Thread switching does not require kernel mode privileges
      d. All of the above

6. In the Linux O/S, multiple threads may be created and executed within a single process. This is an example of the following Thread-to-Process relationship:
      a. 1:1
      b. 1:M
      c. M:N
      d. None of the above

7. The computer system category where a single processor executes a single instruction stream to operate on data stored in a single memory is called:
      a. Single Instruction Single Data (SISD) stream
      b. Single Instruction Multiple Data (SIMD) stream
      c. Multiple Instruction Single Data (MISD) stream
      d. None of the above

8. In a SMP system, each processor maintains a local cache and must alert all other processors that a change to cache update has taken place. This is referred to as the:
      a. Interconnection mechanism problem
      b. Synchronization mechanism problem
      c. Cache coherency problem
      d. None of the above

9. Key issues involved in the design of multiprocessor operating systems include:
      a. Scheduling
      b. Synchronization
      c. Reliability and fault tolerance

        d. All of the above
10. Early operating systems that were designed with little concern about structure are typically referred to as:
        a. Monolithic operating systems
        b. Layered operating systems
        c. Kernel operating systems
        d. All of the above
11. A benefit of the microkernel organization is:
        a. Extensibility
        b. Portability
        c. Flexibility
        d. All of the above
12. In low-level microkernel memory management, an example of an operation that can support external paging and virtual memory management is the:
        a. Grant operation
        b. Map operation
        c. Flush operation
        d. All of the above
13. In a W2K system, the state that a thread enters when it has been unblocked and the resource for which it has been blocked is not yet available is called the:
        a. Transition state
        b. Waiting state
        c. Standby state
        d. None of the above
14. In a Solaris system, a User-Level Thread (ULT) that enters the active state is assigned to a:
        a. Kernel thread
        b. Heavy-Weight Process (HWP)
        c. Light-Weight Process (LWP)
        d. None of the above
15. In a Linux system, when a new process is cloned, the two processes share the same:
        a. Process identifier
        b. Virtual memory
        c. task_struct data structure
        d. All of the above

Fill-In-The-Blank Questions:
1. In an operating system, the unit of dispatching is usually referred to as a _____, while the unit of resource ownership is usually referred to as a process or task.
2. An example of an operating system that supports a single user process and a single thread is _____.
3. An example of an operating system that supports multiple user processes and multiple threads is _____.

4. It is necessary to _____ the activities of various threads so they do not interfere with each other or corrupt data structures.
5. A process that cannot execute until some event occurs is said to be in the _____ state.
6. The Clouds O/S implements the concept of a thread as primarily an entity that can move among address spaces which represents the _____ Thread-to-Process relationship.
7. In a _____ system, the kernel can execute on any processor, and typically each processor does self-scheduling from the pool of available processes or threads.
8. In most modern computer systems, processors generally have at least one level of _____ that is private to the processor.
9. With multiple active processes in an SMP system having potential access to shared address space or shared I/O resources, care must be taken to provide effective _____.
10. In the _____ O/S architecture, functions are organized hierarchically and interaction only takes place between adjacent sections.
11. One advantage of the microkernel architecture is _____, allowing the addition of new services as well as the provision of multiple services in the same functional area.
12. The basic form of communication between processes or threads in a microkernel O/S is _____ .
13. In a Linux system, if the process has been terminated but, for some reason, still must have its task structure in the process table is in the _____ state.
14. In a Solaris system, a User-Level Thread (ULT) in the active state is assigned to a(n) _____, and executes while the underlying kernel thread executes.
15. In a Windows 2000 system, a process that has been selected to run next on a particular process moves from the Ready state to the _____ state.