Chapter 10 – Multiprocessor and Real-Time Scheduling

True / False Questions:

1. The term cluster refers to a set of processors that share a common main memory and are under the integrated control of an operating system.
2. A good way of classifying multiprocessors and placing them in context with other architectures is to consider the synchronization granularity between processes in a system.
3. In a system in which many processors are available, the primary concern shifts from ensuring maximum processor usage to providing the best average performance to all applications.
4. A general conclusion of studies comparing multiprocessor and uniprocessor systems under various conditions is that the specific process scheduling discipline employed becomes much more important as the number of processors increase.
5. In the Load Sharing multiprocessor scheduling and assignment approach, processes are assigned to a specific processor.
6. One advantage to the Load Sharing multiprocessor scheduling and assignment approach is that no centralized scheduler is required.
7. The processor allocation problem on a multiprocessor more closely resembles the memory allocation problem on a uniprocessor than the scheduling problem on a uniprocessor.
8. In Dynamic Scheduling, the operating system leaves all scheduling decisions to the application.
9. A soft real-time task is one which will be terminated if the deadline is missed.
10. An operating system is deterministic to the extent that it performs operations at fixed, predetermined times or within predetermined time intervals.
11. Dynamic best effort scheduling is the approach used by many real-time systems that are currently commercially available.
12. T / F –A particularly useful metric in evaluating real-time operating systems is the frequency of task dispatching and interrupt handling
13. A promising method of resolving multitask scheduling conflicts for periodic tasks is called Deadline Scheduling.
14. Linux builds on the traditional UNIX scheduling described in Chapter 9 by adding two scheduling classes for soft real-time scheduling: SCHED_FIFO and SCHED_RR.
15. Priorities in W2K are organized into two bands, or classes: non-real-time and variable.

Multiple Choice Questions:

1. A multiprocessor system in which there is a master, general-purpose processor that controls and receives services from other processors in the system is referred to as:
    a. Tightly coupled multiprocessing
    b. Loosely coupled multiprocessing
    c. Functionally specialized multiprocessing

   d. None of the above
2. The category of parallelism in multiprocessors in which there is no explicit synchronization among processes is termed:
   a. Independent parallelism
   b. Coarse-grained parallelism
   c. Fine-grained parallelism
   d. None of the above
3. Scheduling on a multiprocessor involves which of the following design issues:
   a. The assignment of processes to processors
   b. The use of multiprogramming on individual processors
   c. The actual dispatching of a process
   d. All of the above
4. Studies show that, as the number of processors in a system increases, the importance of the selection of the specific process scheduling discipline employed:
   a. Increases
   b. Decreases
   c. Stays the same – no impact
   d. All of the above
5. Which of the following statements about the Dedicated Processor Assignment multiprocessor scheduling and assignment approach is true?
   a. Each program is assigned one processor
   b. Related threads are scheduled to run on a set of processors at the same time
   c. Each processor is returned to the available pool as its assigned thread completes
   d. None of the above
6. A disadvantage of the Load Sharing multiprocessor scheduling and assignment approach is:
   a. No centralized scheduler is required
   b. The central queue can be a bottleneck due to mutual exclusion
   c. The load must be distributed evenly across all processors
   d. All of the above
7. An extreme form of Gang Scheduling in which a group of processors is dedicated to a particular application for the duration of its execution is called:
   a. Load Sharing
   b. Dynamic Scheduling
   c. Dedicated Processor Assignment
   d. None of the above
8. An approach to multiprocessor scheduling and assignment in which both the operating system and the application are involved in making scheduling decisions is called:
   a. Load Sharing
   b. Dynamic Scheduling
   c. Dedicated Processor Assignment
   d. None of the above

9. A task that, unless it meets its deadline may cause undesirable damage or a fatal error to the system, is called a(n):
    a. Hard real-time task
    b. Soft real-time task
    c. Aperiodic task
    d. None of the above
10. Which of the following requirements of real-time operating systems is concerned with how long, after acknowledgement, it takes the O/S to service the interrupt?
    a. Determinism
    b. Responsiveness
    c. Reliability
    d. None of the above
11. The result of the schedulability analysis of the following approach is a schedule that determines, at run time, when a task must begin execution.
    a. Static table-driven approach
    b. Static priority-driven preemptive approach
    c. Dynamic planning-based approach
    d. None of the above
12. Useful information about a task that might be used in real-time task scheduling includes:
    a. Starting deadline
    b. Resource requirements
    c. Priority
    d. All of the above
13. A promising method of resolving multitask scheduling conflicts for periodic tasks is:
    a. Deadline Scheduling (DS)
    b. Rate Monotonic Scheduling (RMS)
    c. Real-Time Scheduling (RTS)
    d. All of the above
14. Linux builds on the traditional UNIX scheduling described in Chapter 9 by adding two scheduling classes for soft real-time scheduling:
    a. SCHED_FIFO and SCHED_RR
    b. SCHED_RR and SCHED_OTHER
    c. SCHED_FIFO and SCHED_OTHER
    d. All of the above
15. Priorities in W2K are organized into two bands, or classes:
    a. Real-time and static
    b. Real-time and variable
    c. Non-real-time and variable
    d. All of the above

<u>Fill-In-The-Blank Questions</u>:

1. A collection of relatively autonomous systems, where each processor has its own main memory and I/O channels is called _____.

2. A system that implements a high degree of coordination and interaction among the threads of an application, as specified by the programmer, falls into the category of _____ parallelism.
3. The process assignment strategy where a process is permanently assigned to one processor from activation to completion is referred to as _____ assignment.
4. As the number of processors in a system increases, the impact of the specific scheduling discipline _____.
5. The multiprocessor scheduling and assignment approach in which a set of related threads is scheduled to run on a set of processors at the same time is referred to as _____.
6. Using simulation methods, it has been determined that the _____ load balancing policy is superior to both the preemptive and non-preemptive versions of the Smallest Number of Threads First load balancing policy.
7. The term _____ has been applied to the simultaneous scheduling of the threads that make up a single process.
8. Both Gang Scheduling and Dedicated Processor Assignment attack the scheduling problem by addressing the issue of _____ allocation.
9. A real-time task that has a deadline by which it must finish or start, or that may have a constraint on both start and finish time is called a(n) _____ task.
10. _____ is a characteristic that refers to the ability of a system to fail in such a way as to preserve as much capability and data as possible.
11. A major drawback to the _____ real-time scheduling approach is that it cannot be known whether a timing constraint will be met until a deadline arrives or the task completes.
12. It can be shown, for a given preemption strategy, using either starting or completion deadlines, that a policy of scheduling the task with the _____ deadline minimizes the fraction of tasks that miss their deadlines.
13. The scheduling scheme that assigns priorities to tasks on the basis of their periods (i.e., amount of time between the arrival of instances of the task) is referred to as _____.
14. Linux builds on the traditional UNIX scheduling described in Chapter 9 by adding two additional scheduling classes (SCHED_FIFO and SCHED_RR) to accommodate _____ scheduling.
15. On a uniprocessor system running W2K, if there is more than one thread at the highest priority level, then the processor is utilized in a _____ fashion amongst the available threads at that highest priority level.