## Chapter 11 – I/O Management and Disk Scheduling

True / False Questions:
1. One general grouping of external I/O devices that communicate with computer systems is the Human Readable category, which includes disk drives and tape drives.
2. In the Direct Memory Access (DMA) I/O technique, a DMA module controls the exchange of data between main memory and the I/O module.
3. In the evolution of the I/O function, the general tendency is for the processor to become more involved in I/O operations.
4. A separate bus, other than the system bus, is provided for DMA transfers in the "Single bus, detached DMA" configuration.
5. The two primary objectives that are paramount in designing the I/O facility of a computer system are effectiveness and generality.
6. The logical I/O module, as defined in the hierarchical structure that manages I/O on local peripheral devices, deals with the device as a logical resource and is not concerned with the details of actually controlling the device.
7. Disks and tapes are examples of stream-oriented I/O devices.
8. Double buffering refers to the concept of using two buffers to alternatively fill and empty in order to facilitate the buffering of an I/O request.
9. In the operation of a disk drive, Seek Time is the sum of rotational delay and access time.
10. Random scheduling is useful as a benchmark against which to evaluate other disk scheduling policies because it provides a worst-case scenario.
11. In the C-SCAN disk scheduling algorithm, the disk arm is required to move in one direction only until it reaches the last track or there are no more requests to service in that direction, then it reverses direction and the scan proceeds in the opposite direction in the same fashion.
12. The unique contribution of RAID is that it effectively addresses the need for redundancy in data storage.
13. Cache memory is smaller and faster than main memory and is interposed between main memory and secondary storage.
14. For buffered I/O in a UNIX system, two types of buffers are used: system buffer caches and character queues.
15. In a W2K system, the synchronous mode of I/O operation is used whenever possible to optimize application performance.

Multiple Choice Questions:
1. An example of the key differences that can exist across (and even in) classes of I/O devices is:
    a. Data rate
    b. Data representation
    c. Error conditions
    d. All of the above
2. The I/O technique where the processor busy waits for an I/O operation to complete is called:

    a. Programmed I/O
    b. Interrupt-driven I/O
    c. Direct memory access (DMA)
    d. None of the above

3. The system configuration that includes an I/O module which is a separate processor with a specialized instruction set can be referred to using the following terminology:
    a. Direct Memory Access (DMA)
    b. I/O Channel
    c. I/O Processor
    d. All of the above

4. The bus configuration for DMA that provides no path other than the system bus between the DMA module(s) and I/O devices is:
    a. Single bus, detached DMA
    b. Single bus, integrated DMA-I/O
    c. I/O bus
    d. None of the above

5. The primary objective in designing the I/O facility of a computer system that deals with the desire to handle all I/O devices in a uniform manner is referred to as:
    a. Efficiency
    b. Generality
    c. Directory management
    d. None of the above

6. In a hierarchical structure for managing I/O on a secondary storage device that supports a file system, the layer that is closest to the hardware is the:
    a. Directory management layer
    b. Device I/O layer
    c. Physical organization layer
    d. None of the above

7. An example of a block-oriented I/O device is:
    a. CD-ROM
    b. Printer
    c. Modem
    d. All of the above

8. The scenario where multiple buffers are used in an attempt to alleviate the problem of absorbing rapid bursts of I/O is typically referred to as:
    a. Single buffering
    b. Double buffering
    c. Circular buffering
    d. None of the above

9. The aspect of disk performance that represents the time it takes to position the head at the desired track is known as:
    a. Seek time
    b. Rotational delay
    c. Access time
    d. None of the above

10. The following disk scheduling policy is useful as a benchmark against which to evaluate other disk scheduling policies because it provides a worst-case scenario:
    a. FIFO scheduling
    b. Priority scheduling
    c. Random scheduling
    d. None of the above
11. The disk scheduling algorithm that implements two subqueues in a measure to avoid the problem of "arm stickiness" is the:
    a. C-SCAN policy
    b. FSCAN policy
    c. N-step-SCAN policy
    d. All of the above
12. Which of the following RAID levels implement some form of parity calculation to introduce redundancy:
    a. RAID Level 2
    b. RAID Level 4
    c. RAID Level 6
    d. All of the above
13. The disk cache replacement strategy that replaces the block that has experienced the fewest references is called:
    a. Least Recently Used (LRU)
    b. Least Referenced (LR)
    c. Least Frequently Used (LFU)
    d. All of the above
14. In a UNIX system, which of the following types of I/O devices make use of character queues:
    a. Disk drive
    b. Tape drive
    c. Communications lines
    d. All of the above
15. In a W2K system, the I/O manager module that includes lazy write and lazy commit services to improve overall performance is the:
    a. Cache manager
    b. File system drivers
    c. Hardware device drivers
    d. None of the above

Fill-In-The-Blank Questions:
1. The term _____ refers to the speed with which data moves to and from the individual I/O device.
2. In the _____ I/O technique, the processor issues an I/O request, continues with other work and eventually receives notification that the request was fulfilled.
3. The term _____ characterizes a system configuration that includes an I/O module that is a separate processor with a specialized instruction set.

4. The bus configuration for DMA that provides no path other than the system bus between the DMA module(s) and I/O devices is called _____.
5. The term _____ refers to the I/O design objective that focuses on preventing I/O from becoming a bottleneck in the system.
6. The _____ layer is the hierarchical layer that is closest to the hardware in most I/O management structures.
7. A hard drive is an example of a _____-oriented I/O device.
8. An improvement over single buffering is the technique known as _____, where two system buffers are assigned to the operation and one can be emptied while the other is filled.
9. The _____ of data to or from a disk depends on the rotation speed of the disk, the number of bytes on a track and the number of bytes to be transferred.
10. _____ is useful as a benchmark against which to evaluate other disk scheduling policies because it provides a worst-case scenario.
11. The disk scheduling algorithm that implements exactly 2 subqueues in a measure to avoid the problem of "arm stickiness" is the _____ policy.
12. RAID Level ____ employs a Hamming code to correct single-bit errors and detect double-bit errors.
13. A _____ is a buffer in main memory designed for the temporary storage of disk sectors.
14. In a UNIX system, _____ I/O typically involves the DMA facility, with the transfer taking place directly between the I/O module and the process I/O area.
15. In a W2K system, the term _____ refers to the fact that the system improves performance by recording updates in the cache and later writing the changes to disk when demand on the processor is low.