Question 1. Hard disk drives are a major part of secondary storage in modern computers, often used alongside other devices. What is the primary material used on HDD platters to store data?

a) HDD platters are made of solid-state memory chips that store data electronically without moving parts.

b) HDD platters use optical layers to reflect light for data storage and retrieval processes.

c) HDD platters are covered with a conductive material that uses electric currents to retain data.

d) HDD platters are coated with a magnetically-sensitive material that allows data to be written and read by moving heads.

Question 2. The speed of hard disk drives can vary from 60 to 250 rotations per second, affecting access time. What happens if the disk head makes contact with the platter surface?

a) If the disk head makes contact with the platter, it causes a head crash that can damage the drive and data.

b) If the disk head makes contact with the platter, it improves data transfer rates by reducing latency.

c) If the disk head makes contact with the platter, it triggers a reset to optimize seek time performance.

d) If the disk head makes contact with the platter, it enhances the rotational speed for better efficiency.

Question 3. Hard disk drives come in various sizes, historically ranging from 0.85 to 14 inches. What is the most common size for modern desktop HDDs?

a) The most common size for modern desktop HDDs is 0.85 inches, preferred for its compact design.

b) The most common size for modern desktop HDDs is 3.5 inches, widely used for its balance of capacity and reliability.

c) The most common size for modern desktop HDDs is 14 inches, chosen for maximum storage capacity.

d) The most common size for modern desktop HDDs is 2.5 inches, typically used in portable devices only.

Q**uestion 4.** The transfer rate of an HDD indicates how fast data moves to the computer, with a theoretical maximum of 6 Gb/sec. What is a key factor that reduces the effective transfer rate?

a) The effective transfer rate is reduced by increasing the platter size, which slows data flow.

b) The effective transfer rate is reduced by the number of cylinders, affecting head movement speed.

c) The effective transfer rate is reduced by practical limitations like seek time and rotational latency, often dropping to 1 Gb/sec.

d) The effective transfer rate is reduced by the storage capacity, limiting data throughput.

Question 5. Seek time is a critical factor in HDD performance, ranging from 3 ms to 12 ms for most drives. What does seek time measure in an HDD?

a) Seek time measures the rotation speed of the platter, determining data access speed.

b) Seek time measures the transfer rate between the drive and the computer system.

c) Seek time measures the latency period for the sector to align under the head.

d) Seek time measures the time taken to move the disk arm to the desired cylinder, a key part of access latency.

Question 6. Latency in HDDs depends on the spindle speed, which dictates how fast the platters rotate. How is average latency calculated based on the slides?

a) Average latency is calculated by multiplying the spindle speed by the number of tracks.

b) Average latency is calculated as half of the latency period, using the formula 60 divided by RPM.

c) Average latency is calculated based on the seek time, adjusted for cylinder distance.

d) Average latency is calculated by dividing the transfer rate by the rotation speed.

Question 7. Access latency combines seek time and latency to determine total access time for an HDD. What is the approximate access latency for the slowest disk mentioned?

a) The approximate access latency for the slowest disk is 5 ms, reflecting minimal seek and latency times.

b) The approximate access latency for the slowest disk is 10 ms, based on average rotational speed.

c) The approximate access latency for the slowest disk is 14.56 ms, combining a 9 ms seek time and 5.56 ms latency.

d) The approximate access latency for the slowest disk is 20 ms, due to high controller overhead.

Question 8. Nonvolatile memory devices like SSDs are alternatives to HDDs, offering different advantages. What is one major benefit of NVM devices over HDDs?

a) NVM devices have no moving parts, eliminating seek time and rotational latency for faster access.

b) NVM devices provide larger storage capacities than HDDs, making them ideal for bulk storage.

c) NVM devices are cheaper per MB, offering a cost-effective storage solution.

d) NVM devices have a longer lifespan, requiring less maintenance than HDDs.

Question 9. Nonvolatile memory devices require specific management due to their write mechanisms. What must happen before data can be overwritten in NVM?

a) Data can be overwritten instantly in NVM without erasing, similar to traditional HDDs.

b) Data requires a seek time adjustment before overwriting, aligning with platter rotation.

c) Data must be erased in larger block increments before overwriting, as NVM cannot overwrite in place.

d) Data is overwritten directly in page increments, bypassing any erase process.

Question 10. The lifespan of NVM devices is rated in drive writes per day to indicate durability. What does a 1TB NAND drive with a 5 DWPD rating mean?

a) A 1TB NAND drive with a 5 DWPD rating can handle 5TB of data written daily within its warranty without failing.

b) A 1TB NAND drive with a 5 DWPD rating supports only 1TB of total writes over its lifetime.

c) A 1TB NAND drive with a 5 DWPD rating requires 5TB of daily reads to maintain performance.

d) A 1TB NAND drive with a 5 DWPD rating limits writes to 5MB per day to prevent wear.

Question 11. Hard disk performance is influenced by multiple factors including seek time and latency, which together form access latency. How is the average I/O time calculated for a 4KB block on a 7200 RPM disk with a 5 ms seek time?

a) The average I/O time is calculated as 15 ms, adding extra buffering delays to the seek and latency times.

b) The average I/O time is calculated as 6 ms, focusing only on transfer rate without latency.

c) The average I/O time is calculated as 9.301 ms, including 5 ms seek time, 4.17 ms latency, and minimal transfer time of 0.031 ms.

d) The average I/O time is calculated as 12 ms, based on theoretical transfer rates alone.

Question 12. Nonvolatile memory devices use a flash translation layer to manage data efficiently, especially with invalid pages. What is the main role of the flash translation layer in NVM?

a) The flash translation layer increases the transfer rate by eliminating the need for erase cycles.

b) The flash translation layer prevents data overwriting, focusing on sequential writes only.

c) The flash translation layer reduces latency by bypassing controller management.

d) The flash translation layer tracks valid logical blocks and supports garbage collection to free invalid page space.

Question 13. Volatile memory like DRAM can serve as a mass-storage device despite being temporary. Why might users prefer RAM drives over traditional OS-managed caches?

a) RAM drives rely on hardware caching, making them more durable than software buffers.

b) RAM drives are under user control, providing high-speed temporary storage unlike OS-managed caches.

c) RAM drives eliminate file systems, simplifying data access compared to caches.

d) RAM drives offer permanent storage, surpassing the volatility of caches.

Question 14. Secondary storage connections use various I/O busses to link devices to the computer. Which bus is identified as the most commonly used for connecting storage devices today?

a) The most commonly used bus is SATA, widely adopted for its compatibility with HDDs and NVM devices.

b) The most commonly used bus is USB, preferred for its versatility across different storage types.

c) The most commonly used bus is Fibre Channel, ideal for high-end enterprise storage solutions.

d) The most commonly used bus is ATA, still prevalent due to its legacy support.

Question 15. Disk drives are organized as a 1-dimensional array of logical blocks for data access. How is this logical array mapped onto the physical sectors of an HDD?

a) The logical array is mapped randomly to optimize access time across all cylinders.

b) The logical array is mapped based on transfer rate, prioritizing high-speed sectors first.

c) The logical array is mapped sequentially from the outermost cylinder's first track to the innermost cylinder's last track.

d) The logical array is mapped in reverse order, starting from the innermost cylinder outward.

Question 16. The operating system aims to enhance disk performance by optimizing access time and bandwidth. What is the primary method to minimize seek time in disk operations?

a) The primary method to minimize seek time is to increase rotational speed, bypassing distance issues.

b) The primary method to minimize seek time is to enhance transfer rates, ignoring head positioning.

c) The primary method to minimize seek time is to reduce the seek distance, which directly affects head movement.

d) The primary method to minimize seek time is to reduce controller overhead, simplifying operations.

Question 17. Disk I/O requests originate from multiple sources, including the operating system and user processes. What does the OS do when a disk is busy handling a current request?

a) The OS processes all requests immediately, disregarding any queue management.

b) The OS discards excess requests when the disk is busy to maintain system performance.

c) The OS increases the disk's rotation speed to handle multiple requests at once.

d) The OS maintains a queue of requests per disk, delaying new requests until the disk becomes idle.

Question 18. Disk scheduling algorithms are effective only when a queue of requests exists. Who was historically responsible for managing this queue and scheduling the disk head?

a) Historically, disk controllers managed the queue without any OS involvement.

b) Historically, the operating system was responsible for queue management and disk head scheduling tasks.

c) Historically, user processes directly handled queue management for disk optimization.

d) Historically, hardware adapters managed queues, leaving the OS out of the process.

Question 19. The FCFS scheduling algorithm processes requests in the order they arrive, ensuring fairness. Why might this method not provide the fastest service for disk access?

a) FCFS prioritizes speed by selecting the nearest cylinder, reducing seek time effectively.

b) FCFS does not optimize head movement, resulting in a total head movement of 640 cylinders as seen in examples.

c) FCFS eliminates queues, allowing instant access to all requested cylinders.

d) FCFS dynamically adjusts seek time, minimizing head movement across cylinders.

Question 20. The SCAN algorithm moves the disk arm across all cylinders in a systematic way. What action does the algorithm take when it reaches the end of the disk?

a) The SCAN algorithm reverses direction at the disk’s end, continuing to service requests on the return trip. b) The SCAN algorithm stops at the disk’s end, waiting for a manual restart to process more requests.

c) The SCAN algorithm jumps to the starting point, ignoring requests on the return path.

d) The SCAN algorithm increases speed at the end to cover remaining cylinders quickly.