國立中央大學113學年度碩士班考試入學試題

所別： 資工類

科目： 作業系統與計算機組織

＊本科考試禁用計算器

複選題：共 5 分， 全部答對才給分

1. Consider a system where the cache memory (L1) has an access time of "C ns," and the main memory (L2) has an access time of "M ns." In this architecture, 80% of the memory accesses are read, and the remaining 20% are write requests. If the hit ratio for read operations is "H," and the hit ratio for write operations is 1, what is the average memory access time (AMAT) when a write-through protocol is implemented in the cache?
   (A) M (0.8H + 1) + 0.2(C + M)
   (B) 0.8 (H + C + M) + 0.2(C + M)
   (C) 0.8H (C + M) + 0.2M
   (D) 0.8H + 0.2(C + M)
   (E) None of the above

多選題：共 95 分，每題 5 分，每一選項單獨計分，每一選項答對得 1 分，答錯倒扣 1 分，倒扣到該大題 0 分為止。

2. What factors influence the effectiveness of a cache memory in a memory hierarchy? (Select all that apply)
   (A) Cache size
   (B) Associativity
   (C) Cache line size
   (D) Clock frequency of the CPU
   (E) All of the above

3. Which statements accurately describe the characteristics of non-volatile storage in the memory hierarchy? (Select all that apply)
   (A) Non-volatile storage retains data even when power is lost
   (B) It is primarily used for temporary data storage
   (C) Examples include hard drives and SSDs
   (D) Non-volatile storage has faster access times compared to cache memory
   (E) All of the above

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4. What tasks are performed by the Memory Management Unit (MMU) in the memory hierarchy? (Select all that apply)
   (A) Manage data stored in cache
   (B) Translate virtual addresses to physical addresses
   (C) Control the flow of instructions to the CPU
   (D) Organize data in the main memory
   (E) All of the above

5. In a cache memory system, what are the characteristics of direct-mapped, set-associative, and fully-associative caches? (Select all that apply)
   (A) Direct-mapped caches have one set.
   (B) Set-associative caches allow a block of memory to be placed in any cache line within a specific set.
   (C) Fully-associative caches provide a unique cache line for every block of memory.
   (D) Direct-mapped caches have lower hit rates compared to set-associative and fully-associative caches.
   (E) All of the above

6. In the context of pipelining in a CPU, which of the following statements are true?
   (A) Increases CPU throughput by executing multiple instructions simultaneously.
   (B) Eliminates all control hazards.
   (C) Data hazards can occur due to instruction overlap.
   (D) Can be implemented without any impact on the clock cycle.
   (E) Pipeline depth is inversely proportional to instruction latency.

7. In the context of virtual memory, which of the following statements are accurate?
   (A) Virtual memory allows physical memory to be treated as a cache for the disk.
   (B) TLB (Translation Lookaside Buffer) is used to reduce page table access time.
   (C) Page Faults occur when data requested by a program is not in physical memory.
   (D) Demand paging can lead to a situation known as thrashing.
   (E) Virtual memory supports efficient process isolation and memory protection.

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8. In the context of memory hierarchy, what are the characteristics of cache memory?
   (A) Cache memory has a lower latency than main memory.
   (B) Typically uses SRAM (Static RAM) technology.
   (C) Larger in size compared to main memory.
   (D) Implements temporal and spatial locality principles.
   (E) Contains a subset of the data stored in main memory.

9. What features are associated with the MIPS instruction set architecture?
   (A) A large set of complex instructions
   (B) Support of register-to-register operation format
   (C) Use of a single accumulator for arithmetic operations
   (D) Delayed branch technique
   (E) Fixed-size instruction encoding

10. What are characteristics of SIMD (Single Instruction, Multiple Data) parallelism?
   (A) Executes different instructions on multiple data points.
   (B) Well-suited for tasks with regular data patterns.
   (C) Commonly used in vector processors.
   (D) Typically involves multiple processors working on the same task.
   (E) Typically implemented in graphics processing units (GPUs).

11. Some computer systems do not provide a privileged mode of operation in hardware. An operating system for a machine of this type would need to remain in control (or monitor mode) at all times. This could be accomplished by the following methods:
   (A) Software interpretation of all user programs.
   (B) All programs are written in high-level languages. The compiler would generate the protection checks that the hardware is missing.
   (C) Program executing in cloud server.
   (D) Open sourced user program.
   (E) ROM-based operating system.

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12. What are the factors that should be considered when deciding the page size?
    (A) Size of page table
    (B) Fragmentation
    (C) I/O overhead
    (D) Number of page faults
    (E) None of the above

13. Consider the following page reference string:
    7, 2, 3, 1, 2, 5, 3, 4, 6, 7, 7, 1, 0, 5, 4, 6, 2, 3, 0, 1.
    Assuming demand paging with three frames, how many page faults would occur for the following replacement algorithms?
    - LRU replacement
    - FIFO replacement
    - Optimal replacement

    Select the correct answers:
    (A) 18 for LRU
    (B) 17 for LRU
    (C) 17 for FIFO
    (D) 13 for LRU
    (E) 13 for optimal replacement

14. Choose the correct statements from the multiple choices
    (A) Each container includes the application, the necessary binaries and libraries and an entire guest operating system
    (B) Containers running on a single machine all share the same operating system kernel
    (C) Virtual machine run as an isolated process in user space on the host operating system
    (D) Containers are lightweight than virtual machines
    (E) None of the above

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15. What are the purpose of the separation of mechanism and policy?
    (A) Easy to programming
    (B) Systems are easy to modify
    (C) Flexibility to suit its needs
    (D) Increasing utilization
    (E) Quick and fast system response

16. Choose the correct statements from the multiple choices
    (A) The RAID structure is used to address the performance and reliability issues of disk organization
    (B) RAID level 5 can tolerate two disk failures
    (C) Inverted page table is used to reduce the size of memory dedicated to page tables
    (D) An inverted page table has one entry for each page of virtual memory
    (E) None of the above

17. Choose the correct statements from the multiple choices
    (A) Process-contention scope involves the decision of which kernel thread to schedule onto which CPU
    (B) PCS will typically preempt the thread currently running in favor of a higher-priority thread
    (C) Priority inversion occurs when lower-priority process holds a lock needed by higher-priority process
    (D) A race condition results when several threads try to access the same data concurrently
    (E) None of the above

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18. Choose the correct statements from the multiple choices
    (A) If all jobs have the same run length and the round-robin (RR) scheduler's time quantum is much shorter than the jobs' run length, the RR scheduler provides better average turnaround time than FIFO
    (B) A SJF scheduler may preempt a previously running longer job
    (C) Each queue in a multilevel queue scheduling algorithm has its own scheduling algorithm.
    (D) With a constant number of bits in a virtual address, the size of a page table decreases as the page size increases.
    (E) None of the above

19. Choose the correct statements from the multiple choices
    (A) The valid-invalid bit is adopted to reduce the overhead of page transfers
    (B) Only one process may be active within the monitor at a time
    (C) The Banker's Algorithm is an example of a technique for deadlock prevention
    (D) Copy-on-Write allows more efficient process creation
    (E) None of the above

20. Choose the correct statements from the multiple choices
    (A) ISO/IEC 27001 is an international standard to manage information security
    (B) The DOS attack is a kind of the man-in-the-middle attacks.
    (C) TLS is used by IPSec to provide network security
    (D) The nsloopup tool allows you to query the DNS to obtain the mapping between domain name and IP address.
    (E) None of the above