# 國立中央大學 114 學年度碩士班考試入學試題

系所： 資工類 

科目： 作業系統與計算機組織

＊本科考試禁用計算器

多選題：

共 100 分，每題 5 分，每一選項單獨計分，答錯倒扣 1 分 倒扣至該大題 0 分為止。

1. Virtual memory is a fundamental concept in modern operating systems that provides an abstraction of the physical memory available in a computer system. Which of the following are true about virtual memory systems?
   A. Virtual memory eliminates the need for physical memory.
   B. Virtual memory swap uses a portion of secondary storage as if it were main memory.
   C. Page tables are used to map virtual addresses to physical addresses.
   D. Virtual memory improves the system's security and isolation.
   E. None of the above

2. Which of the following statements regarding ECC (Error-Correcting Code) memory are accurate?
   A. ECC memory modules have an extra memory chip compared to non-ECC modules, which stores the parity bits used for error detection and correction.
   B. DRAM-based memory systems usually employ advanced ECC mechanisms, like LDPC or BCH codes, capable of detecting and correcting multiple-bit errors to ensure data integrity and reliability.
   C. The performance overhead introduced by ECC memory is negligible in modern systems due to advancements in memory controllers.
   D. ECC memory relies on redundancy in data encoding to perform error detection and correction.
   E. None of the above

3. A system employs various techniques to maximize memory bandwidth and minimize latency, including memory banks, interleaving, and multiple memory channels. Given this context, which of the following statements accurately describe the interaction and impact of memory banks and related memory parallelism techniques on overall system performance?

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A. Memory banks allow for simultaneous access to different memory locations, increasing memory bandwidth.
B. More memory banks always result in higher performance, regardless of access patterns.
C. Interleaving distributes consecutive addresses across banks to maximize parallel access during sequential reads/writes.
D. Memory parallelism techniques, such as using multiple memory channels, are independent of the concept of memory banks.
E. None of the above

4. Which of the following statements are true?
   A. The number of bits in a virtual address determines the maximum addressable memory space.
   B. Usually, a single-level page table is more memory-efficient than a multi-level page table.
   C. For a system with a 32-bit virtual address and 8 KB page size, the page table must store $2^{20}$ entries in a single-level page table.
   D. Multi-level page tables increase address translation time compared to single-level page tables.
   E. None of the above

5. In modern computer architecture, the increasing gap between CPU processing speeds and the rate at which data can be accessed from main memory has created a significant bottleneck. This bottleneck impacts overall system performance and has led to the development of various techniques to mitigate its effects. Considering the challenges posed by this bottleneck, which of the following statements are correct?
   A. The memory wall is solved by simply increasing the amount of RAM in a system.
   B. The memory wall refers to the increasing disparity between CPU processing speed and memory access speed.
   C. In-memory computing is only applicable to small datasets that can fit entirely within the CPU cache.
   D. Both in-memory computing and near-data processing aim to reduce the impact of the memory wall by minimizing data movement.
   E. None of the above

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6. What is the primary purpose of forwarding (bypassing) in a pipelined processor?
   A. To reduce the clock cycle time.
   B. To eliminate structural hazards.
   C. To reduce data hazard stalls.
   D. To predict branch outcomes more accurately.
   E. None of the above.

7. Which of the following is a characteristic of a structural hazard?
   A. It occurs when an instruction depends on the result of a previous instruction.
   B. It arises when the pipeline needs to fetch the wrong instruction.
   C. It occurs when multiple instructions require the same hardware resource at the same time.
   D. It occurs when an instruction modifies the PC.
   E. None of the above

8. Which of the following are common techniques for resolving data hazards in pipelined processors?
   A. Forwarding (bypassing)
   B. Stalling (inserting bubbles)
   C. Branch prediction
   D. Code scheduling
   E. None of the above

9. Why is it important to consider associativity in parallel programming when working with floating-point arithmetic?
   A. Because integer arithmetic is not associative.
   B. Because the order of floating-point operations can affect the results.
   C. To optimize the execution on multiple cores.
   D. To reduce the amount of data to be exchanged between threads.
   E. None of the above

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10. What is the purpose of adding a bias to the exponent in a floating-point representation?
    A. To increase the range of representable numbers.
    B. To simplify the arithmetic operations.
    C. To reduce the amount of storage space needed for exponents.
    D. To allow easy comparison of floating-point numbers as if they were integers.
    E. None of the above

11. Choose the correct statements from the multiple choices
    A. A TLB caches translations from frame numbers to page numbers.
    B. TLBs are more beneficial with multi-level page tables than with single-level page tables.
    C. The number of pages is always identical to the number of frames.
    D. Each thread has its own page table.
    E. None of the above.

12. Choose the correct statements from the multiple choices
    A. The Banker's Algorithm is an example of a technique for deadlock avoidance.
    B. A deadlock-free solution is guaranteed to be starvation-free.
    C. A context switch always involves updating the page table, whether it is between processes or threads.
    D. Average context switching overhead for threads is usually less than average context switching overhead for processes
    E. None of the above.

13. Choose the correct statements from the multiple choices
    A. Little's Law cannot be applied to a system with multiple queues.
    B. Pull migration occurs when an idle processor pulls a waiting task from a busy processor
    C. Push migration and pull migration do not need to be mutually exclusive on load-balancing systems.
    D. Push migration often enhances the benefits of processor affinity.
    E. None of the above.

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14. Choose the correct statements from the multiple choices
    A. The virtual memory manager runs the guest operating systems, manages their resource use, and protects each guest from the others.
    B. In paravirtualization, the guest operating system has direct control over hardware resources.
    C. Paravirtualization presents the guest with a system that is identical to the guest's preferred system.
    D. The guest must be modified to run on the paravirtualized virtual hardware
    E. None of the above.

15. Choose the correct statements from the multiple choices
    A. Buffer-overflow attacks can occur within communication protocols.
    B. Breach of confidentiality involves unauthorized modification of data.
    C. A worm is a process that uses the spawn mechanism to duplicate itself.
    D. The DOS attacks are aimed at breaking a target host and stealing its resources.
    E. None of the above.

16. 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

17. 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

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18. 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

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. Which of the following instructions should be privileged?
    A. Set value of timer.
    B. Read the clock.
    C. Clear memory.
    D. Issue a trap instruction.
    E. Turn off interrupts.