Question of the Day
By GATE And Tech

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Sunday 29th December, 2024

Question of the Day
Quantitative Aptitude: Concepts of divisibility
November 12, 2024

Question

1. Consider the following positive integers:

$$A = 1234679580, B = 1234789560$$

Which of the following statements is/are true?

(A) Both A and B are divisible by 36.

(B) Both A and B are divisible by 72.

(C) Only B is divisible by 120.

(D) The number A is divisible by 80.

Explanation

We need to consider the divisibility by $4, 6, 8, 9, 10$. The number A is divisible by $2, 3, 4, 5, 6, 9$ and B is divisible by $2, 3, 4, 5, 6, 8, 9$.
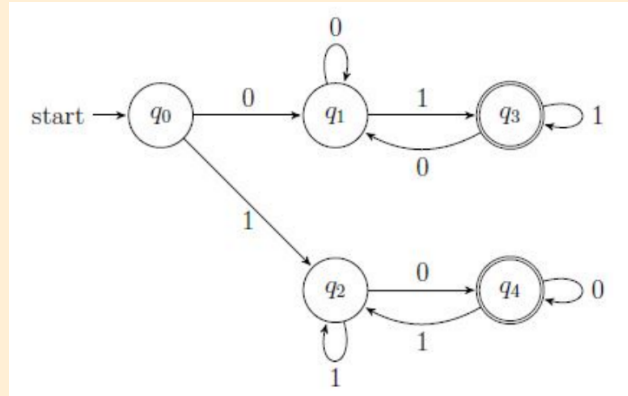Correct Answer: A; C

Question of the Day

November 13, 2024

Question

2. This DFA accepts which strings from the given options?

(A) All the strings with same symbol

(B) All strings of even length

(C) All strings ending with different symbols

(D) None of the above

Source: NPTEL Assignment 3

Explanation

Correct Answer: C

Question of the Day

November 14, 2024

Question

3. Given an arbitrary NFA with n states, the maximum number of states in an equivalent minimized DFA is _____.

(A) n

(B) 2^n

(C) n^2

(D) None of the above

Source: NPTEL Assignment 3

Question of the Day

Theory of computation: Deterministic finite automaton (DFA)

November 15, 2024

Question

4. Given $L = \{ab, baa\}$ which of the following is not in L^*

(A) $ababaaab$

(B) $baaabbaa$

(C) $abbaaab$

(D) $ababbaaab$

Source: NPTEL Assignment 3

Explanation

Correct Answer: A

Question

5. Given NFA accepts strings of which of the given options.
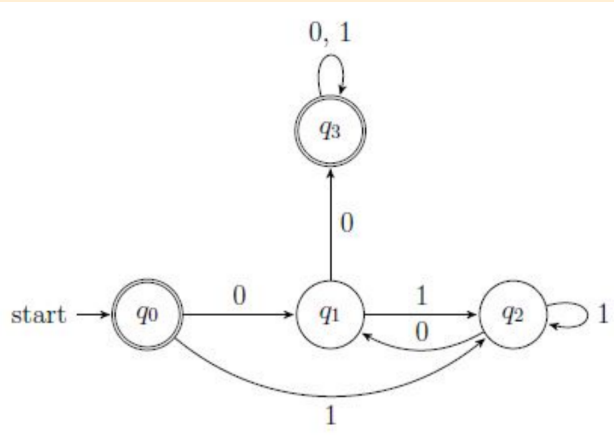
(A) All strings ending with 00

(B) All strings ending with 00, including empty string

(C) All strings containing 00

(D) All strings containing 00, including empty string

Source: NPTEL Assignment 3

Explanation

Correct Answer: D

Question of the Day

November 17, 2024

Question

6. The number of states in minimum DFA corresponding to the language $(0 + 1)^*(10)$ is _____.

(A) 2

(B) 3

(C) 4

(D) 5

Source: NPTEL Assignment 3

Explanation

Correct Answer: B

Question of the Day

Operating Systems: Paging

November 18, 2024

Question

7. One day famed student Joe Surfer had an inspiration while hanging ten at Mission Beach. He observes that most programs have most of their data at the beginning of the address space. For his homegrown SaltWater OS, he decides that he is going to implement his page tables similar to the way Unix implements inodes. He calls this page table design Inode Page Tables. Inode Page Tables are essentially two-level page tables with the following twist: The first half of the page table entries in the master page table directly map physical pages, and the second half of the entries map to secondary page tables as normal. Call the first half the entries fast, and the second half normal. For the following questions, assume that addresses are 32 bits, the page size is 4 KB, and that the master and secondary page tables fit into a single page.

How many virtual pages are fast pages and how many are normal respectively? (**Select all appropriate options**)

(A) $2^9, 2^{19}$

(B) $2^{10}, 2^{20}$

(C) $512, 524288$

(D) $2^8, 2^{18}$

Source: University of California San Diego

Question of the Day

Operating Systems: User Mode and Kernel Mode

November 19, 2024

Question

8. Which of the following situations correctly describes instances of user mode transfer or kernel mode transfer? (Select all options that apply)

(A) The timer interrupt interrupts a user program.

(B) A user program attempts to access unmapped memory and triggers a page fault.

(C) A bug in the kernel's scheduler algorithm causes a segmentation fault.

(D) One process sends a signal to another process.

Source: University of California, Berkeley

Explanation

Safe control transfer involves switching from user mode to kernel mode or vice versa. User to kernel mode transfer include user-mode interrupts and exceptions (not errors that occur in kernel mode). Signals are handled by the kernel, so two-mode transfers are necessary.

Correct Answer: A;B;D

Question

9. In the below program, several threads are created. Which of the following statements in foo always print the same memory address when evaluated by different threads in the same process? (Select all options that apply)

```c
int global;

void* foo(void* arg) {
    printf("%p\n", &foo);
    printf("%p\n", &global);
    printf("%p\n", &arg);
    printf("%p\n", arg);
    return NULL;
}
int main() {
    void* hmem = malloc(1);
    for (int i = 0; i < 3; i++) {
        pthread_t pid;
        pthread_create(&pid, NULL, foo, hmem);
    }
}
```

(A)
```c
        printf("%p\n", &foo)
```

(B)
```c
        printf("%p\n", &global)
```

(C)
```c
        printf("%p\n", &arg)
```

(D)
```c
        printf("%p\n", arg)
```

Source: University of California, Berkeley

Explanation

Threads in the same process share the same address space, so foo and global are the same across all threads. The same argument is given to each thread, so arg stays the same. Each thread has its own stack, so the location of the argument (&arg) is different.

Correct Answer: A;B;D

Question of the Day

Operating Systems: Process and Threads

November 21, 2024

Question

10. Let's assume that there are three threads, Threads A, B, and C, running in Process Z. For which of these synchronization scenarios would you utilize a single semaphore initialized with a value of 2 (as opposed to a semaphore initialized to some other value)? (Select all options that apply)

(A) Preventing more than 2 of the threads from running function f() simultaneously

(B) Ensuring that Thread A completes before Thread B

(C) Ensuring that Thread A runs after Thread B and Thread C have both completed

(D) Preventing Thread A or B from running function f() simultaneously

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Source: University of California, Berkeley

Explanation

Semaphores, unlike locks, do not have a concept of ownership – any thread can up() or down() the semaphore. This means that we cannot enforce some strict ordering with a single semaphore. With a single semaphore initialized to 2, we can only sure that some resource (the function f()) has up to two concurrent usages.

Correct Answer: A

Question of the Day

Operating Systems: Memory Managements

November 22, 2024

Question

11. Which of the following statements is/are True?

(A) Two processes reading from the same virtual address will access the same contents.

(B) Two processes reading from the same physical address will access the same contents.

(C) The size of a virtual page is identical to the size of a physical page.

(D) The OS provides the illusion to each thread that it has its own address space.

Explanation

False - Each process has its own address space.
True - they must have a mapping so share a page so potentially different virtual addresses in each of their address spaces point to the same physical address.
True - The size of a virtual page is identical to the size of a physical page.
False - Each process has its own address space, but threads in the same address space share that address space (e.g., they use the same code and heap).
Correct Answer: B; C

Question of the Day

November 23, 2024

Question

12. Which of the following statements is/are incorrect?

(A) Kernel-level threads are handled by the operating system directly.

(B) Kernel level threads are faster to create and manage than user level threads.

(C) Multiple threads of the same process can be scheduled on different processors in kernel-level threads.

(D) If a kernel-level thread is blocked, all threads of the same process also gets blocked.

Source: University of California, Berkeley

Explanation

A mode switch to kernel mode is required to transfer control from one thread to another in a process. So, a kernel-level thread is slower to create and manage than a user level thread. So option B is false.

Also, since kernel is managing the threads if a kernel level thread gets blocked, the kernel can schedule another thread of the same process which is not the case for user level threads.

Correct Answer: B; D

Question of the Day

November 24, 2024

Question

13. Consider the following program fragment:

```c
main() {
    printf("I'm here!\n");
    fork();
    printf("I'm there!\n");
    if (fork() == 0)
        printf("I'm everywhere!\n");
    else
        printf("No you're not!\n");
    printf("Goodbye.\n");
}
```

Including the original process, this program results in the creation of how many processes?

(A) 6

(B) 4

(C) 5

(D) 3

Source: Lehigh University

Explanation

This program results in the creation of four processes.

Correct Answer: B

Question of the Day

November 25, 2024

Question

14. Which of the following is/are incorrect? (Select all options that apply)

(A) Locks and binary semaphores are equivalent.

(B) The scheduler runs on every context switch.

(C) A context switch can occur in the middle of an instruction.

(D) Shortest-time-to-completion-first is the fairest scheduling algorithm.

Source: Harvard John A. Paulson School Of Engineering And Applied Sciences

Question of the Day

Operating Systems: Semaphores

November 26, 2024

Question

15. Assume that you have a semaphore associated with each item (and on the head structure) on a doubly linked list. Using no other synchronization primitives, what is the fewest number of semaphores that you must acquire for any operation (lookup, insert, delete)?

(A) 1

(B) 3

(C) N, where N is the number of items on the list

(D) None of the above

Source: Harvard John A. Paulson School Of Engineering And Applied Sciences

Explanation

Always lock the head of the list.

Correct Answer: A

Question of the Day

Operating Systems: CPU Scheduling Algorithms

November 27, 2024

Question

16. Which of the following scheduling algorithms will tend to schedule I/O bound jobs before CPU-bound jobs? (Select all options that apply)

(A) Shortest-time-to-completion-first

(B) Multilevel Feedback Queues

(C) Lottery Scheduling

(D) Round Robin

Source: Harvard John A. Paulson School Of Engineering And Applied Sciences

Explanation

Correct Answer: B;C

Question of the Day

November 28, 2024

Question

17. Which of the following expressions surely supports the statement $f(n) = \Omega(g(n))$?

(A) $f(n) \leq 4g(n)$ for all $n \geq 1$

(B) $f(n) \geq 4g(n)$ for all $n \geq 136$

(C) $\lim\limits_{n \to \infty} \frac{f(n)}{g(n)} = 0$

(D) None of the above

Source: California State University, Long Beach

Explanation

Correct Answer: B

Question of the Day

November 29, 2024

Question

18. Let k denote the degree of polynomial $p(n)$, and l the degree of polynomial $q(n)$. If $p(n) = o(q(n))$, then necessarily

(A) $k = l$

(B) $k < l$

(C) $k > l$

(D) None of the above

Source: California State University, Long Beach

Explanation

Correct Answer: B

Question of the Day

Algorithms: Time Complexity

November 30, 2024

Question

19. An algorithm takes as input an $n \times n$ Boolean matrix A. If the running time of the algorithm is $T(n) = \mathrm{O}(n \log n)$ when n is used as the input size parameter, then which of the following expressions describes the big-O growth of $T(m)$, the running time of the algorithm when $m = n^2$ is used as the size parameter?

(A) $\mathrm{O}(\sqrt{m} \log m)$

(B) $\mathrm{O}(m^2 \log m)$

(C) $\mathrm{O}(m \log m)$

(D) $\mathrm{O}(m^2 \log^2 m)$

Source: California State University, Long Beach

Explanation

Correct Answer: A

Question of the Day

Data Structures: Binary Search Tree

December 1, 2024

Question

20. If numbers from the set $\{1, \ldots, n\}$ are selected at random (without replacement) and inserted into an initially-empty binary search tree, then the big-O expression that best describes the average (taken over all possible resulting trees) height of the resulting tree is _____.

(A) $\mathrm{O}(n)$

(B) $\mathrm{O}(\log n)$

(C) $\mathrm{O}(\sqrt{n})$

(D) $\mathrm{O}(n)$

Source: California State University, Long Beach

Explanation

Correct Answer: B

Question of the Day

December 2, 2024

Question

21. If $T(n)$ satisfies $T(n) = 2T(n/3) + \sqrt{n}$, then

(A) $T(n) = \Theta(\sqrt{n})$.

(B) $T(n) = \Theta(n^2)$.

(C) $T(n) = \Theta(n^{\log_3 2})$.

(D) $T(n) = \Theta(n^{\log 3})$.

Source: California State University, Long Beach

Explanation

Correct Answer: C

Question of the Day

Algorithms: Dynamic Programming

December 3, 2024

Question

22. The Floyd-Warshall dynamic programming algorithm defines the matrix of numbers d_{ij}^k, where i and j are graph vertices satisfying $1 \leq i, j \leq n$, and $k \in \{0, 1, \ldots, n\}$. Moreover, d_{ij}^k represents

(A) the distance from i to j when restricted to paths that traverse at most k edges.

(B) the distance from i to j when restricted to paths that traverse at least k edges.

(C) the distance from i to j when restricted to paths whose intermediate vertices must lie within the set $\{1, \ldots, k\}$.

(D) the distance from i to j when restricted to paths whose intermediate vertices must lie within the set $\{k+1, \ldots, n\}$.

Source: California State University, Long Beach

Explanation

Correct Answer: C

Question of the Day

December 4, 2024

Question

23. Suppose $T_1(n) = O(F(n))$ and $T_2(n) = O(F(n))$. Which of the following is/are true?

(A) $T_1(n) + T_2(n) = O(F(n))$

(B) $T_1(n) * T_2(n) = O(F(n))$

(C) $T_1(n)/T_2(n) = O(1)$

(D) $T_1(n) = O(T_2(n))$

Source: FIU School of Computing and Information Sciences

Explanation

Correct Answer: A

Question of the Day

Algorithms: Time Complexity & Asymptotic Notations

December 5, 2024

Question

24. The solution to $T(n) = T(\lfloor 3n/4 \rfloor) + 10$ with $T(0) = 0$ is most accurately given by

(A) $O(\log n)$

(B) $O(n)$

(C) $O(n \log n)$

(D) $O(n^2)$

Source: FIU School of Computing and Information Sciences

Explanation

Correct Answer: A

Question

25. What is the running time of the following routine?

```
// Check if N is prime
function Is_Prime( N : Integer ) return Boolean is
    I : Integer := 3;
begin
    if N = 2 or else N = 3 then
        return TRUE;
    end if;
    if N MOD 2 = 0 then
        return FALSE;
    end if;
    while i * i <= N loop
        if N MOD i = 0 then

            return FALSE;
        else
            I := I + 2;
        end if;
    end loop;
    return TRUE;
end Is_Prime;
```

(A) constant time

(B) $O(\log N)$

(C) $O(N)$

(D) $O(\sqrt{N})$

Explanation

Correct Answer: D

Question of the Day

December 7, 2024

Question

26. Let $C(X)$ be the number of leaves in a binary tree rooted at T. Assume that IsLeaf(T) returns 1 if T is a leaf. Which of the following observations leads to a recursive implementation?

(A) $C(T) := C(T.Left) + C(T.Right)$

(B) $C(T) := C(T.Left) + C(T.\ Right) + 1$

(C) C(T) := C(T.Left) + C(T.Right) + IsLeaf(T)

(D) C(T) := C(T.Left) + C(T.\ Right) + IsLeaf(T) + 1

Source: FIU School of Computing and Information Sciences

Explanation

Correct Answer: C

Question of the Day

Algorithms: Hashing

December 8, 2024

Question

27. Suppose we are implementing quadratic probing with a hash function $Hash(X) = X$ mod 100. If an element with key 4594 is inserted and the first three locations attempted are already occupied, then the next cell that will be tried is _____.

(A) 2

(B) 3

(C) 9

(D) 97

Source: FIU School of Computing and Information Sciences

Explanation

Correct Answer: B

Question

28. This is the logic circuit for finding 2's complement of the 5-bit binary number.
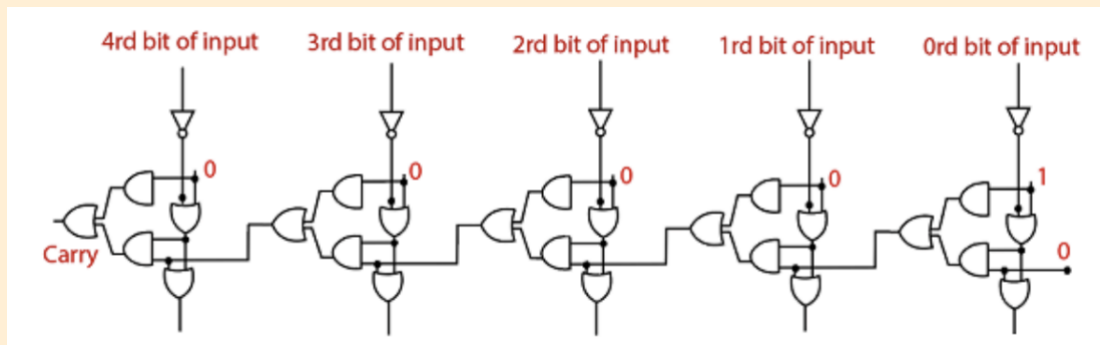
If the input is 10000_2, what's the output in binary?

(A) 10000_2

(B) 00001_2

(C) 10001_2

(D) 00000_2

Source: Universitat Politècnica de Catalunya

Explanation

For 5 bits, this is the most negative number, so it is a special case. The two's complement of the most negative number representable is itself, 10000_2. You have to reverse the bits and add 1, ignoring the overflow.

Correct Answer: A

Question of the Day

Algorithms: Paging

December 10, 2024

Question

29. Which one of the following is true about page-based memory allocation:

(A) It requires the use of a best-fit strategy for memory allocation.

(B) It removes the possibility for external fragmentation.

(C) It removes the possibility for internal fragmentation.

(D) It removes the problems associated with "sparse" address spaces.

Source: UC Berkeley Electrical Engineering & Computer Sciences (EECS)

Explanation

Correct Answer: B

Question of the Day

Operating System: CPU Scheduling

December 11, 2024

Question

30. Consider the following scheduling policy implemented by an OS, in which a user can set numerical priorities for processes running in the system. The OS scheduler maintains all ready processes in a strict priority queue. When the CPU is free, it extracts the ready process with the highest priority (breaking ties arbitrarily), and runs it until the process blocks or terminates. Which of the following statements is/are true about this scheduling policy?

(A) This scheduler is an example of a non-preemptive scheduling policy.

(B) This scheduling policy can result in the starvation of low priority processes.

(C) This scheduling policy guarantees fairness across all active processes.

(D) This scheduling policy guarantees lowest average turnaround time for all processes.

Source: CSE at IIT Bombay

Explanation

Correct Answer: A; B

Question of the Day

Operating System: CPU Scheduling

December 12, 2024

Question

31. Consider the following scheduling policy implemented by an OS. Every time a process is scheduled, the OS runs the process for a maximum of 10 milliseconds or until the process blocks or terminates itself before 10 milliseconds. Subsequently, the OS moves on to the next ready process in the list of processes in a round-robin fashion. Which of the following statements is/are true about this scheduling policy?

(A) This policy cannot be efficiently implemented without hardware support for timer interrupts.

(B) This scheduler is an example of a non-preemptive scheduling policy.

(C) This scheduling policy can sometimes result in involuntary context switches.

(D) This scheduling policy prioritizes processes with shorter CPU burst times over processes that run for long durations.

Source: CSE at IIT Bombay

Explanation

Correct Answer: A; C

Question of the Day

Operating System: System Call

December 13, 2024

Question

32. Consider a process P that needs to save its CPU execution context (values of some CPU registers) on some stack when it makes a function call or system call. Which of the following statements is/are true?

(A) During a system call, when transitioning from user mode to kernel mode, the context of the process is saved on its kernel stack.

(B) During a function call in user mode, the context of the process is saved on its user stack.

(C) During a function call in kernel mode, the context of the process is saved on its user stack.

(D) During a function call in kernel mode, the context of the process is saved on its kernel stack.

Source: CSE at IIT Bombay

Explanation

Correct Answer: A; B; D

Question of the Day

Operating System: Context Switch

December 14, 2024

Question

33. Which of the following statements is/are true about a context switch?

(A) A context switch from one process to another will happen every time a process moves from user mode to kernel mode.

(B) For preemptive schedulers, a trap of any kind always leads to a context switch

(C) A context switch will always occur when a process has made a blocking system call, irrespective of whether the scheduler is preemptive or not

(D) For non-preemptive schedulers, a process that is ready/willing to run will not be context switched out.

Source: CSE at IIT Bombay

Explanation

Correct Answer: C; D

Question of the Day

Operating System: CPU Scheduling

December 15, 2024

Question

34. Consider the following three processes that arrive in a system at the specified times, along with the duration of their CPU bursts. Process P1 arrives at time t=0, and has a CPU burst of 10 time units. P2 arrives at t=2, and has a CPU burst of 2 units. P3 arrives at t=3, and has a CPU burst of 3 units. Assume that the processes execute only once for the duration of their CPU burst, and terminate immediately. For each policy, you must state the completion time of all three processes, P1, P2, and P3. Assume there are no other processes in the scheduler's queue. For the preemptive policies, assume that a running process can be immediately preempted as soon as the new process arrives (if the policy should decide to preempt).

Which of the following options is/are true to calculate the time of completion of the three processes under each of the following scheduling policies?

(A) First Come First Serve $\Rightarrow$ (FCFS: P1 at 10, P2 at 12, P3 at 15)

(B) Shortest Job First (non-preemptive) $\Rightarrow$ SJF: P1 at 10, P2 at 12, P3 at 15

(C) Shortest Remaining Time First (preemptive) $\Rightarrow$ SRTF: P2 at 4, P3 at 7, P1 at 15

(D) Round robin (preemptive) with a time slice of (atmost) 5 units per process $\Rightarrow$ RR: P2 at 7, P3 at 10, P1 at 15

Source: CSE at IIT Bombay

Question of the Day

Operating System: Page Replacement Algorithms
December 16, 2024

Question

35. 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 3 frames, page faults would occur for the following replacement algorithms. Which of the following options is/are correct?

(A) LRU replacement, 18-page faults

(B) FIFO replacement, 17-page faults

(C) Optimal replacement, 13-page faults

(D) None of the above

Source: Indian Institute of Technology, Kharagpur

Explanation

Correct Answer: A; B; C

Question of the Day

Operating System: File Systems
December 17, 2024

Question

36. In an i-node based file system implementation, the i-node typically stores 12 direct block pointers, one 1-indirect block pointer, one 2-indirect block pointer, and one 3-indirect block pointer. Recall that an indirect block is a disk block storing an array of disk block addresses (i.e. pointers). The pointers in a 1-indirect block point to disk blocks that store file data. The pointers in a 2-indirect (or 3-indirect) block point to other 1-indirect (or 2-indirect) blocks. Suppose the file system is configured to use a block size of 2^{10} bytes and each pointer takes up 4-byte. What is the maximum file size that can be supported in the file system?

(A) 6 GB

(B) 4 GB

(C) 16 GB

(D) 8 GB

Source: New York University

23

Each 1-indirect block can address $2^{10}/4 = 2^8$ data blocks. Each 2-indirect block can address $2^8 * 2^8 = 2^{16}$ data blocks.

Each 3-indirect block can address $2^8 * 2^8 * 2^8 = 2^{24}$ data blocks.

In total, the biggest file can contain at most $12 + 2^8 + 2^{16} + 2^{24} \approx 2^{24}$ data blocks (i.e. $2^{24} * 2^{10} = 16$ GB).
Correct Answer: C

Question of the Day

Digital Logic: Number Representations
December 18, 2024

Question

37. If we have seven (7) bits to represent integers, what is the largest unsigned number, and what is the largest 2s complement a signed number we can represent (in decimal and binary)?

(A) Largest unsigned: 1111 111 (127)

(B) Most positive signed: 0111 111 (63)

(C) Most negative signed: 1000 000 (-64)

(D) All of the above

Source: Paul G. Allen School of Computer Science & Engineering University of Washington

Explanation

Correct Answer: D

Question of the Day

December 19, 2024

Question

38. You are using a byte-addressed machine with 64 KiB of Physical address space. You have a 2-way associative L1 data cache of total size 256 bytes with a cache block size of 16 bytes. It uses LRU replacement and write-allocate and write-back policies.

If the $x =$ Number of bits for the cache block offset, $y =$ Number of bits for the cache tag, $z =$ Number of cache sets. Then the value of $x - y + z =$?

(A) 9

(B) 8

(C) 4

(D) 3

Source: Paul G. Allen School of Computer Science & Engineering University of Washington

Explanation

Cache Block Offset: 4
Cache Tag: 9
Cache sets: 8
∴ The value of $x - y + z = 4 - 9 + 8 = 3$.
Correct Answer: A

Question of the Day

Operating System: Translation Lookaside Buffer, Virtual Memory
December 20, 2024

Question

39. Assume we have a virtual memory detailed as follows:

- 8 KiB Virtual Address Space,

- 2 KiB Physical Address Space,

- a TLB (Translation Lookaside Buffer) with 16 entries that is 4-way set associative with LRU replacement

- 64 B page size

How many bits will be used for Page offset, Virtual Page Number (VPN), Physical Page Number(PPN), TLB index, and TLB tag respectively?

(A) 6, 7, 5, 2, 5

(B) 6, 5, 7, 2, 5

(C) 6, 7, 5, 5, 2

(D) 7, 6, 5, 2, 5

Source: Paul G. Allen School of Computer Science & Engineering University of Washington

Explanation

Correct Answer: A

Question of the Day

Operating System: Virtual Memory, Translation Lookaside Buffer

December 21, 2024

Question

40. Assume we have a virtual memory detailed as follows:

- 8 KiB Virtual Address Space,

- 2 KiB Physical Address Space,

- a TLB (Translation Lookaside Buffer) with 16 entries that is 4-way set associative with LRU replacement

- 64 B page size

How many TOTAL entries are in this page table? (Select all the options that apply)

(A) 256

(B) 2^7

(C) 128

(D) 2^8

Source: Paul G. Allen School of Computer Science & Engineering University of Washington

Explanation

Correct Answer: B; C

Question of the Day

Computer Organization and Architecture: Cache Memory
December 22, 2024

Question

41. Suppose we have a system with the following properties:

- Memory accesses are to 4-byte words
- Addresses are 12 bits wide
- The cache is two-way set associative, with a 8-byte block size and 4 sets
- A cache hit has 10ns latency and a cache miss has 100ns latency

What is the size of the cache in bytes?

(A) 64 bytes

(B) 16 bytes

(C) 128 bytes

(D) 32 bytes

Source: Paul G. Allen School of Computer Science & Engineering University of Washington

Explanation

Correct Answer: A

Question of the Day

Digital Logic: Multiplexer, Boolean Algebra, Number Representations
December 23, 2024

Question

42. Which of the following statements is/are incorrect?

(A) An 8-input multiplexer can select between any one of 8 inputs and requires 8/2=4 "select" or control lines.

(B) It is possible to have two different truth tables that describe the same Boolean function.

(C) 2^N is the largest unsigned binary number that can be represented in N bits.

(D) The minimum number of base-3 digits required to obtain at least as many combinations as can be done with 4 binary digits is three

Source: UNC Asheville Department of Computer Science

Explanation

Correct Answer: A;B;C

Question of the Day

December 24, 2024

Question

43. Which of the following statements is/are correct?

(A) An AND gate is the same as an OR gate with its inputs complemented.

(B) An AND gate can be built with fewer transistors than a NAND gate.

(C) A decoder is a combinational logic device that selects one of many inputs to pass through to the output.

(D) Any combinational logic circuit can be build solely with NAND or NOR gates.

Source: UNC Asheville Department of Computer Science

Explanation

Correct Answer: D

Question of the Day

Digital Logic: Number Representations, Decoder, Flip-Flop
December 25, 2024

Question

44. Which of the following statements is/are incorrect?

(A) Given that the ASCII code for the character "c" is 1000011, the ASCII code for "g" is 1000111.

(B) A 2's complement integer representation includes more negative numbers than it does positive ones.

(C) A decoder is a combinational logic device that selects one of many inputs to pass through to the output.

(D) The difference between an SR flip flop and an SR latch is that the SR flip flop's output updates whenever The clock signal is high.

Source: UNC Asheville Department of Computer Science

Explanation

Correct Answer: C; D

Question of the Day

Data Structures: Binary Search Tree, AVL Tree

December 26, 2024

Question

45. Which of the following statements about trees is/are incorrect?

(A) Given a set S of n real keys chosen at random from a uniform distribution over $[a, b)$, a binary search tree can be constructed on S in $O(n)$ expected time.

(B) In the AVL tree they never have a height imbalance greater than 2.

(C) Given a connected, weighted, undirected graph G in which the edge with minimum weight is unique, that edge belongs to every minimum spanning tree of G.

(D) Deleting a node from a binary search tree on n nodes takes $O(\lg n)$ time in the worst case.

Source: Massachusetts Institute of Technology

Explanation

Deletion on an ordinary binary search tree of height h takes $\Theta(h)$ time in the worst case, and h can be $\Omega(n)$ if the tree with n nodes is unbalanced.
Correct Answer: D

Question of the Day

Data Structures: Queue, Linked List

December 27, 2024

Question

46. Suppose that you implement a queue using a null-terminated singly-linked list, maintaining a reference to the item least recently added (the front of the list) but not maintaining a reference to the item most recently added (the end of the list). What are the worst-case running times for enqueue and dequeue?

(A) constant time for both enqueue and dequeue

(B) constant time for enqueue and linear time for dequeue

(C) linear time for enqueue and constant time for dequeue

(D) linear time for both enqueue and dequeue

Source: Princeton Computer Science

Explanation

Correct Answer: C

Question of the Day

Algorithms: Sorting, Dynamic Programming, Topological Sort

December 28, 2024

Question

47. Which of the following statements about trees is/are incorrect?

(A) The Bellman-Ford algorithm applies to instances of the single-source shortest path the problem which do not have a negative-weight directed cycle, but it does not detect the existence of a negative-weight directed cycle if there is one.

(B) The topological sort of an arbitrary directed acyclic graph G = (V, E) can be computed in linear time.

(C) Given an undirected graph, it can be tested to determine whether or not it is a tree in O(V + E) time. A tree is a connected graph without any cycles.

(D) Radix sort works in linear time only if the elements to sort are integers in the range $\{0, 1, \ldots, cn\}$ for some $c = O(1)$.

Source: Massachusetts Institute of Technology

Explanation

A. False. Bellman-Ford detects negative-weight-directed cycles in its input graph.

B. True. A topological sort can be obtained by listing the nodes in the reverse order of the exit times produced by a DFS traversal of the graph. The DFS can also be used to detect if there is a cycle in the graph (there is no valid topological sort in that case). The running time of DFS is O(V + E).

C. True. Using either DFS or BFS yields a running time of O(V + E).

D. False. Radix sort also works in linear time if the elements to sort are integers in the range $\{1, \ldots, n^d\}$ for any constant d.

Correct Answer: A; D

Question of the Day

Data Structures: AVL Tree, Linked List, Binary Tree

December 29, 2024

Question

48. Which of the following statements about trees is/are incorrect?

(A) The AVL invariant states that a tree's shortest and longest paths differ in length by at most 1.

(B) The rotate operation on AVL trees preserves inorder numbering.

(C) Binary search is as efficient on linked lists as on arrays, provided the list is doubly linked.

(D) In the worst case, search in an unbalanced binary tree is asymptotically the same complexity as search in a balanced binary tree.

Source: Cornell Computer Science

Question of the Day

Algorithms: Asymptotic Complexity

December 30, 2024

Question

49. Suppose we wish to compute x^n for integer values of n. We can do this recursively as follows:

- if $n = 0$, return 1

- if $n = 1$, return x

- if $n > 1$ and n is even, recursively compute $y = x^{n/2}$ and return $y \cdot y$

- if $n > 1$ and n is odd, recursively compute $y = x^{n-1}$ and return $x \cdot y$

Assuming addition and multiplication are $O(1)$ operations, what is the worst-case asymptotic complexity of computing x^n this way?

(A) $O(n^2)$

(B) $O(n)$

(C) $O(\log n)$

(D) $O(1)$

Source: Cornell Computer Science

Explanation

Correct Answer: C

Question of the Day

Data Structures: Binary Tree

December 31, 2024

Question

50. In a binary tree, a node may have 0,1 , or 2 children. In the following questions about binary trees, the height of a tree is the length (number of edges) of the longest path. A tree consisting of just one node has height 0.

If x = the maximum number of nodes in a binary tree of height d, y = the minimum number of nodes in a binary tree of height d, z = the maximum height of a binary tree containing n nodes, w = the minimum height of a binary tree containing n nodes, then what is the value of x, y, z, w respectively?

(A) $x = 2^d - 1, y = d + 1, z = n - 1, w = \lfloor \log n \rfloor$

(B) $x = 2^{d+1} - 1, y = d + 1, z = n - 1, w = \lfloor \log n \rfloor$

(C) $x = 2^{d+1} - 1, y = d, z = n - 1, w = \lfloor \log n \rfloor$

(D) $x = 2^{d+1} - 1, y = d + 1, z = n, w = \lfloor \log n \rfloor$

Source: Cornell Computer Science

Explanation

The maximum number of nodes in a binary tree of height d is $2^{d+1} - 1$.

The minimum number of nodes in a binary tree of height d is $d + 1$.

The maximum height of a binary tree containing n nodes is $n - 1$.

The minimum height of a binary tree containing n nodes is $\lfloor \log n \rfloor$.

Correct Answer: B