CS Set 3

Q1. Which addressing mode allows accessing data by adding a constant value to a register before memory access?
A) Immediate addressing
B) Indexed addressing
C) Register indirect
D) Base-relative addressing
Answer: B) Indexed addressing
Explanation: Indexed addressing uses a base register plus an index (constant/offset) to compute the effective address.

Q2. In a multiprocessor system, *false sharing* occurs when:
A) Processors share the same data intentionally
B) Multiple processors access different variables located on the same cache line causing unnecessary coherence traffic
C) A thread acquires a lock it already holds
D) A process reads stale data due to lack of synchronization
Answer: B) Multiple processors access different variables located on the same cache line causing unnecessary coherence traffic
Explanation: False sharing arises when unrelated variables share a cache line; writes by one core invalidate the line for others, hurting performance.

Q3. The minimum number of comparators required to build a 4-bit magnitude comparator (A vs B) that outputs A>B, A=B, A<B is:
A) 6
B) 4
C) 3
D) 16
Answer: A) 6
Explanation: A ripple comparison can be performed using bitwise comparators; a common efficient implementation uses 6 basic 1-bit comparator units (or equivalent combinational logic).

Q4. Which of the following C++ features enables runtime polymorphism?
A) Function overloading
B) Operator overloading
C) Virtual functions
D) Templates
Answer: C) Virtual functions
Explanation: Virtual functions allow method calls to be dispatched according to the actual object type at runtime.

Q5. For a red-black tree with n nodes, what is the maximum possible height (in Big-O terms)?
A) O(log n)
B) O(n)
C) $O(\log^2 n)$
D) $O(\sqrt{n})$
Answer: A) O(log n)
Explanation: Red-black trees maintain balanced height bounded by $2 \cdot \log_2(n+1)$, i.e., O(log n).

Q6. In relational databases, which isolation level may allow non-repeatable reads but prevents dirty reads?
A) READ UNCOMMITTED
B) READ COMMITTED
C) REPEATABLE READ
D) SERIALIZABLE
Answer: B) READ COMMITTED
Explanation: READ COMMITTED prevents dirty reads (no reading uncommitted data) but allows non-repeatable reads (data read twice may differ if another transaction committed).

Q7. In an LRU cache implemented with a doubly linked list and a hashmap, the complexity to move an accessed node to the front is:
A) O(1) amortized
B) O(log n)
C) O(n)

D) O(1) worst-case
Answer: D) O(1) worst-case
Explanation: Using direct pointers from hashmap to list nodes allows removal and insertion in constant time deterministically.

Q8. Which graph traversal modification efficiently detects cycles in a directed graph?
A) BFS with visited set only
B) DFS with recursion stack marker
C) Dijkstra's algorithm
D) Topological sort on undirected graph
Answer: B) DFS with recursion stack marker
Explanation: Marking nodes currently in recursion stack during DFS reveals back edges indicating directed cycles.

Q9. In floating-point representation (IEEE 754 single precision), what happens to a denormalized (subnormal) number when multiplied by a large normalized number that results in exponent overflow?
A) It rounds to zero then overflows
B) It becomes normalized then overflows
C) The product becomes ±infinity if overflow occurs beyond representable range
D) Denormals are converted to NaN
Answer: C) The product becomes ±infinity if overflow occurs beyond representable range
Explanation: If a multiplication yields a result magnitude exceeding the maximum representable finite value, IEEE 754 signals overflow and represents ±infinity (subject to rounding and exceptions).

Q10. Which page replacement policy approximates LRU while using constant-time hardware-friendly operations?
A) FIFO
B) CLOCK (second-chance)
C) Optimal
D) Random

Answer: B) CLOCK (second-chance)
Explanation: CLOCK uses a circular buffer and reference bits to approximate LRU with O(1) operations per step.

Q11. Which SQL operation is most appropriate to remove duplicate records from a result set while preserving all columns?
A) DELETE DISTINCT *
B) SELECT DISTINCT * FROM table
C) GROUP BY all columns
D) ALTER TABLE ... UNIQUE
Answer: B) SELECT DISTINCT * FROM table
Explanation: SELECT DISTINCT * eliminates duplicate rows in the result set across all columns; GROUP BY all columns could also work but is less idiomatic.

Q12. In a star topology LAN, a single point of failure that disconnects multiple hosts is:
A) A NIC failure on one host
B) A central hub/switch failure
C) A single cable break between two end hosts
D) DNS server outage
Answer: B) A central hub/switch failure
Explanation: Star topology relies on a central device; its failure isolates all attached hosts.

Q13. In a combinational logic minimization using Karnaugh maps, combining two minterms that differ in two variables is:
A) Always allowed
B) Not allowed (only differ in one variable per grouping)
C) Allowed if one is a don’t-care
D) Equivalent to De Morgan’s theorem
Answer: B) Not allowed (only differ in one variable per grouping)
Explanation: K-map grouping simplifies adjacent cells differing in a single variable; grouping minterms differing in two variables is invalid for direct combination.

Q14. Which mechanism prevents the priority inversion problem in real-time systems?
A) Priority inheritance protocol
B) Round Robin scheduling
C) FCFS scheduling
D) Aging only
Answer: A) Priority inheritance protocol
Explanation: Priority inheritance temporarily raises a lower-priority task's priority to the highest blocked task, avoiding inversion.

Q15. Given two's complement 8-bit numbers, what is the decimal result of adding 01011011 and 10100110 (ignore overflow flag)?
A) -71
B) 0
C) -1
D) 1
Answer: C) -1
Explanation: 01011011 (91) + 10100110 (-90) = 1; but check arithmetic carefully: 10100110 is two's complement: invert 01011001 add1 -> value = -90. 91 + (-90) = 1. Wait options show C) -1 and D)1. Correct result is 1 → D) 1.
Correction: Answer: D) 1.
Explanation: 01011011 (91) + 10100110 (-90) = 1; two's complement arithmetic yields 00000001.

Q16. In SSL/TLS, which entity issues and signs certificates used to authenticate servers?
A) Client
B) Certificate Authority (CA)
C) DNS server
D) Firewall
Answer: B) Certificate Authority (CA)
Explanation: CAs verify identities and digitally sign certificates binding public keys to domain/server identities.

Q17. Which data structure yields optimal merge patterns (minimizing total comparison cost) when merging multiple sorted lists?
A) Merge them left-to-right sequentially
B) Use a min-heap to repeatedly merge smallest pairs (Huffman-like)
C) Merge largest lists first
D) Use insertion sort approach
Answer: B) Use a min-heap to repeatedly merge smallest pairs (Huffman-like)
Explanation: Optimal merging reduces total cost by merging smallest lists first — analogous to Huffman coding using a min-heap.

Q18. In a RAID 5 array, the storage overhead for parity (on n drives) is:
A) 0%
B) 1/n of total raw capacity
C) 50%
D) n-1 of drives used for parity
Answer: B) 1/n of total raw capacity
Explanation: RAID 5 uses distributed parity across n disks; parity occupies capacity equivalent to one disk → overhead = 1/n.

Q19. Which compiler optimization may change the order of floating-point additions resulting in slightly different results due to non-associativity?
A) Loop unrolling
B) Dead code elimination
C) Common subexpression elimination
D) Floating-point reassociation / instruction reordering
Answer: D) Floating-point reassociation / instruction reordering
Explanation: Reordering FP operations for performance can alter rounding behavior because floating-point addition is not strictly associative.

Q20. The maximum matching in a bipartite graph can be found in polynomial time using:
A) Dijkstra's algorithm
B) Ford-Fulkerson / Hopcroft–Karp algorithm
C) Prim's algorithm
D) Backtracking only

Answer: B) Ford-Fulkerson / Hopcroft–Karp algorithm
Explanation: Bipartite maximum matching reduces to max flow; Hopcroft–Karp runs in O(√V E).

Q21. Which semiconductor parameter primarily determines the switching speed of a MOSFET?
A) Gate capacitance and channel resistance (RC time)
B) Threshold voltage only
C) Package color
D) Thermal conductivity only
Answer: A) Gate capacitance and channel resistance (RC time)
Explanation: The RC time constant (gate capacitance × drive resistance) dictates how fast the gate voltage changes and thus switching speed.

Q22. In TCP, what mechanism prevents a sender from overwhelming a slow receiver?
A) Time to Live (TTL)
B) Flow control using receiver window (rwnd)
C) Congestion control using sequence numbers
D) ARP caching
Answer: B) Flow control using receiver window (rwnd)
Explanation: TCP uses the advertised receive window to inform sender of available buffer space, preventing receiver overflow.

Q23. In normalized floating-point multiplication, the exponent is adjusted by:
A) Adding exponents of operands and subtracting bias
B) XORing the exponents
C) Averaging the exponents
D) Not changing exponent at all
Answer: A) Adding exponents of operands and subtracting bias
Explanation: IEEE 754 multiplies significands and adds exponents; to get unbiased exponent, subtract bias once.

Q24. Which mutex property ensures only one thread enters the critical section at a time?
A) Starvation-freedom
B) Mutual exclusion
C) Deadlock prevention
D) Priority inversion
Answer: B) Mutual exclusion
Explanation: Mutual exclusion enforces single-thread access to shared resources, preventing concurrent entry.

Q25. Which HTML/CSS technique is best to make images responsive (scale with viewport) without distortion?
A) Set fixed width and height in px
B) Use width:100%; height:auto;
C) Use <img> without attributes only
D) Use background-image with fixed size
Answer: B) Use width:100%; height:auto;
Explanation: Setting width to container percentage and height:auto preserves aspect ratio while scaling with viewport.

Q26. In virtual memory systems, increasing the page size will generally:
A) Increase internal fragmentation but reduce page table size
B) Decrease internal fragmentation and increase page table size
C) Decrease both internal fragmentation and page table size
D) Not affect either fragmentation or table size
Answer: A) Increase internal fragmentation but reduce page table size
Explanation: Larger pages mean fewer pages per process → smaller tables, but more unused space in partially filled pages.

Q27. In an ER diagram, a weak entity is identified by:
A) Its own primary key
B) A discriminator key and a relationship with its owner
C) A composite primary key only
D) A derived attribute
Answer: B) A discriminator key and a relationship with its owner

Explanation: Weak entities depend on strong entities for identification and have partial keys (discriminators).

Q28. Which digital circuit technique reduces dynamic power consumption most effectively?
A) Using faster clocks
B) Clock gating
C) Increasing supply voltage
D) Cascading buffers
Answer: B) Clock gating
Explanation: Clock gating disables clock signals to idle blocks, preventing unnecessary switching and power waste.

Q29. In Java, the volatile keyword ensures:
A) Atomic operations
B) Visibility of changes to variables across threads
C) Thread safety for compound actions
D) Performance optimization
Answer: B) Visibility of changes to variables across threads
Explanation: Volatile variables are read and written directly to main memory, ensuring visibility but not atomicity.

Q30. A *perfect hash function* is one that:
A) Produces no collisions for a given key set
B) Uses cryptographic hashing
C) Always distributes keys evenly
D) Depends on chaining
Answer: A) Produces no collisions for a given key set
Explanation: Perfect hashing ensures each key maps to a unique slot within a known key set.

Q31. The asymptotic upper bound of the recurrence $T(n) = T(\sqrt{n}) + \log\ n$is:
A) O(log n)
B) O(log log n)

C) O(√n)
D) O(n)
Answer: A) O(log n)
Explanation: Repeated substitution gives decreasing logarithmic terms; summation forms a convergent logarithmic series → O(log n).

Q32. In SQL, which operator tests for NULL values?
A) = NULL
B) == NULL
C) IS NULL
D) EQUAL NULL
Answer: C) IS NULL
Explanation: IS NULL and IS NOT NULL check nullity; = NULL is invalid because NULL is not comparable.

Q33. Which transport-layer feature enables reliable packet delivery?
A) Sequence numbers and acknowledgments
B) IP fragmentation
C) ARP resolution
D) DNS caching
Answer: A) Sequence numbers and acknowledgments
Explanation: TCP uses sequence and ACK numbers to detect losses and reorder segments, ensuring reliability.

Q34. A Mealy machine differs from a Moore machine in that:
A) Outputs depend only on states
B) Outputs depend on both current state and input
C) It has no outputs
D) It can't be minimized
Answer: B) Outputs depend on both current state and input
Explanation: Mealy machine output changes immediately with inputs; Moore depends only on states.

Q35. In semiconductor physics, increasing temperature generally causes the mobility of charge carriers to:
A) Increase linearly
B) Decrease due to lattice scattering
C) Remain constant
D) Increase exponentially
Answer: B) Decrease due to lattice scattering
Explanation: Lattice vibrations increase with temperature, reducing carrier mobility.

Q36. Which programming language feature violates encapsulation most easily?
A) Public global variables
B) Private data members
C) Inheritance
D) Constructor overloading
Answer: A) Public global variables
Explanation: Globals can be accessed and modified freely across modules, breaking encapsulation principles.

Q37. The time complexity of inserting into a **min-heap** with n elements is:
A) O(1)
B) O(log n)
C) O(n)
D) O(n log n)
Answer: B) O(log n)
Explanation: Insertion percolates an element up the heap — height ≈ log n.

Q38. In a DBMS, *write-ahead logging* (WAL) ensures:
A) Log entries are written before actual data modifications
B) Data is written before logs
C) Rollback is impossible
D) Buffer pool is bypassed
Answer: A) Log entries are written before actual data modifications
Explanation: WAL preserves durability and atomicity — logs must be persistent before changes occur.

Q39. In OS scheduling, a process that voluntarily yields the CPU is said to be:
A) Preempted
B) Cooperative
C) Starved
D) Zombie
Answer: B) Cooperative
Explanation: In cooperative multitasking, processes release CPU voluntarily rather than by preemption.

Q40. The *hidden terminal problem* occurs in:
A) Ethernet CSMA/CD
B) Token ring
C) Wireless networks (CSMA/CA)
D) Optical fiber links
Answer: C) Wireless networks (CSMA/CA)
Explanation: Hidden terminals can't sense each other's transmissions, causing collisions at a receiver.

Q41. Which software-engineering model allows iterative development with early partial deliveries?
A) Waterfall
B) Spiral
C) Big-bang
D) Build-and-fix
Answer: B) Spiral
Explanation: Spiral model integrates iterative refinement with risk assessment and incremental releases.

Q42. Which attack exploits a buffer overflow vulnerability to execute arbitrary code?
A) SQL injection
B) XSS
C) Code injection via stack smashing

D) CSRF
Answer: C) Code injection via stack smashing
Explanation: Stack smashing overwrites return addresses with malicious payloads exploiting overflow.

Q43. The HTML5 element <canvas> is used for:
A) Displaying tabular data
B) 2D/3D dynamic graphics drawing via JavaScript
C) Embedding media files
D) Responsive layout containers
Answer: B) 2D/3D dynamic graphics drawing via JavaScript
Explanation: <canvas> provides pixel-level drawing API for games, charts, or rendering contexts.

Q44. Which logic simplification technique uses algebraic manipulation rather than graphical methods?
A) Karnaugh map
B) Quine–McCluskey
C) Boolean algebra laws
D) Tabulation method
Answer: C) Boolean algebra laws
Explanation: Algebraic simplification uses Boolean identities to reduce expressions symbolically.

Q45. The maximum number of hosts per /26 IPv4 subnet is:
A) 32
B) 62
C) 64
D) 30
Answer: B) 62
Explanation: /26 = 64 addresses, minus 2 reserved (network + broadcast) → 62 usable hosts.

Q46. Which file-allocation method in operating systems avoids external fragmentation?
A) Contiguous allocation
B) Linked allocation
C) Indexed allocation
D) Both B and C
Answer: D) Both B and C
Explanation: Linked and indexed methods allocate non-contiguous blocks, eliminating external fragmentation.

Q47. In C, const int *p means:
A) p is a constant pointer to an int
B) p points to a constant int
C) Both pointer and value are constant
D) None of these
Answer: B) p points to a constant int
Explanation: const before the type makes the pointed data constant, not the pointer itself.

Q48. The *cut-set* of a network graph is:
A) A set of branches forming a closed path
B) Set of branches whose removal disconnects the graph
C) A spanning tree of the graph
D) Any minimal circuit
Answer: B) Set of branches whose removal disconnects the graph
Explanation: Cut-set defines the minimal set of edges separating the network into two parts.

Q49. The time complexity of building a binary search tree by inserting n random keys is on average:
A) O(n)
B) O(n log n)
C) $O(n^2)$
D) O(log n)
Answer: B) O(n log n)

Explanation: Random insertions yield expected balanced structure → average cost ≈ log n per insertion.

Q50. Which HTTP status code indicates that the resource has been permanently moved to a new URI?
A) 301
B) 302
C) 400
D) 404
Answer: A) 301
Explanation: HTTP 301 = *Moved Permanently*; 302 is temporary redirection.

Q51. The instruction MOV A, M in 8085 means:
A) Move data from accumulator to memory
B) Move data from memory to accumulator
C) Move data between two registers
D) Move immediate data to memory
Answer: B) Move data from memory to accumulator
Explanation: MOV A, M copies the content of the memory location addressed by HL register pair into the accumulator.

Q52. Which of the following data structures is most efficient for implementing recursion?
A) Queue
B) Stack
C) Linked list
D) Binary tree
Answer: B) Stack
Explanation: Each function call's return address and variables are stored in the stack, which follows LIFO order required for recursion.

Q53. A 16-bit microprocessor can address a maximum of
A) 16 KB
B) 32 KB

C) 64 KB
D) 64 KB × 1K = 64 MB
Answer: D) 64 KB × 1K = 64 MB
Explanation: 2^{16}= 65,536 address lines → 64 KB per segment; if extended via segmentation, total 64 MB.

Q54. Which sorting algorithm has a worst-case time complexity of $O(n^2)$but best-case $O(n)$?
A) Bubble Sort
B) Insertion Sort
C) Selection Sort
D) Merge Sort
Answer: B) Insertion Sort
Explanation: For already sorted data, insertion sort performs only n–1 comparisons; worst case (reverse order) gives O(n^2).

Q55. The propagation delay in a CMOS gate depends primarily on
A) Supply voltage and load capacitance
B) Input resistance only
C) Temperature only
D) Power dissipation
Answer: A) Supply voltage and load capacitance
Explanation: Delay $\propto C_L \times (V_{DD}/I_{drive})$; lower VDD or higher load capacitance increases delay.

Q56. A function is said to be *tail-recursive* if
A) The recursive call is the last operation
B) It calls itself indirectly
C) It has no return statement
D) It contains multiple recursive calls
Answer: A) The recursive call is the last operation
Explanation: Tail recursion allows optimization because no further operations are pending after the recursive call.

Q57. Which addressing mode uses the instruction form MOV A, @R0?
A) Immediate
B) Direct
C) Register indirect
D) Indexed
Answer: C) Register indirect
Explanation: In 8051 microcontroller, @R0 means the memory address is stored in R0 → register indirect mode.

Q58. The relational algebra operation that performs both selection and projection simultaneously is
A) JOIN
B) PRODUCT
C) SELECT
D) VIEW
Answer: D) VIEW
Explanation: A *view* can be defined to represent a subset (selection) and particular columns (projection) of a table.

Q59. The entropy of a binary source with p = 0.5 is
A) 0
B) 0.5
C) 1
D) 2
Answer: C) 1
Explanation: $H(p) = -p\log_2 p - (1-p)\log_2(1-p) = 1$bit → maximum uncertainty at equal probability.

Q60. The maximum data rate of a noiseless channel with bandwidth B is given by
A) $2B$
B) $B\log_2 M$
C) $2B\log_2 M$
D) B^2
Answer: C) $2B\log_2 M$

Explanation: Nyquist theorem: Maximum bit rate = $2B \times \log_2(M)$ for M-level signaling.

Q61. The minimum number of colors required to color a complete graph of n vertices is
A) 2
B) n
C) n−1
D) $\log_2 n$
Answer: B) n
Explanation: Each vertex in a complete graph is adjacent to every other → each must have a unique color.

Q62. In a computer system, *thrashing* occurs when
A) CPU utilization is high
B) Page fault rate is very high
C) Page size is too large
D) I/O operations are minimized
Answer: B) Page fault rate is very high
Explanation: Thrashing happens when processes spend more time swapping pages than executing instructions.

Q63. The *critical section* problem in operating systems is solved using
A) Virtual memory
B) Mutual exclusion
C) Spooling
D) Context switching
Answer: B) Mutual exclusion
Explanation: Only one process should access shared resources at a time → ensures data consistency.

Q64. A half adder circuit cannot directly perform
A) AND operation
B) OR operation

C) Carry propagation
D) Subtraction
Answer: D) Subtraction
Explanation: Half adder adds two bits only; subtraction requires borrow handling → full subtractor needed.

Q65. The process of converting high-level code to machine code by a compiler is
A) Interpretation
B) Parsing
C) Translation
D) Linking
Answer: C) Translation
Explanation: Compiler translates entire source code to object code before execution.

Q66. Which type of memory is *non-volatile* and can be *electrically reprogrammed*?
A) RAM
B) EPROM
C) EEPROM
D) DRAM
Answer: C) EEPROM
Explanation: EEPROM retains data without power and allows byte-level electrical reprogramming.

Q67. The primary difference between TCP and UDP is
A) UDP is reliable; TCP is not
B) TCP provides connection-oriented service; UDP is connectionless
C) Both are unreliable
D) TCP is used only for email
Answer: B) TCP provides connection-oriented service; UDP is connectionless
Explanation: TCP ensures reliable delivery with sequencing and acknowledgment, unlike UDP.

Q68. A recursive algorithm that calls itself twice per call will have approximately
A) Linear time
B) Quadratic time
C) Exponential time
D) Logarithmic time
Answer: C) Exponential time
Explanation: Each call creates two new calls → total ≈ 2^n complexity.

Q69. The dual of the Boolean expression $A + (BC)$is
A) $A(B + C)$
B) $A(B'C')$
C) $A(B + C)'$
D) $A(B' + C')$
Answer: A) $A(B + C)$
Explanation: Dual: interchange + ↔ · and 0 ↔ 1 → dual of A+(BC) is A(B+C).

Q70. In a relational database, a *foreign key*
A) Uniquely identifies each record
B) Refers to a primary key in another table
C) Must be unique in its table
D) Cannot be null
Answer: B) Refers to a primary key in another table
Explanation: Foreign key enforces referential integrity between two related tables.

Q71. Which of the following statements about dynamic memory allocation is *false*?
A) malloc() allocates memory at runtime
B) Memory allocated with malloc() must be freed
C) calloc() initializes allocated memory to zero
D) Memory allocated by malloc() automatically frees when a function ends
Answer: D)

Explanation: Memory allocated with malloc() persists until explicitly freed by free(), not automatically released.

Q72. The time required for a cache hit compared to main memory access is typically
A) Smaller
B) Larger
C) Equal
D) Negligible difference
Answer: A) Smaller
Explanation: Cache is faster (nanoseconds) due to proximity and lower latency compared to DRAM.

Q73. The avalanche breakdown in a diode occurs when
A) Forward bias is too high
B) Reverse voltage exceeds critical value
C) Junction temperature increases
D) Doping concentration is low
Answer: B) Reverse voltage exceeds critical value
Explanation: High reverse voltage accelerates carriers → impact ionization → avalanche breakdown.

Q74. Which of these protocols operates at the *data link layer* of the OSI model?
A) IP
B) TCP
C) ARP
D) HTTP
Answer: C) ARP
Explanation: Address Resolution Protocol maps IP to MAC addresses — operates at Layer 2 (Data Link).

Q75. The bandwidth of a signal limited to 4 kHz sampled at 8 kHz produces how many Nyquist samples per second?

A) 4000
B) 6000
C) 8000
D) 16000
Answer: C) 8000
Explanation: Nyquist rate = 2 × f_max = 2 × 4000 = 8000 samples/sec.

Q76. Which type of addressing mode uses the instruction format ADD A, #25H?
A) Immediate
B) Direct
C) Register
D) Indirect
Answer: A) Immediate
Explanation: The "#" symbol denotes that the operand is an immediate value directly provided in the instruction.

Q77. In digital communication, *Shannon's theorem* gives the maximum data rate as
A) $C = 2B\log_2 M$
B) $C = B\log_2(1 + S/N)$
C) $C = \log_2(1 + B/S)$
D) $C = S/N$
Answer: B) $C = B\log_2(1 + S/N)$
Explanation: Shannon capacity defines the upper bound of error-free data transmission over a channel of bandwidth B and SNR S/N.

Q78. In C, what will printf("%d", 5/2); output?
A) 2.5
B) 2
C) 2.0
D) Compilation error
Answer: B) 2
Explanation: Both operands are integers → integer division truncates the fractional part.

Q79. Which of the following is **not** a characteristic of an algorithm?
A) Finiteness
B) Ambiguity
C) Effectiveness
D) Input/output
Answer: B) Ambiguity
Explanation: Algorithms must be unambiguous; every step clearly defined and executable.

Q80. The probability of error in Binary Phase-Shift Keying (BPSK) is
A) $Q(\sqrt{2E_b/N_0})$
B) $Q(\sqrt{E_b/N_0})$
C) $1/2Q(\sqrt{E_b/N_0})$
D) $1 - Q(\sqrt{E_b/N_0})$
Answer: A) $Q(\sqrt{2E_b/N_0})$
Explanation: BPSK error probability = Q-function of √(2E_b/N_0); high SNR gives low error rate.

Q81. The 8086 microprocessor has how many address lines?
A) 16
B) 20
C) 24
D) 32
Answer: B) 20
Explanation: 8086 uses a 20-bit address bus → $2^{20} = 1$MB addressable memory.

Q82. The efficiency of a class-B amplifier is approximately
A) 25%
B) 50%
C) 78.5%
D) 100%

Answer: C) 78.5%
Explanation: Class-B amplifier conducts for half-cycle and ideally achieves 78.5% efficiency.

Q83. Which of the following is *not* a stable sorting algorithm?
A) Merge Sort
B) Insertion Sort
C) Quick Sort
D) Bubble Sort
Answer: C) Quick Sort
Explanation: Quick sort may reorder equal elements differently; it's unstable by default.

Q84. Which of the following is used to measure phase difference between two AC signals?
A) Wattmeter
B) CRO
C) Digital multimeter
D) Megger
Answer: B) CRO
Explanation: Cathode Ray Oscilloscope can display two signals simultaneously for phase comparison.

Q85. In database normalization, eliminating transitive dependencies occurs at
A) 1NF
B) 2NF
C) 3NF
D) BCNF
Answer: C) 3NF
Explanation: Third Normal Form removes transitive functional dependencies among non-key attributes.

Q86. Which data structure is best for implementing a priority queue?
A) Linked list

B) Stack
C) Heap
D) Queue
Answer: C) Heap
Explanation: Heap allows efficient retrieval of the highest or lowest priority element in O(log n).

Q87. In software engineering, *cyclomatic complexity* measures
A) Code efficiency
B) Number of control paths
C) Time complexity
D) Compilation errors
Answer: B) Number of control paths
Explanation: Cyclomatic complexity = E – N + 2; used to estimate number of independent test paths.

Q88. A 4-bit synchronous counter built using JK flip-flops has a maximum count of
A) 4
B) 8
C) 15
D) 16
Answer: C) 15
Explanation: 4 bits → 0 to 15 range (16 states) → maximum count before overflow is 15.

Q89. In IPv4, the address 255.255.255.255 is used for
A) Local host
B) Default gateway
C) Broadcast
D) Multicast
Answer: C) Broadcast
Explanation: 255.255.255.255 denotes network-wide broadcast to all hosts.

Q90. Which of these best describes an *interrupt vector table*?
A) Stack of return addresses
B) Table of I/O ports
C) Table storing addresses of ISR routines
D) List of DMA channels
Answer: C) Table storing addresses of ISR routines
Explanation: IVT holds the memory addresses of interrupt service routines for each interrupt type.

Q91. In an RDBMS, *ACID* property ensures
A) Speed
B) Transaction reliability
C) Normalization
D) Query optimization
Answer: B) Transaction reliability
Explanation: ACID = Atomicity, Consistency, Isolation, Durability → ensures reliable database transactions.

Q92. The output of a logic gate is 1 only when both inputs are different. The gate is
A) OR
B) XOR
C) XNOR
D) NAND
Answer: B) XOR
Explanation: XOR outputs high when inputs differ; truth table: 0-1 or 1-0 → 1.

Q93. The main advantage of a virtual memory system is
A) Faster CPU
B) Larger effective memory
C) Fewer cache misses
D) Simpler hardware
Answer: B) Larger effective memory
Explanation: Virtual memory uses disk as extension of RAM, providing illusion of large continuous memory.

Q94. Which scheduling algorithm can cause starvation?
A) FCFS
B) Round Robin
C) SJF (Shortest Job First)
D) Priority with aging
Answer: C) SJF
Explanation: Long jobs can be postponed indefinitely if shorter jobs keep arriving.

Q95. The transistor region used for amplification is
A) Cut-off
B) Active
C) Saturation
D) Breakdown
Answer: B) Active
Explanation: In active region, transistor operates linearly; collector current $\propto$ base current.

Q96. The number of leaf nodes in a full binary tree with 15 nodes is
A) 7
B) 8
C) 10
D) 11
Answer: B) 8
Explanation: For full binary tree: leaves = $(n + 1)/2 \rightarrow (15 + 1)/2 = 8$.

Q97. Which protocol is responsible for translating domain names to IP addresses?
A) HTTP
B) SMTP
C) DNS
D) FTP
Answer: C) DNS

Explanation: Domain Name System resolves human-readable domain names into numerical IP addresses.

Q98. The depletion region in a FET lies between
A) Gate and source
B) Gate and drain
C) Channel and gate
D) Source and drain
Answer: C) Channel and gate
Explanation: Depletion region forms around gate–channel junction, controlling channel conductivity.

Q99. Which Java keyword prevents method overriding?
A) private
B) final
C) static
D) abstract
Answer: B) final
Explanation: Declaring a method as final prevents subclasses from overriding it.

Q100. In HTML5, which tag is used to define scalable vector graphics?
A) <canvas>
B) <img>
C) <svg>
D) <vector>
Answer: C) <svg>
Explanation: <svg> allows resolution-independent, XML-based vector graphics directly embedded in web pages.