

TS PGECET 2026

Computer Science and Information Technology

Guess Paper – High Probability Questions

Conducted by	JNTU Hyderabad on behalf of TGCHE
Total Questions	120
Total Marks	120
Duration	2 Hours
Question Type	Multiple Choice Questions (MCQs)
Marking Scheme	+1 for correct; No negative marking
Sections	Engineering Mathematics (10 Q) + CS Core (110 Q)
Prepared by	Career Decode

1 Engineering Mathematics (Q. 1–10)

1.1 Linear Algebra and Calculus

Q.1. The rank of the matrix $A = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}$ is:

- (A) 3
- (B) 2
- (C) 1
- (D) 0

Q.2. The eigenvalues of the matrix $B = \begin{pmatrix} 4 & 1 \\ 2 & 3 \end{pmatrix}$ are:

- (A) 5 and 2
- (B) 4 and 3
- (C) 6 and 1
- (D) 3 and 4

Q.3. If $f(x) = x^3 - 3x^2 + 4$, then the value of $f'(2)$ is:

- (A) 0
- (B) 2
- (C) -2
- (D) 4

Q.4. The value of $\int_0^1 xe^x dx$ is:

- (A) $e - 1$
- (B) 1
- (C) e
- (D) $2e - 1$

1.2 Probability and Statistics

Q.5. A fair die is rolled twice. The probability that the sum of the outcomes equals 7 is:

- (A) $\frac{1}{6}$
- (B) $\frac{5}{36}$
- (C) $\frac{7}{36}$
- (D) $\frac{1}{9}$

Q.6. For a Poisson distribution with mean $\lambda = 3$, the probability $P(X = 0)$ is:

- (A) e^{-3}
- (B) $3e^{-3}$
- (C) $1 - e^{-3}$
- (D) e^3

Q.7. The standard deviation of the data set $\{2, 4, 4, 4, 5, 5, 7, 9\}$ is:

- (A) 2
- (B) 4
- (C) 1
- (D) 3

1.3 Discrete Mathematics

Q.8. The number of simple graphs on 4 vertices is:

- (A) 11
- (B) 12
- (C) 10
- (D) 64

Q.9. How many relations on a set of n elements are both reflexive and symmetric?

- (A) $2^{n(n-1)/2}$
- (B) 2^{n^2}
- (C) 2^n
- (D) $2^{n(n+1)/2}$

Q.10. The sum of all positive divisors of 36 is:

- (A) 91
- (B) 84
- (C) 96
- (D) 72

2 Computer Science and Information Technology (Q. 11–120)

2.1 Programming and Data Structures (Q. 11–25)

- Q.11.** Which of the following data structures uses LIFO (Last In First Out) order?
- (A) Queue
 - (B) Stack
 - (C) Deque
 - (D) Priority Queue
- Q.12.** The time complexity of inserting an element at the beginning of a singly linked list is:
- (A) $O(n)$
 - (B) $O(\log n)$
 - (C) $O(1)$
 - (D) $O(n^2)$
- Q.13.** Which traversal of a binary search tree (BST) produces elements in sorted order?
- (A) Preorder
 - (B) Postorder
 - (C) Inorder
 - (D) Level order
- Q.14.** Consider a stack initially empty. After operations Push(1), Push(2), Pop, Push(3), Pop, the top element is:
- (A) 1
 - (B) 2
 - (C) 3
 - (D) Empty
- Q.15.** A complete binary tree with n internal nodes has how many leaf nodes?
- (A) n
 - (B) $n - 1$
 - (C) $n + 1$
 - (D) $2n$
- Q.16.** What is the output of the following C code snippet?
- ```
int x = 5;
printf("%d", x++);
```
- (A) 6

- (B) 5
  - (C) Undefined
  - (D) 4
- Q.17.** The height of an AVL tree with  $n$  nodes is:
- (A)  $O(n)$
  - (B)  $O(\sqrt{n})$
  - (C)  $O(\log n)$
  - (D)  $O(n \log n)$
- Q.18.** Which of the following is NOT a property of a min-heap?
- (A) The root is the smallest element
  - (B) It is a complete binary tree
  - (C) Inorder traversal yields sorted output
  - (D) Parent is always smaller than or equal to children
- Q.19.** In a doubly linked list, deleting a node that has both predecessor and successor requires updating how many pointers?
- (A) 1
  - (B) 2
  - (C) 4
  - (D) 3
- Q.20.** Hashing with chaining handles collision by:
- (A) Finding the next empty slot
  - (B) Maintaining a linked list at each bucket
  - (C) Rehashing with a secondary hash function
  - (D) Increasing table size
- Q.21.** Which sorting algorithm has the best average case time complexity?
- (A) Bubble Sort
  - (B) Insertion Sort
  - (C) Merge Sort
  - (D) Selection Sort
- Q.22.** The number of nodes at depth  $d$  in a full binary tree is:
- (A)  $d$
  - (B)  $2^d$
  - (C)  $2d$
  - (D)  $d^2$
- Q.23.** Which data structure is most suitable to implement a priority queue efficiently?

- (A) Stack
- (B) Linked list
- (C) Binary heap
- (D) Array

**Q.24.** The space complexity of recursive Merge Sort on an array of  $n$  elements is:

- (A)  $O(1)$
- (B)  $O(\log n)$
- (C)  $O(n)$
- (D)  $O(n \log n)$

**Q.25.** Which of the following is a stable sorting algorithm?

- (A) Quick Sort (standard partition)
- (B) Heap Sort
- (C) Merge Sort
- (D) Selection Sort

## 2.2 Algorithms (Q. 26–40)

**Q.26.** Dijkstra's algorithm fails on graphs with:

- (A) Directed edges
- (B) Undirected edges
- (C) Negative weight edges
- (D) Cycles

**Q.27.** The worst-case time complexity of Quick Sort on an already sorted array using the first element as pivot is:

- (A)  $O(n \log n)$
- (B)  $O(n^2)$
- (C)  $O(n)$
- (D)  $O(\log n)$

**Q.28.** Dynamic programming solves problems by:

- (A) Dividing into equal halves
- (B) Storing solutions to overlapping subproblems
- (C) Using greedy choices at each step
- (D) Exhaustive enumeration

**Q.29.** Which algorithm is used to find the Minimum Spanning Tree of a graph?

- (A) Dijkstra's
- (B) Bellman–Ford

- (C) Kruskal's
  - (D) Floyd–Warshall
- Q.30.** The time complexity of Binary Search on a sorted array of  $n$  elements is:
- (A)  $O(n)$
  - (B)  $O(\log n)$
  - (C)  $O(n \log n)$
  - (D)  $O(1)$
- Q.31.** Which of the following is an example of a greedy algorithm?
- (A) Longest Common Subsequence
  - (B) 0/1 Knapsack
  - (C) Fractional Knapsack
  - (D) Matrix Chain Multiplication
- Q.32.** The recurrence relation  $T(n) = 2T(n/2) + n$  has the solution:
- (A)  $O(n)$
  - (B)  $O(n^2)$
  - (C)  $O(n \log n)$
  - (D)  $O(\log n)$
- Q.33.** The Floyd–Warshall algorithm computes:
- (A) Single source shortest paths
  - (B) Minimum spanning tree
  - (C) All-pairs shortest paths
  - (D) Longest path in a DAG
- Q.34.** Which problem is NP-Complete?
- (A) Sorting
  - (B) Binary Search
  - (C) Hamiltonian Cycle
  - (D) Minimum Spanning Tree
- Q.35.** The number of edges in a minimum spanning tree of a graph with  $n$  vertices is:
- (A)  $n$
  - (B)  $n - 1$
  - (C)  $n + 1$
  - (D)  $n(n - 1)/2$
- Q.36.** Prim's algorithm for MST uses which data structure for efficient implementation?
- (A) Queue

- (B) Stack
  - (C) Min-heap (Priority Queue)
  - (D) Hash Table
- Q.37.** What is the time complexity of Bellman–Ford algorithm for a graph with  $V$  vertices and  $E$  edges?
- (A)  $O(V \log V)$
  - (B)  $O(VE)$
  - (C)  $O(E \log V)$
  - (D)  $O(V^2)$
- Q.38.** The principle of optimality is the foundation of:
- (A) Greedy algorithms
  - (B) Divide and conquer
  - (C) Dynamic programming
  - (D) Backtracking
- Q.39.** The number of comparisons required by Heap Sort in the worst case for  $n$  elements is:
- (A)  $O(n)$
  - (B)  $O(n^2)$
  - (C)  $O(n \log n)$
  - (D)  $O(\log n)$
- Q.40.** Which traversal is used by BFS (Breadth First Search) in a graph?
- (A) Stack
  - (B) Queue
  - (C) Priority queue
  - (D) Recursion stack

### 2.3 Theory of Computation (Q. 41–55)

- Q.41.** Which of the following is NOT a regular language?
- (A)  $\{a^n b^m \mid n, m \geq 0\}$
  - (B)  $\{a^n b^n \mid n \geq 0\}$
  - (C)  $\{a^* b^*\}$
  - (D)  $\{w \mid w \text{ has equal number of 0s and 1s}\}^c$  for finite  $|w|$
- Q.42.** A Deterministic Finite Automaton (DFA) and a Non-deterministic Finite Automaton (NFA) recognize:
- (A) The same class of languages
  - (B) DFA recognizes more languages than NFA

- (C) NFA recognizes more languages than DFA
  - (D) Neither can recognize all regular languages
- Q.43.** Which grammar type generates context-free languages?
- (A) Type 0
  - (B) Type 1
  - (C) Type 2
  - (D) Type 3
- Q.44.** The pumping lemma for regular languages is used to:
- (A) Prove a language is regular
  - (B) Prove a language is not regular
  - (C) Construct a DFA from an NFA
  - (D) Minimize a DFA
- Q.45.** Which of the following problems is undecidable?
- (A) Membership in a regular language
  - (B) Emptiness of a DFA
  - (C) Halting problem for Turing machines
  - (D) Equivalence of two DFAs
- Q.46.** The language  $L = \{a^n b^n c^n \mid n \geq 1\}$  is:
- (A) Regular
  - (B) Context-free
  - (C) Context-sensitive
  - (D) Neither context-free nor context-sensitive
- Q.47.** A pushdown automaton (PDA) recognizes:
- (A) Regular languages
  - (B) Context-free languages
  - (C) Context-sensitive languages
  - (D) Recursively enumerable languages
- Q.48.** The minimum number of states in a DFA to accept all binary strings ending with '01' is:
- (A) 2
  - (B) 3
  - (C) 4
  - (D) 5
- Q.49.** Epsilon-closure of a state in an NFA is:
- (A) Set of states reachable on input symbol  $\varepsilon$  only

- (B) Set of states reachable on any input
  - (C) Set of states reachable via zero or more  $\varepsilon$ -transitions
  - (D) Set of start states
- Q.50.** The Chomsky Normal Form (CNF) requires that every production is of the form:
- (A)  $A \rightarrow BC$  or  $A \rightarrow a$
  - (B)  $A \rightarrow aB$  or  $A \rightarrow a$
  - (C)  $A \rightarrow ABC$
  - (D)  $A \rightarrow \varepsilon$
- Q.51.** Which of the following is a property of a Turing machine that a PDA does not have?
- (A) Ability to read input
  - (B) Infinite memory (unbounded tape)
  - (C) Finite set of states
  - (D) Transition function
- Q.52.** The regular expression  $(a|b)^*abb$  denotes:
- (A) All strings over  $\{a, b\}$  containing 'abb'
  - (B) All strings over  $\{a, b\}$  ending with 'abb'
  - (C) All strings over  $\{a, b\}$  starting with 'abb'
  - (D) All strings of length at most 3
- Q.53.** A language is recursively enumerable if and only if it is accepted by:
- (A) A DFA
  - (B) A PDA
  - (C) A Turing machine
  - (D) A linear bounded automaton
- Q.54.** The class P contains decision problems solvable in:
- (A) Exponential time
  - (B) Polynomial time
  - (C) Logarithmic space
  - (D) Non-deterministic polynomial time
- Q.55.** Which of the following is true about NP-hard problems?
- (A) They are all in P
  - (B) Every NP problem reduces to them in polynomial time
  - (C) They are all NP-complete
  - (D) They can be solved in polynomial time

## 2.4 Computer Organization and Architecture (Q. 56–68)

- Q.56.** In a two's complement representation using 8 bits, the decimal value of  $11111110_2$  is:
- (A) 254
  - (B)  $-2$
  - (C)  $-1$
  - (D)  $-127$
- Q.57.** Which cache mapping technique has the lowest miss penalty on average for large caches?
- (A) Direct-mapped
  - (B) Fully associative
  - (C) Set-associative
  - (D) None of the above
- Q.58.** The instruction cycle of a CPU consists of:
- (A) Fetch, Execute
  - (B) Fetch, Decode, Execute
  - (C) Fetch, Decode, Execute, Write-back
  - (D) Decode, Execute, Store
- Q.59.** In a pipelined processor with 5 stages, executing  $n$  instructions takes approximately how many clock cycles?
- (A)  $5n$
  - (B)  $n + 4$
  - (C)  $5 + n - 1$
  - (D)  $n/5$
- Q.60.** The number of address lines required to address 64 KB of memory with byte addressability is:
- (A) 16
  - (B) 8
  - (C) 32
  - (D) 12
- Q.61.** RISC architecture is characterized by:
- (A) Complex instruction set with variable format
  - (B) Simple, fixed-length instructions and large register file
  - (C) Microcoded control unit
  - (D) Memory-to-memory operations
- Q.62.** Booth's multiplication algorithm handles:

- (A) Only unsigned multiplication
  - (B) Signed multiplication in two's complement
  - (C) Floating-point multiplication
  - (D) Division of two integers
- Q.63.** Which interrupt is generated by the CPU itself when it detects an error such as division by zero?
- (A) Hardware interrupt
  - (B) Software interrupt
  - (C) Exception (internal interrupt)
  - (D) Non-maskable interrupt
- Q.64.** Direct Memory Access (DMA) is used to:
- (A) Allow CPU to directly access disk
  - (B) Transfer data between memory and I/O device without CPU involvement
  - (C) Increase cache speed
  - (D) Manage virtual memory
- Q.65.** The IEEE 754 single precision floating point format uses:
- (A) 1 sign bit, 8 exponent bits, 23 mantissa bits
  - (B) 1 sign bit, 11 exponent bits, 52 mantissa bits
  - (C) 1 sign bit, 7 exponent bits, 24 mantissa bits
  - (D) 2 sign bits, 8 exponent bits, 22 mantissa bits
- Q.66.** In a  $k$ -way set-associative cache with  $n$  sets and block size  $b$  bytes, the total cache size is:
- (A)  $n \times b$
  - (B)  $k \times n \times b$
  - (C)  $k \times b$
  - (D)  $n \times k$
- Q.67.** Which bus is used to carry memory addresses from CPU to memory?
- (A) Data bus
  - (B) Control bus
  - (C) Address bus
  - (D) I/O bus
- Q.68.** Write-back policy in cache means:
- (A) Every write updates both cache and main memory
  - (B) Write to cache only; update main memory when block is replaced
  - (C) Write directly to main memory, bypassing cache
  - (D) Write to both cache and ROM

## 2.5 Operating Systems (Q. 69–82)

- Q.69.** Which CPU scheduling algorithm can cause starvation?
- (A) Round Robin
  - (B) First Come First Served
  - (C) Shortest Job First (preemptive)
  - (D) Multilevel feedback queue with aging
- Q.70.** Deadlock can occur only if all four Coffman conditions hold simultaneously. Which of the following is NOT one of them?
- (A) Mutual Exclusion
  - (B) Hold and Wait
  - (C) Preemption
  - (D) Circular Wait
- Q.71.** The Banker's algorithm is used for:
- (A) CPU scheduling
  - (B) Deadlock avoidance
  - (C) Page replacement
  - (D) Memory allocation
- Q.72.** In the FIFO page replacement algorithm, which anomaly can occur?
- (A) Thrashing
  - (B) Belady's anomaly
  - (C) Starvation
  - (D) Priority inversion
- Q.73.** The LRU page replacement algorithm replaces the page that has been:
- (A) Used most recently
  - (B) Not used for the longest time
  - (C) Loaded first
  - (D) Accessed the fewest times
- Q.74.** A semaphore initialized to 1 used for mutual exclusion is called a:
- (A) Counting semaphore
  - (B) Binary semaphore (mutex)
  - (C) Spinlock
  - (D) Monitor
- Q.75.** Which of the following is a non-preemptive scheduling algorithm?
- (A) Shortest Remaining Time First
  - (B) Round Robin

- (C) First Come First Served
  - (D) Priority (preemptive)
- Q.76.** Internal fragmentation occurs in:
- (A) Segmentation
  - (B) Fixed-size partitioning
  - (C) Variable-size partitioning
  - (D) Paging with demand paging only
- Q.77.** A page table entry contains the:
- (A) Virtual page number
  - (B) Physical frame number
  - (C) File name
  - (D) Process ID
- Q.78.** The Translation Lookaside Buffer (TLB) is a:
- (A) Type of page replacement algorithm
  - (B) Cache for page table entries
  - (C) Secondary storage device
  - (D) Disk scheduling queue
- Q.79.** Which condition does NOT need to hold for a critical section solution to be correct?
- (A) Mutual exclusion
  - (B) Progress
  - (C) Bounded waiting
  - (D) Starvation
- Q.80.** Thrashing in an operating system refers to:
- (A) High CPU utilization
  - (B) Excessive paging activity that reduces CPU utilization
  - (C) Disk defragmentation process
  - (D) Priority inversion
- Q.81.** In a system with 3 processes and 2 resource types, which algorithm detects deadlocks?
- (A) Banker's algorithm
  - (B) Resource allocation graph detection algorithm
  - (C) Round Robin scheduler
  - (D) First Fit allocator
- Q.82.** The working set model in operating systems is used to:
- (A) Prevent thrashing by tracking pages used in a window
  - (B) Improve disk scheduling
  - (C) Schedule processes by priority
  - (D) Manage semaphores

## 2.6 Database Management Systems (Q. 83–96)

- Q.83.** Which normal form eliminates partial dependencies?
- (A) 1NF
  - (B) 2NF
  - (C) 3NF
  - (D) BCNF
- Q.84.** A relation is in BCNF if for every non-trivial functional dependency  $X \rightarrow Y$ ,  $X$  is a:
- (A) Prime attribute
  - (B) Foreign key
  - (C) Superkey
  - (D) Candidate key only
- Q.85.** The SQL command to remove all rows from a table without deleting the table structure is:
- (A) DROP TABLE
  - (B) DELETE FROM table
  - (C) TRUNCATE TABLE
  - (D) REMOVE TABLE
- Q.86.** Which JOIN returns all rows from both tables, with NULLs for non-matching rows?
- (A) INNER JOIN
  - (B) LEFT OUTER JOIN
  - (C) FULL OUTER JOIN
  - (D) CROSS JOIN
- Q.87.** In relational algebra, the operation to combine two relations on a common attribute is:
- (A) Union
  - (B) Projection
  - (C) Natural Join
  - (D) Difference
- Q.88.** A transaction that reads a value written by an uncommitted transaction is called:
- (A) Non-repeatable read
  - (B) Phantom read
  - (C) Dirty read
  - (D) Lost update
- Q.89.** Which indexing structure supports efficient range queries?

- (A) Hash index
  - (B) B+ tree index
  - (C) Bitmap index
  - (D) Inverted index
- Q.90.** The ACID property that ensures a transaction is treated as a single unit (all or nothing) is:
- (A) Consistency
  - (B) Isolation
  - (C) Durability
  - (D) Atomicity
- Q.91.** A functional dependency  $A \rightarrow B$  and  $B \rightarrow C$  implies  $A \rightarrow C$  by:
- (A) Reflexivity
  - (B) Augmentation
  - (C) Transitivity
  - (D) Union
- Q.92.** In SQL, the GROUP BY clause is used with:
- (A) WHERE to filter groups
  - (B) HAVING to filter grouped results
  - (C) ORDER BY only
  - (D) JOIN operations only
- Q.93.** A deadlock in DBMS between transactions is resolved by:
- (A) Aborting one of the transactions
  - (B) Increasing the lock timeout
  - (C) Upgrading hardware
  - (D) Committing all transactions
- Q.94.** The degree of a relation is:
- (A) Number of rows (tuples)
  - (B) Number of columns (attributes)
  - (C) Number of primary keys
  - (D) Number of foreign keys
- Q.95.** Which concurrency control protocol uses timestamps to order transactions?
- (A) Two-phase locking (2PL)
  - (B) Thomas write rule
  - (C) MVCC
  - (D) Timestamp ordering protocol

- Q.96.** Entity integrity constraint states that:
- (A) Foreign key must reference a valid primary key
  - (B) No attribute of a primary key can be NULL
  - (C) All tuples must be unique
  - (D) A table must have at least one attribute

## 2.7 Computer Networks (Q. 97–110)

- Q.97.** The TCP/IP model has how many layers?
- (A) 7
  - (B) 5
  - (C) 4
  - (D) 3
- Q.98.** Which layer of the OSI model is responsible for end-to-end delivery and error recovery?
- (A) Network layer
  - (B) Data link layer
  - (C) Transport layer
  - (D) Session layer
- Q.99.** The IP address 192.168.10.0/24 belongs to which class?
- (A) Class A
  - (B) Class B
  - (C) Class C
  - (D) Class D
- Q.100.** Which protocol is used to map an IP address to a MAC address?
- (A) DNS
  - (B) DHCP
  - (C) ARP
  - (D) RARP
- Q.101.** The sliding window protocol is used for:
- (A) Routing
  - (B) Flow and error control at the data link layer
  - (C) IP address assignment
  - (D) Name resolution
- Q.102.** Which routing protocol uses the Bellman–Ford algorithm?
- (A) OSPF

- (B) RIP
- (C) BGP
- (D) IS-IS

**Q.103.** The maximum segment size (MSS) in TCP is negotiated during:

- (A) Data transfer phase
- (B) Three-way handshake
- (C) Connection termination
- (D) Flow control phase

**Q.104.** CSMA/CD is used in which network type?

- (A) Token Ring
- (B) Ethernet (wired LAN)
- (C) Wi-Fi (802.11)
- (D) ATM

**Q.105.** Which of the following is a connection-oriented transport layer protocol?

- (A) UDP
- (B) TCP
- (C) IP
- (D) ICMP

**Q.106.** Subnetting is used to:

- (A) Increase IP address space
- (B) Divide a network into smaller sub-networks
- (C) Translate private to public IP
- (D) Assign MAC addresses

**Q.107.** The default port number of HTTP is:

- (A) 21
- (B) 25
- (C) 80
- (D) 443

**Q.108.** A router operates at which layer of the OSI model?

- (A) Physical
- (B) Data link
- (C) Network
- (D) Transport

**Q.109.** Which multiplexing technique divides the channel by frequency?

- (A) TDM
- (B) FDM
- (C) CDM
- (D) WDM (for optical)

**Q.110.** Congestion control in TCP uses which mechanism to probe network capacity?

- (A) Go-Back-N
- (B) Slow Start and Congestion Avoidance
- (C) Selective Repeat
- (D) Stop-and-Wait

## 2.8 Compiler Design (Q. 111–116)

**Q.111.** Which phase of a compiler converts a sequence of characters into tokens?

- (A) Syntax analysis
- (B) Semantic analysis
- (C) Lexical analysis
- (D) Code generation

**Q.112.** An LL(1) parser is:

- (A) Bottom-up, rightmost derivation
- (B) Top-down, leftmost derivation with 1 lookahead
- (C) Bottom-up with 1 lookahead
- (D) Top-down with infinite lookahead

**Q.113.** LALR(1) parsers are more powerful than:

- (A) LR(1)
- (B) SLR(1)
- (C) LL(1)
- (D) LR(0)

**Q.114.** Intermediate code in a compiler serves as input to:

- (A) Lexical analyzer
- (B) Syntax analyzer
- (C) Code optimizer and code generator
- (D) Symbol table

**Q.115.** The action of replacing a variable by its right-hand side in a derivation is called:

- (A) Reduction
- (B) Substitution
- (C) Expansion (derivation step)

(D) Parsing

**Q.116.** Register allocation is performed during which compiler phase?

(A) Lexical analysis

(B) Syntax analysis

(C) Semantic analysis

(D) Code optimization / generation

## 2.9 Digital Logic (Q. 117–120)

**Q.117.** The Boolean expression  $A \cdot (A + B)$  simplifies to:

(A)  $A + B$

(B)  $A$

(C)  $B$

(D)  $A \cdot B$

**Q.118.** A D flip-flop stores:

(A) 2 bits

(B) 1 bit (the value of D on clock edge)

(C) The complement of D

(D) Neither D nor its complement

**Q.119.** The minimum number of NAND gates required to realize the expression  $Y = A \cdot B + C$  is:

(A) 2

(B) 3

(C) 4

(D) 5

**Q.120.** Which number system is used internally by all modern digital computers?

(A) Octal

(B) Decimal

(C) Binary

(D) Hexadecimal

## Answer Key

| Q. No. | Answer | Brief Answer                                         |
|--------|--------|------------------------------------------------------|
| 1      | B      | Rank is 2; rows are linearly dependent               |
| 2      | A      | Eigenvalues 5 and 2 (trace=7, det=10)                |
| 3      | A      | $f'(x) = 3x^2 - 6x$ ; at $x=2$ , $f'(2) = 0$         |
| 4      | B      | Integration by parts gives value = 1                 |
| 5      | A      | 6 favorable outcomes out of 36; $P = 1/6$            |
| 6      | A      | $P(X=0) = e^{(-\lambda)} = e^{-3}$                   |
| 7      | A      | Variance = 4; SD = 2                                 |
| 8      | A      | 11 non-isomorphic simple graphs on 4 vertices        |
| 9      | A      | Reflexive and symmetric: $2^{(n(n-1)/2)}$            |
| 10     | A      | Divisors of 36: $1+2+3+4+6+9+12+18+36 = 91$          |
| 11     | B      | Stack is LIFO                                        |
| 12     | C      | Insert at head of linked list is $O(1)$              |
| 13     | C      | Inorder traversal of BST gives sorted order          |
| 14     | A      | After all ops, top = 1                               |
| 15     | C      | Full binary tree: leaves = internal nodes + 1        |
| 16     | B      | Post-increment: prints current value 5               |
| 17     | C      | AVL tree height is $O(\log n)$                       |
| 18     | C      | Inorder of heap does not yield sorted output         |
| 19     | C      | Update prev->next and next->prev; 4 pointer changes  |
| 20     | B      | Chaining maintains linked list at each bucket        |
| 21     | C      | Merge Sort: $O(n \log n)$ average case               |
| 22     | B      | Nodes at depth d in full binary tree: $2^d$          |
| 23     | C      | Binary heap gives $O(\log n)$ insert/extract-min     |
| 24     | C      | Merge Sort auxiliary space is $O(n)$                 |
| 25     | C      | Merge Sort is stable                                 |
| 26     | C      | Dijkstra fails with negative weight edges            |
| 27     | B      | Sorted input with first-element pivot gives $O(n^2)$ |
| 28     | B      | DP stores solutions to overlapping subproblems       |
| 29     | C      | Kruskal's algorithm finds MST                        |
| 30     | B      | Binary Search is $O(\log n)$                         |
| 31     | C      | Fractional Knapsack uses greedy approach             |
| 32     | C      | By Master Theorem Case 2: $O(n \log n)$              |
| 33     | C      | Floyd-Warshall computes all-pairs shortest paths     |
| 34     | C      | Hamiltonian Cycle is NP-Complete                     |
| 35     | B      | MST has exactly n-1 edges                            |
| 36     | C      | Min-heap (priority queue) makes Prim's $O(E \log V)$ |
| 37     | B      | Bellman-Ford time complexity is $O(VE)$              |
| 38     | C      | Principle of optimality is basis of DP               |
| 39     | C      | Heap Sort worst-case is $O(n \log n)$                |
| 40     | B      | BFS uses a queue                                     |
| 41     | B      | $a^n b^n$ is context-free, not regular               |

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| <b>Q. No.</b> | <b>Answer</b> | <b>Brief Answer</b>                                         |
|---------------|---------------|-------------------------------------------------------------|
| 42            | A             | DFA and NFA recognize same (regular) languages              |
| 43            | C             | Type 2 grammar generates context-free languages             |
| 44            | B             | Pumping lemma proves a language is not regular              |
| 45            | C             | Halting problem is undecidable                              |
| 46            | C             | $a^n b^n c^n$ is context-sensitive                          |
| 47            | B             | PDA recognizes context-free languages                       |
| 48            | B             | 3 states needed for strings ending with 01                  |
| 49            | C             | Epsilon-closure: all states via zero or more epsilon-moves  |
| 50            | A             | CNF: $A \rightarrow BC$ or $A \rightarrow a$                |
| 51            | B             | Turing machine has unbounded tape (infinite memory)         |
| 52            | B             | $(a b)^*abb$ matches strings ending with $abb$              |
| 53            | C             | Turing machine recognizes recursively enumerable languages  |
| 54            | B             | Class P: solvable in polynomial time                        |
| 55            | B             | Every NP problem is polynomial-time reducible to NP-hard    |
| 56            | B             | 1111110 in 2's complement = -2                              |
| 57            | B             | Fully associative has lowest miss rate                      |
| 58            | C             | Instruction cycle: Fetch, Decode, Execute, Write-back       |
| 59            | B             | Pipeline: $n+k-1$ cycles; for 5 stages, $n+4$               |
| 60            | A             | 64K = $2^{16}$ addresses; need 16 address lines             |
| 61            | B             | RISC: simple fixed-length instructions, large register file |
| 62            | B             | Booth's handles signed 2's complement multiplication        |
| 63            | C             | Exception (internal interrupt) for divide-by-zero           |
| 64            | B             | DMA transfers data without CPU involvement                  |
| 65            | A             | IEEE 754 single: 1 sign, 8 exponent, 23 mantissa bits       |
| 66            | B             | Cache size = $k * n * b$                                    |
| 67            | C             | Address bus carries memory addresses                        |
| 68            | B             | Write-back: update main memory only on block eviction       |
| 69            | C             | SJF preemptive can starve long processes                    |
| 70            | C             | Preemption is NOT a Coffman deadlock condition              |
| 71            | B             | Banker's algorithm is for deadlock avoidance                |
| 72            | B             | FIFO can exhibit Belady's anomaly                           |
| 73            | B             | LRU replaces least recently used page                       |
| 74            | B             | Binary semaphore initialized to 1 is a mutex                |
| 75            | C             | FCFS is non-preemptive                                      |
| 76            | B             | Fixed-size partitioning causes internal fragmentation       |

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| <b>Q. No.</b> | <b>Answer</b> | <b>Brief Answer</b>                                           |
|---------------|---------------|---------------------------------------------------------------|
| 77            | B             | Page table entry contains physical frame number               |
| 78            | B             | TLB caches page table entries                                 |
| 79            | D             | Starvation freedom is desirable but not a mandatory condition |
| 80            | B             | Thrashing: excessive paging reduces CPU utilization           |
| 81            | B             | Resource allocation graph algorithm detects deadlock          |
| 82            | A             | Working set tracks recently used pages to prevent thrashing   |
| 83            | B             | 2NF eliminates partial dependencies                           |
| 84            | C             | BCNF: determinant of every non-trivial FD must be superkey    |
| 85            | C             | TRUNCATE removes all rows, keeps table structure              |
| 86            | C             | FULL OUTER JOIN returns all rows with NULLs for gaps          |
| 87            | C             | Natural Join combines on common attribute                     |
| 88            | C             | Reading uncommitted data is a dirty read                      |
| 89            | B             | B+ tree supports efficient range queries                      |
| 90            | D             | Atomicity ensures all-or-nothing transaction                  |
| 91            | C             | Transitivity: A->B and B->C implies A->C                      |
| 92            | B             | HAVING filters grouped results after GROUP BY                 |
| 93            | A             | Abort one transaction to resolve DBMS deadlock                |
| 94            | B             | Degree = number of attributes (columns)                       |
| 95            | D             | Timestamp ordering protocol uses timestamps                   |
| 96            | B             | Entity integrity: no primary key attribute can be NULL        |
| 97            | C             | TCP/IP model has 4 layers                                     |
| 98            | C             | Transport layer handles end-to-end delivery                   |
| 99            | C             | 192.x.x.x is Class C                                          |
| 100           | C             | ARP maps IP address to MAC address                            |
| 101           | B             | Sliding window provides flow and error control                |
| 102           | B             | RIP uses Bellman-Ford algorithm                               |
| 103           | B             | MSS is negotiated during three-way handshake                  |
| 104           | B             | CSMA/CD is used in Ethernet (wired LAN)                       |
| 105           | B             | TCP is connection-oriented transport protocol                 |
| 106           | B             | Subnetting divides network into sub-networks                  |
| 107           | C             | HTTP default port is 80                                       |
| 108           | C             | Router operates at Network layer                              |
| 109           | B             | FDM divides channel by frequency                              |
| 110           | B             | TCP uses Slow Start and Congestion Avoidance                  |
| 111           | C             | Lexical analysis produces tokens from characters              |
| 112           | B             | LL(1): top-down, leftmost derivation, 1 lookahead             |

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| <b>Q. No.</b> | <b>Answer</b> | <b>Brief Answer</b>                                            |
|---------------|---------------|----------------------------------------------------------------|
| 113           | B             | LALR(1) is more powerful than SLR(1)                           |
| 114           | C             | Intermediate code feeds optimizer and code generator           |
| 115           | C             | Expanding a variable with its RHS is a derivation step         |
| 116           | D             | Register allocation occurs during code optimization/generation |
| 117           | B             | $A.(A+B) = A.A + A.B = A + A.B = A$ (absorption)               |
| 118           | B             | D flip-flop stores 1 bit: value of D on clock edge             |
| 119           | C             | Realize $A.B + C$ using 4 NAND gates                           |
| 120           | C             | Digital computers use binary number system                     |

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Career Decode