

Technical Abilities (Computer Science): 100 MCQs

- Target Exam: RRB Junior Engineer (RRB JE)
- Study Notes Prepared for: Entri App Users

Here is a comprehensive 100-question Multiple Choice Practice Set covering programming fundamentals, data structures, algorithms, operating systems, databases, computer networks, and software engineering.

Section 1: Data Structures & Algorithms (Q1–Q25)

Q1. What is the time complexity to access an element by index in a contiguous array?

- A) $O(1)$
- B) $O(n)$
- C) $O(\log n)$
- D) $O(n^2)$

Answer: A

Q2. Which data structure operates on a Last-In, First-Out (LIFO) principle?

- A) Queue
- B) Stack
- C) Array
- D) Linked List

Answer: B

Q3. Which data structure operates on a First-In, First-Out (FIFO) principle?

- A) Stack
- B) Queue
- C) Tree
- D) Graph

Answer: B

Q4. The worst-case time complexity of QuickSort is:

A) $O(n \log n)$

B) $O(n)$

C) $O(n^2)$

D) $O(\log n)$

Answer: C

Q5. The average-case time complexity of MergeSort is:

A) $O(n)$

B) $O(n \log n)$

C) $O(n^2)$

D) $O(1)$

Answer: B

Q6. Binary Search requires the input array to be:

A) Unsorted

B) Sorted

C) Reversed

D) Doubly linked

Answer: B

Q7. The time complexity of Binary Search on a sorted array of size n is:

A) $O(n)$

B) $O(\log n)$

C) $O(n \log n)$

D) $O(1)$

Answer: B

Q8. Which data structure uses pointers to link nodes sequentially in memory?

- A) Array
- B) Linked List
- C) Hash Table
- D) Stack Array

Answer: B

Q9. What is the worst-case time complexity of searching in a standard Binary Search Tree (BST)?

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

Answer: C

Q10. An AVL tree is a self-balancing BST where the height difference between left and right subtrees is at most:

- A) 0
- B) 1
- C) 2
- D) $\log n$

Answer: B

Q11. Which traversal method visits a BST in strictly non-decreasing order?

- A) Pre-order
- B) In-order
- C) Post-order
- D) Level-order

Answer: B

Q12. Breadth-First Search (BFS) on a graph uses which underlying data structure?

- A) Stack
- B) Queue
- C) Priority Queue
- D) Hash Map

Answer: B

Q13. Depth-First Search (DFS) on a graph uses which underlying data structure?

- A) Queue
- B) Stack (or recursion)
- C) Min-Heap
- D) Deque

Answer: B

Q14. Dijkstra's algorithm finds the shortest path in a graph with:

- A) Negative edge weights
- B) Non-negative edge weights
- C) Directed acyclic edges only
- D) Unweighted edges only

Answer: B

Q15. Which algorithm handles shortest paths in graphs with negative edge weights?

- A) Dijkstra's Algorithm
- B) Bellman-Ford Algorithm
- C) Kruskal's Algorithm
- D) Prim's Algorithm

Answer: B

Q16. Kruskal's and Prim's algorithms are used to find:

- A) Shortest path between two nodes
- B) Minimum Spanning Tree (MST)
- C) Topological ordering
- D) Strongly connected components

Answer: B

Q17. The primary average-case time complexity for key lookup in a Hash Table is:

- A) $O(1)$
- B) $O(\log n)$
- C) $O(n)$
- D) $O(n^2)$

Answer: A

Q18. Resolving hash collisions by creating a linked list at each table index is known as:

- A) Open Addressing
- B) Linear Probing
- C) Chaining
- D) Double Hashing

Answer: C

Q19. A Max-Heap guarantees that the root node contains the:

- A) Smallest element
- B) Largest element
- C) Median element
- D) First inserted element

Answer: B

Q20. In Dynamic Programming, storing the results of subproblems to avoid recomputation is called:

- A) Recursion
- B) Memoization
- C) Backtracking
- D) Greedy choice

Answer: B

Q21. The 0/1 Knapsack problem is optimally solved using:

- A) Greedy approach
- B) Dynamic Programming
- C) Divide and Conquer
- D) Linear Search

Answer: B

Q22. Topological sorting is applicable to:

- A) Undirected cyclic graphs
- B) Directed Acyclic Graphs (DAGs)
- C) Complete graphs
- D) Bipartite graphs

Answer: B

Q23. Which sorting algorithm is stable and operates in $O(n + k)$ linear time for integer inputs?

- A) HeapSort
- B) Counting Sort
- C) QuickSort
- D) Selection Sort

Answer: B

Q24. Space complexity of a simple recursive algorithm is primarily determined by:

- A) Heap space
- B) Call stack depth
- C) Disk storage
- D) CPU cache size

Answer: B

Q25. Postfix expression $3\ 4\ +\ 2\ *$ evaluates to:

- A) 14
- B) 11
- C) 24
- D) 20

Answer: A

Section 2: Operating Systems & System Architecture (Q26–Q50)

Q26. What is the core program of an Operating System that manages system resources?

- A) Shell
- B) Kernel
- C) Compiler
- D) Bootloader

Answer: B

Q27. The state transition of a process from 'Running' to 'Ready' is typically caused by:

- A) I/O completion
- B) Interrupt / Time quantum expiry
- C) Termination
- D) Memory allocation

Answer: B

Q28. A thread shares which of the following with other threads of the same process?

- A) Stack
- B) Registers
- C) Code, data, and OS resources
- D) Program counter

Answer: C

Q29. Which CPU scheduling algorithm can lead to starvation for long processes?

- A) Round Robin
- B) Shortest Job First (SJF)
- C) First-Come, First-Served (FCFS)
- D) Priority Scheduling without aging

Answer: B

Q30. Round Robin CPU scheduling uses which core concept?

- A) Priority level
- B) Fixed Time Quantum
- C) Shortest execution time
- D) Multilevel stack

Answer: B

Q31. Which condition is NOT one of Coffman's four necessary conditions for deadlock?

- A) Mutual Exclusion
- B) Hold and Wait
- C) Preemption allowed
- D) Circular Wait

Answer: C

Q32. Banker's algorithm is used for deadlock:

- A) Prevention
- B) Avoidance
- C) Detection
- D) Recovery

Answer: B

Q33. Swapping virtual memory pages to disk when RAM is full causes severe performance degradation known as:

- A) Fragmentation
- B) Thrashing
- C) Deadlock
- D) Paging leak

Answer: B

Q34. Virtual memory is implemented using:

- A) Cache memory only
- B) Paging and Segmentation
- C) Registers
- D) ROM

Answer: B

Q35. Page fault occurs when a requested page is:

- A) Corrupted in memory
- B) Not present in main memory (RAM)
- C) In the CPU cache
- D) Written to disk

Answer: B

Q36. Which page replacement algorithm replaces the page that will not be used for the longest period in the future?

- A) FIFO
- B) Optimal (OPT)
- C) Least Recently Used (LRU)
- D) LFU

Answer: B

Q37. Belady's Anomaly (where increasing frames increases page faults) can occur in:

- A) LRU
- B) FIFO
- C) Optimal
- D) Stack-based page replacement

Answer: B

Q38. External fragmentation in memory management is eliminated by:

- A) Paging
- B) Contiguous allocation
- C) Static partitioning
- D) Overlays

Answer: A

Q39. A synchronization primitive using an integer variable accessed via atomic `wait()` and `signal()` operations is a:

- A) Mutex lock
- B) Semaphore
- C) Monitor

D) Condition variable

Answer: B

Q40. The critical section problem deals with preventing:

A) Deadlock

B) Race conditions

C) Cache misses

D) Page faults

Answer: B

Q41. A process that has finished execution but still has an entry in the process table is a:

A) Orphan process

B) Zombie process

C) Daemon process

D) Foreground process

Answer: B

Q42. An orphan process occurs when its parent process:

A) Terminates before the child

B) Enters an infinite loop

C) Is killed by the user

D) Enters a deadlock state

Answer: A

Q43. Context switching involves saving and restoring the state of:

A) Hard drive sectors

B) Process Control Block (PCB)

C) System logs

D) Virtual memory tables only

Answer: B

Q44. Which disk scheduling algorithm selects the request closest to the current head position?

A) FCFS

B) SSTF (Shortest Seek Time First)

C) SCAN

D) C-LOOK

Answer: B

Q45. Spooling is primarily used in I/O devices like:

A) Keyboards

B) Printers

C) Monitors

D) RAM modules

Answer: B

Q46. The command interpreter that interfaces between the user and the kernel in Unix-like systems is the:

A) Compiler

B) Shell

C) Linker

D) GUI Manager

Answer: B

Q47. In RISC architecture, instruction sets are:

A) Complex and variable length

B) Reduced and simple with fixed length

- C) Microprogrammed only
- D) Software-generated

Answer: B

Q48. Direct Memory Access (DMA) allows I/O devices to transfer data directly to/from main memory without constant intervention from:

- A) Hard drive
- B) CPU
- C) Bus arbiter
- D) Cache

Answer: B

Q49. A cache hit ratio measures:

- A) Total memory size
- B) Percentage of memory accesses satisfied by cache
- C) CPU clock frequency
- D) RAM speed

Answer: B

Q50. RAID 1 provides data reliability using:

- A) Striping without parity
- B) Disk Mirroring
- C) Distributed Parity
- D) Dual Parity

Answer: B

Section 3: Database Management Systems (DBMS) (Q51–Q75)

Q51. In a relational database, a row is formally known as a:

- A) Attribute

- B) Tuple
- C) Entity
- D) Schema

Answer: B

Q52. In a relational database, a column is formally known as a:

- A) Tuple
- B) Attribute
- C) Relation
- D) Instance

Answer: B

Q53. A key that uniquely identifies every tuple in a relation is a:

- A) Primary Key
- B) Foreign Key
- C) Secondary Key
- D) Composite Attribute

Answer: A

Q54. A Foreign Key is used to enforce:

- A) Entity Integrity
- B) Referential Integrity
- C) Domain Integrity
- D) User-defined Integrity

Answer: B

Q55. Normalization is primarily performed to:

- A) Increase query execution speed

- B) Eliminate data redundancy and anomalies
- C) Encrypt sensitive data
- D) Index database columns

Answer: B

Q56. A table is in First Normal Form (1NF) if:

- A) All attributes depend on the primary key
- B) All domain values are atomic (no repeating groups)
- C) Transitive dependencies are removed
- D) Multi-valued dependencies are removed

Answer: B

Q57. Second Normal Form (2NF) eliminates:

- A) Partial functional dependencies
- B) Transitive dependencies
- C) Multi-valued dependencies
- D) Join dependencies

Answer: A

Q58. Third Normal Form (3NF) eliminates:

- A) Partial dependencies
- B) Transitive dependencies
- C) Redundant keys
- D) Non-atomic attributes

Answer: B

Q59. ACID properties in DBMS stand for:

- A) Accuracy, Consistency, Isolation, Durability

- B) Atomicity, Consistency, Isolation, Durability
- C) Atomicity, Concurrency, Integrity, Durability
- D) Access, Control, Integrity, Data

Answer: B

Q60. Which SQL command is used to remove all records from a table without logging individual row deletions?

- A) DELETE
- B) TRUNCATE
- C) DROP
- D) REMOVE

Answer: B

Q61. Which SQL clause is used to filter records after aggregation with **GROUP BY?**

- A) WHERE
- B) HAVING
- C) ORDER BY
- D) FILTER

Answer: B

Q62. A transaction state that permanently saves changes to the database is reached after:

- A) ROLLBACK
- B) COMMIT
- C) SAVEPOINT
- D) ABORT

Answer: B

Q63. Which type of JOIN returns all rows from the left table and matching rows from the right table?

- A) INNER JOIN
- B) LEFT JOIN
- C) RIGHT JOIN
- D) FULL OUTER JOIN

Answer: B

Q64. Two-Phase Locking (2PL) protocol guarantees:

- A) Deadlock freedom
- B) Serializability of concurrent transactions
- C) High performance
- D) No cascading rollbacks

Answer: B

Q65. A database index speeds up retrieval at the cost of:

- A) Decreased storage space
- B) Slower write/insert performance
- C) Lower query accuracy
- D) Broken integrity constraints

Answer: B

Q66. The most common data structure used for database indexing is:

- A) Binary Search Tree
- B) B+ Tree
- C) Stack
- D) Doubly Linked List

Answer: B

Q67. DDL (Data Definition Language) includes which of the following commands?

- A) SELECT, INSERT, UPDATE
- B) CREATE, ALTER, DROP
- C) GRANT, REVOKE
- D) COMMIT, ROLLBACK

Answer: B

Q68. DML (Data Manipulation Language) includes which of the following commands?

- A) CREATE, DROP
- B) INSERT, UPDATE, DELETE
- C) ALTER, TRUNCATE
- D) GRANT, REVOKE

Answer: B

Q69. In ER Diagrams, double ellipses represent:

- A) Key Attributes
- B) Multivalued Attributes
- C) Derived Attributes
- D) Weak Entity Sets

Answer: B

Q70. In ER Diagrams, dashed/dashed-line ellipses represent:

- A) Composite Attributes
- B) Derived Attributes
- C) Foreign Attributes
- D) Primary Keys

Answer: B

Q71. NoSQL databases are designed primarily to handle:

- A) Strict ACID relational transactions only
- B) Unstructured, semi-structured, and large-scale horizontal data
- C) Single-node flat files
- D) Embedded systems with low RAM

Answer: B

Q72. MongoDB is classified as a:

- A) Relational DBMS
- B) Document-oriented NoSQL database
- C) Graph database
- D) Key-Value memory cache

Answer: B

Q73. The execution plan of a database query is determined by the:

- A) Transaction Manager
- B) Query Optimizer
- C) Storage Engine
- D) Lock Manager

Answer: B

Q74. Phantom Read anomaly is prevented at which transaction isolation level?

- A) Read Uncommitted
- B) Read Committed
- C) Repeatable Read
- D) Serializable

Answer: D

Q75. View in SQL is a:

- A) Physical table stored on disk
- B) Virtual table based on the result set of an SQL query
- C) Secondary index structure
- D) Database backup file

Answer: B

Section 4: Computer Networks & Software Engineering (Q76–Q100)

Q76. How many layers are present in the OSI Reference Model?

- A) 4
- B) 5
- C) 7
- D) 9

Answer: C

Q77. Which layer of the OSI model handles end-to-end reliability and error recovery?

- A) Network Layer
- B) Transport Layer
- C) Data Link Layer
- D) Physical Layer

Answer: B

Q78. IP addresses reside at which layer of the OSI model?

- A) Data Link Layer
- B) Network Layer
- C) Transport Layer
- D) Application Layer

Answer: B

Q79. MAC addresses operate at which layer of the OSI model?

- A) Physical Layer
- B) Data Link Layer
- C) Network Layer
- D) Session Layer

Answer: B

Q80. TCP is a connection-oriented protocol, whereas UDP is:

- A) Connection-oriented
- B) Connectionless
- C) Routing-focused
- D) Application-restricted

Answer: B

Q81. The standard port number used for HTTP is:

- A) 21
- B) 22
- C) 80
- D) 443

Answer: C

Q82. The standard port number used for HTTPS (secure) is:

- A) 80
- B) 110
- C) 443
- D) 8080

Answer: C

Q83. DNS (Domain Name System) translates:

- A) MAC address to IP address
- B) Domain names to IP addresses
- C) IP addresses to MAC addresses
- D) HTTP requests to TCP packets

Answer: B

Q84. ARP (Address Resolution Protocol) resolves:

- A) IP address to MAC address
- B) Domain name to IP address
- C) MAC address to IP address
- D) Port number to Service name

Answer: A

Q85. Which device operates at the Network Layer (Layer 3) to route packets across subnets?

- A) Hub
- B) Switch
- C) Router
- D) Repeater

Answer: C

Q86. An IPv4 address is composed of how many bits?

- A) 16 bits
- B) 32 bits
- C) 64 bits
- D) 128 bits

Answer: B

Q87. An IPv6 address is composed of how many bits?

- A) 32 bits
- B) 64 bits
- C) 128 bits
- D) 256 bits

Answer: C

Q88. What protocol is used to automatically assign IP addresses to network devices?

- A) DNS
- B) DHCP
- C) FTP
- D) SMTP

Answer: B

Q89. CSMA/CD is a media access control method used primarily in:

- A) Wireless LANs
- B) Ethernet networks
- C) Satellite links
- D) Fiber optic trunks

Answer: B

Q90. Which error detection method uses polynomial division?

- A) Parity Bit
- B) Checksum
- C) Cyclic Redundancy Check (CRC)
- D) Hamming Code

Answer: C

Q91. In software design, high cohesion and low coupling represent:

- A) Bad software architecture
- B) Good software design principle
- C) High memory usage pattern
- D) Hardware-dependent design

Answer: B

Q92. Which software process model is sequential and does not accommodate changing requirements easily?

- A) Agile
- B) Scrum
- C) Waterfall Model
- D) Spiral Model

Answer: C

Q93. The Agile framework emphasizes:

- A) Heavy upfront documentation
- B) Iterative development and continuous collaboration
- C) Strict linear project phases
- D) Manual testing exclusively

Answer: B

Q94. Black-box testing tests a system without knowledge of its:

- A) Requirements
- B) Internal source code design
- C) Input values
- D) Expected output

Answer: B

Q95. White-box testing primarily focuses on testing:

- A) User interface design
- B) Internal code structure, paths, and logic
- C) System response time under stress
- D) Customer usability

Answer: B

Q96. Regression testing is conducted to ensure that:

- A) Code runs faster
- B) Recent code changes have not broken existing functionality
- C) Database schema is normalized
- D) Software passes security audits

Answer: B

Q97. Git is a:

- A) Centralized build tool
- B) Distributed version control system
- C) Database management tool
- D) Operating System kernel

Answer: B

Q98. In object-oriented programming, creating a new class based on an existing class is called:

- A) Encapsulation
- B) Polymorphism
- C) Inheritance
- D) Abstraction

Answer: C

Q99. Hiding implementation details and exposing only essential interfaces is known as:

- A) Inheritance
- B) Abstraction
- C) Overloading
- D) Coupling

Answer: B

Q100. In object-oriented programming, method overriding allows a subclass to:

- A) Define multiple methods with the same name but different parameter lists in the same class
- B) Provide a specific implementation of a method already defined in its superclass
- C) Access private variables of another object
- D) Allocate memory dynamically on the heap

Answer: B