

Question 1: A small web app is slow when many users submit forms simultaneously. Which backend issue is most likely and easiest first check?

- a) CSS file size
- b) Database connection pool exhaustion or insufficient concurrent DB connections
- c) Page title length
- d) Favicon format

Question 2: Which encryption concept ensures that a message encrypted with one key can only be decrypted with a different key held privately by the recipient?

- a) Symmetric encryption using same key both ways
- b) Asymmetric (public-key) encryption with public/private key pairs
- c) Plain text transmission
- d) Simple substitution cipher

Question 3: Which programming construct best represents a function that calls itself with smaller inputs to solve a problem (e.g., factorial)?

- a) Iteration with for/while only
- b) Recursion — a function that calls itself with base case(s) to stop
- c) Callback queue only
- d) Database trigger

Question 4: Which data structure gives $O(1)$ average-time lookup, insert, and delete for unordered keys?

- a) Array with linear search
- b) Hash table (hash map) with good hashing and low load factor
- c) Binary search on unsorted array
- d) Linked list traversal

Question 5: A web form accepts user file uploads. Which server-side validation is most important to prevent code injection and security breaches?

- a) Accept filenames as given and save directly
- b) Validate file type, scan for malware, enforce size limits, and store outside webroot with safe filenames
- c) Trust client-side JavaScript validation exclusively
- d) Display uploaded file contents in HTML without sanitizing

Question 6: Which machine learning term describes the process of using labelled examples to train a model to predict labels on new data?

- a) Unsupervised learning where no labels exist
- b) Supervised learning using labelled input-output pairs
- c) Reinforcement learning only for robotics
- d) Cross-validation as a training algorithm

Question 7: Which SQL statement returns rows where a column age is greater than 18 and sorts them by name?

- a) `SELECT * FROM table ORDER BY name WHERE age > 18;`
- b) `SELECT * FROM table WHERE age > 18 ORDER BY name;`
- c) `SELECT * FROM table ORDER BY name AND age > 18;`
- d) `SELECT * FROM table WHERE age > 18 SORT name;`

Question 8: Which web layout technology controls page structure and box models, including margins, padding, and flex/grid placement?

- a) HTML semantics only
- b) CSS (Cascading Style Sheets) for styling and layout (flexbox/grid)
- c) SQL for layout
- d) SMTP for layout transmission

Question 9: A simple password policy requires at least 8 characters but no complexity rules. Which risk remains most significant?

- a) Users will always choose unique, random passwords
- b) High risk of weak passwords and credential stuffing; recommend complexity rules/length and multi-factor authentication
- c) CPU overuse on login servers only
- d) Too many administrators

Question 10: Which algorithmic complexity class describes an algorithm that examines each element once in a list of n elements?

- a) $O(\log n)$
- b) $O(n)$ — linear time complexity
- c) $O(n^2)$
- d) $O(1)$

Question 11: Which HTML element is correct for embedding JavaScript code inside a page?

- a) `<script> ... </script>`
- b) `<style> ... </style>`
- c) `<link> ... </link>`
- d) `<meta> ... </meta>`

Question 12: A classifier trained on biased historical loan data unfairly denies loans to a minority group. Which immediate remedy helps reduce bias?

- a) Delete all minority
- b) Audit model outputs, retrain with balanced/representative data, include fairness adjustments or constraints
- c) Ignore the bias
- d) Use a deeper network without checking data

Question 13: Which technique stores passwords securely so that even if the database is leaked, original passwords are not trivially recovered?

- a) Store plaintext passwords in DB for convenience
- b) Hash passwords with a slow cryptographic hash and salt uniquely per password
- c) Encrypt passwords with reversible encryption using app key only
- d) Send passwords by email to all admins

Question 14: Which data structure is the best primary choice for implementing a LIFO (last-in, first-out) behaviour?

- a) Queue
- b) Stack (push/pop operations)
- c) Priority queue
- d) Graph

Question 15: A JSON API returns slightly different field names between versions, breaking clients. What is the best design practice to avoid breaking clients?

- a) Change field names without notice
- b) Version the API (e.g., `/v1/`, `/v2/`), maintain backward compatibility, and provide clear deprecation timeline and documentation
- c) Remove all field names and use positional data only
- d) Only support newest clients

Question 16: Which CSS property controls the spacing inside an element between content and border?

- a) margin
- b) padding
- c) display
- d) float

Question 17: Which search algorithm is optimal for finding shortest path in an unweighted graph from a source node?

- a) Depth-first search (DFS)
- b) Breadth-first search (BFS) for unweighted shortest path
- c) Greedy best-first without backtracking
- d) Bubble sort

Question 18: A school network detects repeated failed login attempts from an IP. Which immediate cybersecurity action is most appropriate?

- a) Ignore
- b) Temporarily block or throttle the IP, require CAPTCHA or MFA, and investigate for brute-force attack patterns
- c) Publish the IP on social media
- d) Reboot all school computers

Question 19: Which SQL clause is used to combine rows from two tables based on matching column values?

- a) GROUP BY
- b) JOIN (e.g., INNER JOIN ON table1.id = table2.ref_id)
- c) ORDER BY
- d) HAVING

Question 20: Which ML concept measures how well a model generalizes to unseen data and is estimated by evaluating on a held-out set?

- a) Overfitting only occurs when training error high
- b) Generalization error measured by validation/test set performance (e.g., accuracy, RMSE)
- c) Hyperparameter tuning automatically eliminates errors
- d) Data ingestion speed

Question 21: Which programming paradigm emphasizes immutable data and pure functions to reduce side effects?

- a) Object-oriented programming only
- b) Functional programming emphasizing pure functions and immutability
- c) Procedural programming exclusively
- d) Spaghetti programming

Question 22: A web page loads slowly because many large images are included. Which frontend optimization is most effective while preserving image quality?

- a) Use uncompressed BMP images only
- b) Serve appropriately sized images, use responsive `srcset`, compress images (webp/jpeg), and lazy-load offscreen images
- c) Put all images inline as base64 data URIs for every page
- d) Remove alt attributes to speed rendering

Question 23: Which cryptographic primitive provides message integrity and origin authentication (ensuring message wasn't altered)?

- a) Plaintext transfer
- b) Message Authentication Code (MAC) or digital signature
- c) Simple checksum like sum of bytes
- d) Removing headers

Question 24: Which data structure is most suitable to implement a priority queue?

- a) Hash map only
- b) Binary heap (min-heap or max-heap) providing $O(\log n)$ insert/remove-min
- c) Singly linked list with constant-time random access
- d) Static array with no operations

Question 25: A team uses Git and merges a feature branch; now unexpected bugs appear in production. Which Git workflow practice helps reduce such risks?

- a) Directly push to main branch without review
- b) Use code reviews, continuous integration (CI) builds, automated tests, and pull requests before merging to main
- c) Disable version control completely
- d) Merge by force and ignore failing tests

Question 26: Which HTTP status code indicates that the requested resource was not found on the server?

- a) 200 OK
- b) 404 Not Found
- c) 500 Internal Server Error
- d) 301 Moved Permanently

Question 27: Which algorithmic approach divides a problem into subproblems, solves them, and combines results (e.g., mergesort)?

- a) Greedy only
- b) Divide and conquer technique (split, solve, combine)
- c) Brute force always
- d) Manual lookup

Question 28: Which SQL command safely removes all rows in a table but can be slower because it logs each row deletion and allows rollback?

- a) DROP TABLE table;
- b) TRUNCATE TABLE table; (fast, may not log row-by-row)
- c) DELETE FROM table; (deletes rows and is logged; safe for rollback)
- d) SELECT * FROM table;

Question 29: A dataset has missing values in several columns. Which is a defensible pre-processing step before training a model?

- a) Drop rows or columns blindly without analysing missingness pattern
- b) Analyse missing pattern and either impute reasonable values (mean/median for numeric, model-based) or use algorithms that handle missingness; document choices
- c) Fill with zeros for all types always
- d) Replace missing values with random strings

Question 30: Which CSS selector targets an element with id="main-content"?

- a) .main-content { }
- b) #main-content { }
- c) main-content { }
- d) *main-content { }

Question 31: Which cybersecurity practice least helps protect against SQL injection attacks?

- a) Use parameterized queries / prepared statements instead of string concatenation for SQL
- b) Validate and sanitize user inputs server-side and use least privilege DB accounts
- c) Rely only on client-side JavaScript validation without server checks
- d) Use ORM layers or stored procedures that parameterize queries

Question 32: Which data structure is ideal for implementing undo functionality where you need to revert the most recent action first?

- a) Queue (FIFO)
- b) Stack (LIFO — push state, pop to undo)
- c) Binary search tree for ordering actions
- d) Hash table for chronological retrieval

Question 33: A neural network is overfitting: high training accuracy, low validation accuracy. Which one-step approach is likely to reduce overfitting?

- a) Increase model complexity (add more layers) only
- b) Apply regularization (dropout, L2), get more training data, or reduce model capacity
- c) Train longer with same settings only
- d) Memorize training labels manually

Question 34: Which HTML form attribute specifies where to send form-data on submission?

- a) method="post" sets HTTP method only
- b) action="/submit" sets the URL endpoint to which the form is sent
- c) enctype only encodes type but not destination
- d) src attribute for forms

Question 35: Which symmetric encryption mode ensures confidentiality but may leak patterns if used naively on repeated blocks?

- a) ECB (Electronic Codebook)
- b) CBC (Cipher Block Chaining)
- c) GCM only
- d) Stream cipher with identical key reuse is always safe

Question 36: Which algorithm sorts n numbers in average-case $O(n \log n)$ time and is commonly used in practice?

- a) Bubble sort
- b) Quick sort (with good pivot choice)
- c) Selection sort
- d) Linear search

Question 37: A user reports that a web page displays stale data after the backend updates. Which caching issue is most likely and a reasonable fix?

- a) Browser caching or CDN edge cache serving outdated responses; set proper cache-control headers and invalidate/refresh caches on update
- b) Server's clock is wrong only
- c) Database schema needs renaming columns
- d) Increase client-side font size

Question 38: Which SQL clause groups rows so aggregate functions like COUNT or SUM can be applied per group?

- a) WHERE
- b) GROUP BY
- c) ORDER BY
- d) LIMIT

Question 39: Which machine learning metric is appropriate for evaluating a classifier on imbalanced classes?

- a) Accuracy only
- b) Precision, recall, F1-score
- c) Training loss only
- d) Number of epochs

Question 40: Which data structure can represent hierarchical relationships like file systems and supports parent-child links?

- a) Graph limited to single node only
- b) Tree (rooted tree with nodes d) Hash set with no ordering and children)
- c) Flat array without relations

Question 41: An application needs to store user sessions efficiently across multiple servers. Which approach helps scale session state?

- a) Store sessions in server memory only (won't share across servers)
- b) Use a centralized session store (Redis/memcached) or stateless JWT tokens so sessions are available across instances
- c) Write sessions to local temp files on each web server only
- d) Require users to log in for every request

Question 42: Which JavaScript concept causes functions to retain access to variables from their lexical scope even after the outer function returns?

- a) Hoisting only
- b) Closures
- c) Callback hell exclusively
- d) CSS selectors

Question 43: Which backup strategy allows restoring a system to a point-in-time but has trade-offs in storage and recovery time?

- a) No backups at all
- b) Incremental backups combined with periodic full backups
- c) Printing DB to paper only
- d) Single manual copy once and never again

Question 44: Which SQL index type is most useful for fast lookups of equality matches on discrete values (e.g., user_id)?

- a) Full table scan only
- b) B-tree index (balanced tree) for range and equality queries
- c) Text file search on OS
- d) No index

Question 45: A simple ML model must run on-device with limited memory (mobile). Which model design choice best supports on-device deployment?

- a) Use a very deep large transformer without pruning
- b) Choose a small, efficient model (e.g., lightweight CNN, quantized/ pruned model) and optimize for latency and memory
- c) Always send data to powerful cloud only despite connectivity limits
- d) Use raw decision trees with millions of nodes

Question 46: Which HTTP method is idempotent and typically used for updating a resource with full replacement?

- a) POST
- b) PUT
- c) TRACE
- d) CONNECT for tunneling only

Question 47: Which programming error is most associated with accessing array [index] where index equals array length in zero-based languages?

- a) Off-by-one error leading to index out-of-bounds
- b) Perfect indexing always returns last element
- c) Index of length always points to middle element
- d) Extra whitespace in code

Question 48: A developer discovers sensitive API keys hard-coded in a public repo. What immediate corrective action is crucial?

- a) Leave them — they can't cause harm
- b) Revoke/rotate the leaked keys immediately, remove from repo and move keys to secure secret store (env vars/secret manager)
- c) Change variable names only without rotating keys
- d) Publicize the keys for transparency

Question 49: Which NoSQL database type stores documents as JSON-like objects and is flexible with schemas?

- a) Relational SQL table only
- b) Document store (e.g., MongoDB) for JSON-like documents
- c) Columnar with fixed schema exclusively
- d) File system without query language

Question 50: Which evaluation method helps estimate model performance reliably by splitting data into multiple folds and averaging (reduces variance)?

- a) Single train/test split only
- b) k-fold cross-validation
- c) Using test set for training to maximize accuracy
- d) Random label shuffling as method

Question 51: A SQL query joining three tables is slow. Which immediate index strategy could speed it up?

- a) Index the join columns used in ON clauses (foreign key columns) and consider composite indexes for common multi-column filters
- b) Remove indexes entirely to speed up joins
- c) Store tables in Excel for faster joins
- d) Use SELECT * to avoid planning

Question 52: Which web security header helps prevent Clickjacking by controlling whether a page may be embedded in frames?

- a) Content-Type only
- b) X-Frame-Options or frame-ancestors CSP directive
- c) Cache
- d) Access

Question 53: Which algorithmic technique uses heuristics and a priority queue to find shortest or lowest-cost paths (e.g., A* for pathfinding)?

- a) Random search only
- b) A* search with heuristic $f(n) = g(n) + h(n)$ and priority queue open set
- c) Linear regression for path planning
- d) Merge sort adaptation

Question 54: Which SQL clause filters rows after grouping (applies to aggregates)?

- a) WHERE
- b) HAVING
- c) ORDER BY
- d) LIMIT

Question 55: A web app needs to prevent Cross-Site Request Forgery (CSRF). Which mitigation is most effective?

- a) Rely on Referrer header only
- b) Use anti-CSRF tokens in forms and validate server-side, or use Same Site cookies + anti-CSRF tokens for state-changing requests
- c) Disable authentication for all POST requests
- d) Allow cross-origin POSTs without checks

Question 56: Which machine learning technique reduces dimensionality by finding orthogonal directions capturing variance?

- a) PCA (Principal Component Analysis)
- b) K-means clustering
- c) One-hot encoding only
- d) HTTP caching

Question 57: Which SQL construct enforces uniqueness of values in a column to prevent duplicate entries?

- a) FOREIGN KEY
- b) UNIQUE
- c) GROUP BY
- d) ORDER BY

Question 58: A developer uses inner join but expects rows even when the right table is missing matches. Which join type should they use to keep left-side rows?

- a) CROSS JOIN
- b) LEFT OUTER JOIN
- c) INNER JOIN
- d) NATURAL JOIN

Question 59: Which HTTP status code indicates a server error (generic server-side failure)?

- a) 201 Created
- b) 403 Forbidden
- c) 500 Internal Server Error
- d) 302 Found

Question 60: An AI classifier must explain its decisions to non-technical stakeholders. Which approach best improves interpretability without major accuracy loss?

- a) Use a complex uninterpretable ensemble and refuse explanation
- b) Use interpretable models (decision trees, simple models), or apply model-agnostic explanation tools (LIME/SHAP) and produce human-friendly summaries
- c) Only provide raw logits and weights to stakeholders
- d) Hide the predictions entirely

ROUGH WORK

(NOT TO BE EVALUATED)

DATE

[illegible]