C1 - REMEMBER (Knowledge/Recall)

1. What is the definition of an algorithm? A. A programming language syntax B. A step-by-step procedure for solving a problem C. A type of computer hardware D. A database management system

2. The basic unit of information in a computer is called what? A. Byte B. Bit C. Kilobyte D. Megabyte

3. Which component is known as the brain of the computer? A. RAM B. Hard Drive C. CPU (Central Processing Unit) D. Motherboard

4. What does HTTP stand for? A. HyperText Transfer Protocol B. High Transfer Text Protocol C. Hyper Text Transmission Process D. High Technology Transfer Protocol

5. The first step in the software development life cycle is typically what? A. Implementation B. Requirements gathering C. Testing D. Maintenance

6. Which data structure follows the Last-In-First-Out (LIFO) principle? A. Queue B. Stack C. Array D. Linked List

7. What type of memory is volatile and loses its contents when power is turned off? A. ROM (Read-Only Memory) B. Hard Disk C. RAM (Random Access Memory) D. Flash Memory

8. In object-oriented programming, what is encapsulation? A. The ability of objects to inherit properties B. The bundling of data and methods that operate on that data C. The creation of multiple methods with the same name D. The execution of code in parallel

C2 - UNDERSTAND (Comprehension)

9. Why is normalization important in database design? A. It increases data redundancy B. It reduces data redundancy and improves data integrity C. It makes queries run slower D. It eliminates the need for primary keys

10. Explain the difference between a compiler and an interpreter. A. A compiler translates entire code at once; an interpreter translates line by line B. They are exactly the same C. A compiler is faster at runtime than an interpreter D. Both A and C are correct

11. What does it mean when we say an algorithm has O(n) time complexity? A. The algorithm runs in constant time B. The execution time increases linearly with input size C. The algorithm runs in logarithmic time D. The algorithm cannot be executed

12. How does a VPN (Virtual Private Network) protect user privacy? A. By encrypting internet traffic and masking IP addresses B. By increasing internet speed C. By installing antivirus software D. By blocking all incoming connections

13. What is the relationship between classes and objects in object-oriented programming? A. Classes are instances of objects B. Objects are blueprints for classes C.

Classes are blueprints from which objects are created D. There is no relationship between them

14. Describe what happens during the compilation process of a program. A. The source code is executed directly B. Source code is translated into machine code or bytecode C. The program is uploaded to the internet D. The program is compressed for storage

15. What factors influence the choice between SQL and NoSQL databases? A. Only cost considerations B. Data structure, scalability requirements, and consistency needs C. The color of the company logo D. Only the size of the development team

C3 - APPLY (Application)

16. Calculate the number of possible IP addresses in a subnet with a /24 CIDR notation. A. 128 addresses B. 256 addresses C. 512 addresses D. 1024 addresses

17. Given an array [5, 2, 8, 1, 9], apply the bubble sort algorithm for one complete pass. What would be the result? A. [1, 2, 5, 8, 9] B. [2, 5, 1, 8, 9] C. [5, 2, 8, 1, 9] D. [9, 8, 5, 2, 1]

18. How would you implement input validation to prevent SQL injection attacks in a web application? A. Allow all user input without checking B. Use parameterized queries and prepared statements C. Only use client-side validation D. Disable the database entirely

19. Using the OSI model, at which layer would you troubleshoot a problem with MAC addresses? A. Physical Layer (Layer 1) B. Data Link Layer (Layer 2) C. Network Layer (Layer 3) D. Application Layer (Layer 7)

20. Apply the principle of least privilege to design access controls for a database system. Which approach is most appropriate? A. Give all users full administrative access B. Grant users only the minimum permissions needed for their tasks C. Allow read-only access for everyone D. Rotate passwords daily

21. Demonstrate how you would use version control (Git) to manage a collaborative software project. What is the correct workflow? A. Everyone edits the same file simultaneously B. Create branches for features, commit changes, and merge back to main C. Never commit changes D. Delete the repository after each change

C4 - ANALYZE (Analysis)

22. Analyze the following code snippet and identify the potential security vulnerability: `$query = "SELECT * FROM users WHERE username = " + userInput + ""` A. Buffer overflow B. SQL injection vulnerability C. Memory leak D. No vulnerability present

23. Compare and contrast TCP and UDP protocols. What are the trade-offs between them? A. TCP is reliable but slower; UDP is faster but unreliable B. They are identical protocols C. UDP is always better than TCP D. TCP cannot handle multiple connections

24. Examine this system architecture: A web server connects to a single database server. What is the primary risk of this design? A. Too many servers B. Single point of failure at the database C. Excessive redundancy D. No risk present

25. Analyze why a binary search tree might become unbalanced. What causes this issue? A. Random insertion order always creates balanced trees B. Inserting sorted or nearly-sorted data creates skewed trees C. The tree has too few nodes D. Binary search trees cannot become unbalanced

26. Break down the components of a REST API. What are the essential elements that make an API RESTful? A. Only HTTP methods B. Statelessness, client-server architecture, uniform interface, and resource-based C. Just JSON format D. Any API using HTTP is RESTful

27. Categorize the following into appropriate design patterns: Singleton, Factory, Observer. What problems does each solve? A. They all solve the same problem B. Singleton ensures one instance; Factory creates objects; Observer enables pub-sub C. They are not design patterns D. Only Singleton is a valid pattern

28. Diagnose the cause of high memory usage in an application. What analysis techniques would you use? A. Ignore the problem B. Profile memory allocation, check for leaks, analyze data structures C. Restart the computer D. Buy more RAM only

C5 - EVALUATE (Evaluation)

29. Evaluate whether microservices architecture is appropriate for a small startup with 3 developers. Justify your decision. A. Yes, always use microservices regardless of team size B. No, monolithic architecture is more appropriate for small teams due to lower complexity C. Microservices are never appropriate D. Team size doesn't matter for architecture decisions

30. Assess the trade-offs between using cloud infrastructure versus on-premise servers for a healthcare application handling patient data. A. Cloud is always better B. Consider compliance requirements, cost, control, and scalability needs C. On-premise is always better D. It makes no difference

31. Critique the decision to use JavaScript for a computationally intensive scientific application. Is this appropriate? A. Perfect choice for any application B. Poor choice; languages like C++ or Python with NumPy are more suitable for performance C. JavaScript is the fastest language available D. All languages perform identically

32. Judge the effectiveness of using a relational database for storing unstructured social media posts versus a document database. A. Relational is always superior B. Document database is more effective for flexible, unstructured data C. Both are equally ineffective D. Use spreadsheets instead

33. Assess whether test-driven development (TDD) adds value to a project with tight deadlines. Support your position. A. TDD always slows development B. TDD can reduce

long-term bugs but may slow initial development; evaluate project needs C. Never write tests D. Tests are only for junior developers

34. Evaluate the security posture of an API that uses basic authentication over HTTPS. What are the strengths and weaknesses? A. Perfectly secure with no weaknesses B. HTTPS provides encryption, but basic auth lacks features like token expiration C. Completely insecure D. Authentication method doesn't matter

C6 - CREATE (Synthesis/Creation)

35. Design a caching strategy for a high-traffic e-commerce website to minimize database load. A. Never use caching B. Implement multi-layer caching with Redis for sessions, CDN for static assets, and application-level cache C. Only cache one type of data D. Caching is unnecessary for e-commerce

36. Develop a disaster recovery plan for a financial services application. What components are essential? A. No plan needed B. Backup strategy, failover systems, RTO/RPO definitions, testing procedures, and communication plan C. Just buy more servers D. Hope nothing fails

37. Create a data model for a university course registration system. What entities and relationships would you include? A. Only one table needed B. Students, Courses, Instructors, Enrollments with many-to-many relationships C. Use paper forms instead D. No relationships needed

38. Formulate a security policy for a company allowing employees to use personal devices (BYOD). A. Allow everything without restrictions B. Define device requirements, MDM enrollment, encryption standards, and acceptable use policies C. Ban all personal devices D. Trust everyone completely

39. Compose an algorithm to detect and prevent race conditions in a multi-threaded application. A. Race conditions cannot be prevented B. Use mutex locks, semaphores, or atomic operations to synchronize access to shared resources C. Single-threaded applications only D. Ignore the problem

40. Construct a monitoring and alerting system for a production web application. What metrics and thresholds would you establish? A. No monitoring needed B. Track CPU, memory, response time, error rates with automated alerts and dashboards C. Manual checking only D. Monitor only disk space