

# AP PGECET 2026 CS & IT

## Question Paper with Solutions

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### General Instructions

- (i) The test is of 2 hours duration.
- (ii) This test paper consists of 120 questions. The maximum marks are 120.
- (iii) Each question carries +1 marks for correct answer and there is no negative marking for wrong answer.

1. How many different 5-character passwords can be formed using the digits 0-9 and lowercase letters a-z if the first character must be a letter and repetitions are allowed?

- (A)  $26 \times 36^4$
- (B)  $36^5$
- (C)  $26 \times 35^4$
- (D)  $26 \times 10 \times 36^3$

2. The number of ways to distribute 10 identical apples among 4 children such that every child receives at least one apple is:

- (A)  ${}^{13}C_3$
- (B)  ${}^9C_3$
- (C)  ${}^{10}C_4$
- (D)  ${}^{14}C_4$

3. For a connected planar graph with 10 vertices and 15 edges, how many faces does the graph have?

- (A) 5

- (B) 6
  - (C) 7
  - (D) 8
- 

**4. Two graphs  $G_1$  and  $G_2$  are isomorphic if which of the following conditions is satisfied?**

- (A) Both graphs have the same number of vertices only
  - (B) Both graphs have the same number of edges only
  - (C) There exists a one-to-one correspondence between their vertices that preserves adjacency
  - (D) Both graphs have the same number of vertices but different edges
- 

**5. A graph is said to be Eulerian if it contains a closed trail that includes every:**

- (A) Vertex exactly once.
  - (B) Edge exactly once.
  - (C) Vertex at least once.
  - (D) Edge at most once.
- 

**6. If a graph  $G$  has 10 vertices and each vertex has degree 3, how many edges does  $G$  have?**

- (A) 30
  - (B) 15
  - (C) 10
  - (D) 20
- 

**7. In a simple undirected graph, the sum of the degrees of all vertices is 20. How many edges are present in the graph?**

- (A) 8
  - (B) 10
  - (C) 12
  - (D) 20
-

8. Which of the following propositions is logically equivalent to  $p \rightarrow q$ ?

- (A)  $p \wedge q$
  - (B)  $\neg p \vee q$
  - (C)  $p \vee q$
  - (D)  $\neg q \rightarrow \neg p$
- 

9. Which of the following circuits is a sequential circuit?

- (A) Multiplexer
  - (B) Decoder
  - (C) Flip-Flop
  - (D) Adder
- 

10. What is the 2's complement representation of the decimal number -5 in 8-bit binary?

- (A) 00000101
  - (B) 11111011
  - (C) 11111010
  - (D) 00000110
- 

11. In which addressing mode does the instruction contain the actual operand value itself rather than the address of operand?

- (A) Direct Addressing
  - (B) Indirect Addressing
  - (C) Immediate Addressing
  - (D) Register Addressing
- 

12. Which of the following statements about Arithmetic Logic Unit (ALU) is correct?

- (A) ALU stores instructions permanently.
- (B) ALU performs arithmetic and logical operations on data.

- (C) ALU controls the execution of programs.
  - (D) ALU is responsible for input and output operations.
- 

**13. In CPU Control design, what is the primary difference between hardwired control and micro programmed control?**

- (A) Hardwired control uses software programs, while micro programmed control used combinational circuits.
  - (B) Hardwired control is faster but less flexible, while micro programmed control is slower but easier to modify.
  - (C) Hardwired control cannot execute arithmetic operations, while micro programmed control can.
  - (D) Hardwired control uses registers for control signals, while microprogrammed control does not.
- 

**14. Which of the following statements about linked lists is true?**

- (A) Elements of a linked list are stored in contiguous memory locations.
  - (B) Accessing the  $n^{th}$  element of a linked list takes  $O(1)$  time.
  - (C) In a singly linked list, each node contains a data part and a pointer to the next node.
  - (D) A linked list cannot be dynamically resized.
- 

**15. A connected undirected graph has 8 vertices and 12 edges. How many edges will its spanning tree contain?**

- (A) 6
  - (B) 7
  - (C) 8
  - (D) 12
- 

**16. An algorithm repeatedly divides a problem into smaller sub-problems, solves them independently, and combines the results to obtain the final solution. Determine the algorithm that follows this strategy.**

- (A) Linear search
- (B) Binary search

- (C) Breadth First search
  - (D) Bubble sort
- 

**17. Consider the linear search algorithm on an array of size 'n'. What is the worst-case time complexity of linear search?**

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

**18. A grammar is given:**

$$E \rightarrow E + T \mid T$$

$$T \rightarrow T * F \mid F$$

$$F \rightarrow (E) \mid id$$

**For the input:  $id + id * id$ , what is the correct interpretation?**

- (A)  $(id + id) * id$
  - (B)  $id + (id * id)$
  - (C)  $(id + id * id)$
  - (D) Ambiguous expression
- 

**19. A program allocates memory dynamically using `malloc()` and does not free it. After repeated execution, what is the most likely outcome?**

- (A) Deadlock
  - (B) Memory Leak
  - (C) Thrashing
  - (D) Starvation
- 

**20. Which of the following is TRUE about the Quick Sort algorithm?**

- (A) It is a stable sorting algorithm.
- (B) Its worst-case complexity is  $O(n \log n)$ .

- (C) Its performance depends heavily on the choice of the pivot.  
(D) It requires  $O(n)$  auxiliary space for merging.
- 

**21. The Huffman coding algorithm used for data compression is based on which algorithmic strategy?**

- (A) Divide and Conquer  
(B) Dynamic Programming  
(C) Backtracking  
(D) Greedy Method
- 

**22. Which of the following parameter passing mechanisms allows a function to modify the actual variable in the calling function?**

- (A) Pass by value  
(B) Pass by constant  
(C) Pass by reference  
(D) Pass by result
- 

**23. In a circular queue implemented using an array of size  $MAX$ , if 'front' and 'rear' are the indices, the condition for the queue being full is:**

- (A)  $(rear + 1) \% MAX == front$   
(B)  $rear == MAX - 1$   
(C)  $front == (rear + 1)$   
(D)  $front == 0 \ \&\& \ rear == MAX$
- 

**24. Which data structure is used by the compiler to manage function calls and local variables (Activation Records)?**

- (A) Queue  
(B) Linked List  
(C) Stack  
(D) Heap
-

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**25. Boolean algebra is mainly used in which area?**

- (A) Database design
  - (B) Sorting algorithms
  - (C) Circuit design
  - (D) Graph theory
- 

**26. Which data structure allows insertion and deletion at both ends?**

- (A) Stack
  - (B) Queue
  - (C) Deque
  - (D) Array
- 

**27. Which tree traversal visits left subtree, root, then right subtree?**

- (A) Preorder
  - (B) Inorder
  - (C) Postorder
  - (D) Level order
- 

**28. Which data structure is used to implement priority scheduling?**

- (A) Stack
  - (B) Queue
  - (C) Priority queue
  - (D) Linked list
- 

**29. Which data structure is used for level order traversal in trees?**

- (A) Stack
- (B) Queue

- (C) Array
  - (D) Tree
- 

**30. Which sorting algorithm has the best-case time complexity of  $O(n)$  when the input array is already sorted?**

- (A) Merge Sort
  - (B) Quick Sort
  - (C) Insertion Sort
  - (D) Heap Sort
- 

**31. The Bellman-Ford algorithm is preferred over Dijkstra's algorithm when the graph contains:**

- (A) Positive weight cycles
  - (B) Large number of nodes
  - (C) Negative weight edges
  - (D) Disconnected components
- 

**32. What is the time complexity of the optimal solution for the 0/1 Knapsack problem with  $n$  items and capacity  $W$  using Dynamic Programming?**

- (A)  $O(n + W)$
  - (B)  $O(nW)$
  - (C)  $O(2^n)$
  - (D)  $O(W^2)$
- 

**33. A statement that is always false regardless of truth values is called\_\_\_\_\_**

- (A) Contradiction
  - (B) Tautology
  - (C) Condition
  - (D) Implication
-

**34. Which circuit produces output only based on current inputs without memory?**

- (A) Sequential circuit
  - (B) Combinational circuit
  - (C) Register circuit
  - (D) Flip-flop circuit
- 

**35. In a singly linked list, what is the time complexity to delete a node given a pointer to that specific node?**

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

**36. The problem solving technique which divides a problem into smaller sub problems and then combines their results \_\_\_\_\_**

- (A) Greedy
  - (B) Backtracking
  - (C) Divide and conquer
  - (D) Brute force
- 

**37. Which algorithm is commonly used to find a minimum spanning tree?**

- (A) Prim's
  - (B) Dijkstra
  - (C) Binary search
  - (D) DFS
- 

**38. Name the notation that represents the average-case complexity of an algorithm.**

- (A) Big O
- (B) Little o

- (C) Big Omega
  - (D) Big Theta
- 

**39. Which time complexity grows the slowest as input size increases?**

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

**40. Which of the following is true about a good hash function?**

- (A) It always produces the same hash value for different keys.
  - (B) It distributes keys uniformly across the hash table.
  - (C) It always results in hash collisions.
  - (D) It requires storing all keys in contiguous memory locations.
- 

**41. What type of automaton is mainly used for simple pattern matching?**

- (A) DFA
  - (B) PDA
  - (C) Turing machine
  - (D) Grammar
- 

**42. Which type of grammar is mainly used in programming languages?**

- (A) Regular
  - (B) Context free
  - (C) Unrestricted
  - (D) Linear
- 

**43. Name the computational model that can simulate both PDA and DFA?**

- (A) PDA
  - (B) DFA
  - (C) Compiler
  - (D) Turing machine
- 

**44. In a deterministic finite automaton, the behaviour of transitions is strictly defined for every input symbol at each state. Identify the statement that correctly describes this property.**

- (A) DFA can have  $\epsilon$  (epsilon) transitions.
  - (B) DFA can recognize all context-free languages.
  - (C) DFA has exactly one transition for each symbol from every state.
  - (D) DFA can have multiple start states.
- 

**45. Consider the language  $L = \{a^n b^n \mid n \geq 0\}$ . Choose the computational model that can recognize this language.**

- (A) Finite Automata
  - (B) Pushdown Automata
  - (C) Turing Machine with no Stack
  - (D) Linear Search Algorithm
- 

**46. A pushdown automaton differs from a finite automaton due to the presence of a \_\_\_\_\_ that helps in handling nested structures.**

- (A) Queue
  - (B) Stack
  - (C) Heap
  - (D) Register
- 

**47. If a language  $L$  and its complement  $L'$  are both Recursively Enumerable (RE), then  $L$  is:**

- (A) Context-sensitive
- (B) Recursive

- (C) Not accepted by any Turing Machine
  - (D) Universal
- 

**48. According to the Rice's Theorem, any non-trivial property of the language recognized by a Turing Machine is:**

- (A) Decidable
  - (B) Undecidable
  - (C) Context-free
  - (D) Recursive
- 

**49. Which class of problem solving is considered the easiest one?**

- (A) NP
  - (B) NP-hard
  - (C) P
  - (D) Complex
- 

**50. A lexical analyser processes the input string `int x = a + 10;` How many tokens are generated?**

- (A) 5
  - (B) 6
  - (C) 7
  - (D) 8
- 

**51. A program requires more memory than the available physical memory. The system allows execution by loading only required parts of the program into memory while keeping the rest on disk. This mechanism is known as?**

- (A) Paging
- (B) Virtual Memory
- (C) Deadlock
- (D) Multiprocessing

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**52. Which type of graph does not contain any cycles?**

- (A) Complete graph
  - (B) Directed graph
  - (C) Tree
  - (D) Weighted graph
- 

**53. Consider the code:**

$X = a * 2$

$Y = a * 2$

**After optimization, what is the most efficient transformation?**

- (A) Keep both statements unchanged
  - (B) Replace multiplication with addition
  - (C) Compute once and reuse result
  - (D) Remove both statements
- 

**54. In a compiler, which phase is responsible for identifying the token types from the source program's stream of characters?**

- (A) Syntax Analysis
  - (B) Semantic Analysis
  - (C) Lexical Analysis
  - (D) Intermediate Code Generation
- 

**55. Which of the following statements is TRUE regarding LL(1) grammars?**

- (A) A grammar with left recursion can be LL(1).
  - (B) Every LL(1) grammar is also LR(1).
  - (C) LL(1) parsers are bottom-up parsers.
  - (D) Ambiguous grammars can be LL(1).
-

**56. In Syntax Directed Translation (SDT), an attribute is called "inherited" if its value at a node in the parse tree is defined in terms of attributes at:**

- (A) Its children only.
  - (B) Its parent and/or its siblings.
  - (C) Its left child only.
  - (D) Its descendants only.
- 

**57. Which of the following intermediate code representations is typically used to represent expressions where each instruction has at most three operands?**

- (A) Postfix Notation
  - (B) Syntax Trees
  - (C) Three Address Code
  - (D) Directed Acyclic Graph
- 

**58. In the context of code optimization, "Loop Invariant Code Motion" refers to:**

- (A) Removing loops that never execute.
  - (B) Moving computations that yield the same result regardless of the loop iteration outside the loop.
  - (C) Replacing expensive operations with cheaper ones inside a loop.
  - (D) Combining two loops into a single loop.
- 

**59. A handle in a bottom-up parser is a substring that matches the right-hand side of a production and whose reduction represents:**

- (A) The next step in a derivation.
  - (B) One step in the reverse of a rightmost derivation.
  - (C) The leftmost leaf of the parse tree.
  - (D) A terminal symbol to be shifted.
- 

**60. Which phase of a compiler checks variable declaration?**

- (A) Lexical
- (B) Syntax

- (C) Semantic
  - (D) Code generation
- 

**61. A system has 4 redundant units of a resource. There are 3 processes, each requiring 2 units of the resource. Which of the following is TRUE?**

- (A) Deadlock is certain to occur.
  - (B) Deadlock can never occur.
  - (C) Deadlock occurs only if all processes request resources at the same time.
  - (D) The system is in an unsafe state.
- 

**62. 'Belady's Anomaly' refers to the phenomenon where the page fault rate increases as the number of allocated page frames increases. This is observed in which page replacement algorithm?**

- (A) Optimal (OPT)
  - (B) Least Recently Used (LRU)
  - (C) First-In-First-Out (FIFO)
  - (D) Stack-based algorithms
- 

**63. In an I/O system, 'Direct Memory Access (DMA)' is used to:**

- (A) Allow the CPU to execute I/O instructions faster.
  - (B) Transfer data between I/O devices and memory without continuous CPU intervention.
  - (C) Synchronize the speeds of the CPU and the disk.
  - (D) Prevent deadlocks in peripheral devices.
- 

**64. Consider the following C function:**

```
int fun(int n){  
    if (n == 0) return 0;  
    else return n + fun(n - 1);  
}
```

**What does the function fun(4) return?**

- (A) 4
  - (B) 10
  - (C) 24
  - (D) 16
- 

**65. Three processes arrive at time 0 with burst times 5, 3, and 1 unit respectively. The scheduler always selects the process with the smallest burst time next. The order of execution will be?**

- (A) 5 → 3 → 1
  - (B) 1 → 3 → 5
  - (C) 3 → 1 → 5
  - (D) 1 → 5 → 3
- 

**66. Which memory technique creates the illusion of larger memory?**

- (A) Virtual memory
  - (B) Cache
  - (C) Register
  - (D) Buffer
- 

**67. What is the "Thrashing" phenomenon in virtual memory systems?**

- (A) High CPU utilization due to heavy process loads.
  - (B) Excessive paging activity where the system spends more time swapping than executing.
  - (C) Frequent disk crashes due to high read/write speeds.
  - (D) Corruption of the page table by a malicious process.
- 

**68. What is the main purpose of a Translation Lookaside Buffer (TLB)?**

- (A) To increase the size of physical memory.
- (B) To reduce the effective memory access time for virtual-to-physical address translation.

- (C) To store frequently used files for faster I/O.
- (D) To manage the CPU registers during a context switch.
- 

**69. Which of the following is a solution to the "Critical Section Problem" that satisfies mutual exclusion, progress, and bounded waiting?**

- (A) Peterson's Solution
- (B) Test-and-Set Lock (hardware-only)
- (C) Busy Waiting
- (D) Shared Memory without synchronization
- 

**70. Which of the following transitions is NOT possible in a standard process state transition diagram?**

- (A) Running → Ready
- (B) Ready → Running
- (C) Blocked → Running
- (D) Running → Blocked
- 

**71. An ER model contains:**

- **Student with attributes: StudentID, Name, Age**
- **Course with attributes: CourseID, Title**
- **A many-to-many relationship Enrols between Student and Course, with attribute Grade**

**In the relational design, a separate table is needed to capture the relationship and its attribute. The correct schema design is?**

- (A) The Enrols relationship can be represented as a table with columns: StudentID, CourseID, Grade only, with no foreign keys
- (B) The relational schema will have three tables: Student, Course, Enrols, where Enrols includes
-

StudentID and CourseID as foreign keys referencing Student and Course

- (C) The relational schema can merge Enrols into Student table without violating normalization
  - (D) The relational schema will have two tables only: Student and Course, since Enrols is many-to-many and does not require a separate table
- 

**72. Which of the following relational algebra operations is equivalent to a Cartesian product followed by a selection ( $\sigma$ )?**

- (A) Natural Join
  - (B) Theta Join
  - (C) Outer Join
  - (D) Intersection
- 

**73. A relation R is in 3NF if every non-prime attribute of R is:**

- (A) Partially dependent on the primary key.
  - (B) Non-transitively dependent on every candidate key.
  - (C) Functionally dependent on a non-key attribute.
  - (D) Multi-valued.
- 

**74. A database designer is refining a relation that has a composite primary key. Some non-key attributes depend only on part of this key, leading to redundancy. Removing such dependencies ensures the relation satisfies a higher normal form. The correct statement describing this transformation is \_\_\_\_\_.**

- (A) First Normal Form (1NF) allows repeating groups and multi-valued attributes
  - (B) Second Normal Form (2NF) eliminates partial dependencies on a composite key
  - (C) Third Normal Form (3NF) allows transitive dependencies
  - (D) Boyce-Codd Normal Form (BCNF) is weaker than 3NF
-

**75. A relation  $R(A, B, C)$  has the following functional dependencies:**

$A \rightarrow B, B \rightarrow C$

**If attribute  $A$  is known, the value of  $C$  can be determined due to:**

- (A) Partial dependency
  - (B) Transitive dependency
  - (C) Multivalued dependency
  - (D) Trivial dependency
- 

**76. Two transactions operate on the same data item:**

- $T_1$ : Read(X), Write(X)
- $T_2$ : Read(X), Write(X)

**If both execute without proper control, the system may face?**

- (A) Deadlock
  - (B) Lost update problem
  - (C) Starvation
  - (D) Thrashing
- 

**77. What is the primary difference between a B-tree and a B+ tree?**

- (A) B-trees have a higher fill factor.
  - (B) B+ trees store data pointers only in the leaf nodes.
  - (C) B-trees do not allow duplicate keys.
  - (D) B+ trees cannot be used for primary indexing.
- 

**78. Which of the following is a conflict-serializable schedule?**

- (A) One that is equivalent to some serial schedule.
- (B) One that uses only shared locks.

- (C) One that results in a deadlock.
  - (D) One where all write operations occur at the end.
- 

**79. Two transactions execute concurrently, but their results are the same as if they were executed one after another. This property is called?**

- (A) Atomicity
  - (B) Durability
  - (C) Consistency
  - (D) Serializability
- 

**80. A file is stored such that records are placed in no particular order, and searching requires scanning the entire file. This organization is known as?**

- (A) Sequential file organization
  - (B) Indexed file organization
  - (C) Heap file organization
  - (D) Clustered file organization
- 

**81. A development team conducts interviews, observations, and questionnaires before starting system design. The goal is to understand user expectations, constraints, and workflows. This activity primarily supports?**

- (A) Requirement elicitation
  - (B) Coding phase
  - (C) Testing phase
  - (D) Deployment
- 

**82. Software project management involves multiple activities carried out throughout the project lifecycle, including planning, execution, and post-delivery support. Select the statement that correctly reflects this concept?**

- (A) Project planning is only concerned with coding and testing schedules.
  - (B) Effective project management includes estimating resources, scheduling tasks, and monitoring progress.
  - (C) Risk management is not part of project management.
  - (D) Project management continues through maintenance and support, even after software delivery.
- 

**83. During software development, the implementation phase focuses on transforming system design into an executable system. Select the activity that belongs to this phase?**

- (A) Coding modules, integration them, and testing the system.
  - (B) Gathering requirements from users and analysing them.
  - (C) Writing marketing materials for the software product.
  - (D) Conducting post-deployment user training only.
- 

**84. Which of the following statement about a Data Flow Diagram (DFD) is true?**

- (A) A DFD represents the physical implementation of a system.
  - (B) A DFD shows how data moves through a system, including processes, data stores, and external entities.
  - (C) A DFD is used to write sources code directly.
  - (D) A DFD ignores the flow of data and focuses only on user interface design.
- 

**85. A software application has been in use for two years. Users report that some features are not working as expected, and there are minor bugs that need fixing. The development team also wants to add a new reporting feature based on recent user requests. Which type(s) of software maintenance does this scenario involve?**

- (A) Corrective maintenance only.
  - (B) Adaptive maintenance only.
  - (C) Both corrective and perfective maintenance.
  - (D) Preventive maintenance only.
-

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**86. The "Cyclomatic Complexity" of a software module is primarily used to estimate:**

- (A) The number of lines of code (LOC).
  - (B) The number of linearly independent paths through the source code.
  - (C) The total memory consumption of the module.
  - (D) The time required for integration testing.
- 

**87. A software project follows a spiral model for development. Which of the following statements is true about the spiral model compared to the traditional waterfall model?**

- (A) The spiral model eliminates the need for risk analysis because all requirements are known upfront.
  - (B) The spiral model allows iterative refinement of the system through multiple loops, incorporating risk assessment at each iteration.
  - (C) In the spiral model, testing is performed only at the end, similar to the waterfall model.
  - (D) The spiral model is suitable only for small projects with well-understood requirements.
- 

**88. Software testing plays a crucial role in ensuring reliability and correctness at different stages of development. Select the statement that correctly represents this role?**

- (A) Software testing is only done after the software is fully implemented.
  - (B) Unit testing verifies individual modules or components for correctness.
  - (C) System testing tests only the hardware components of the system.
  - (D) Testing is essential to identify defects and ensure software quality, even if the software is well-designed.
- 

**89. Cohesion is a measure of how strongly related the functions within a single module are. Which level of cohesion is considered the most desirable?**

- (A) Coincidental cohesion
- (B) Logical cohesion

- (C) Functional cohesion
  - (D) Procedural cohesion
- 

**90. Which testing technique focuses on exercising the internal logic, control flow, and data structures of a software module?**

- (A) Black Box Testing
  - (B) White Box Testing
  - (C) Regression Testing
  - (D) Beta Testing
- 

**91. Software coupling is a measure of the degree of interdependence between modules. Which of the following is the most desirable (best) type of coupling?**

- (A) Content coupling
  - (B) Control coupling
  - (C) Data coupling
  - (D) External coupling
- 

**92. Which software process model is most appropriate for projects with poorly defined requirements that are expected to evolve significantly over time?**

- (A) Waterfall Model
  - (B) Iterative Prototyping
  - (C) V-Model
  - (D) Incremental Model
- 

**93. In project management, the "Critical Path" in a PERT/CPM chart represents:**

- (A) The shortest sequence of tasks in the project.
- (B) The path with the maximum slack/float.

- (C) The longest path of planned activities to the end of the project.
  - (D) The path containing only non-essential tasks.
- 

**94. In a relational schema, a "Foreign Key" is used to enforce:**

- (A) Entity Integrity
  - (B) Referential Integrity
  - (C) Domain Integrity
  - (D) Check Constraints
- 

**95. A developer is designing a network application. She needs reliable delivery of messages with error checking, sequencing, and acknowledgment, but another part of her application needs fast transmission of data without delay, and occasional data loss is acceptable. Identify the protocols should she use for the above two cases?**

- (A) Use TCP for reliable delivery, and UDP for fast, unreliable transmission.
  - (B) Use UDP for reliable delivery, and TCP for fast, unreliable transmission.
  - (C) Use TCP for both reliable and fast transmission.
  - (D) Use UDP for both cases because it's faster than TCP.
- 

**96. A network uses a routing protocol where each router periodically shares its entire routing table with its immediate neighbours. Over time, the network experiences issues like slow convergence and routing loops (count-to-infinity problem). Determine the routing algorithm, which is most likely being used in this network.**

- (A) Link State Routing
  - (B) Distance Vector Routing
  - (C) Flooding Algorithm
  - (D) Hierarchical Routing
-

97. A user is using an encryption system where a pair of keys is generated. One key is shared publicly, while the other key is kept secret by the owner and is used to decrypt messages or create digital signatures. Which key is being described?

- (A) Public Key
  - (B) Session key
  - (C) Private key
  - (D) Shared key
- 

98. Which application layer protocol is used to retrieve emails from a remote server to a local client?

- (A) SMTP
  - (B) POP3
  - (C) SNMP
  - (D) FTP
- 

99. A "Digital Signature" provides which of the following security services?

- (A) Confidentiality and Privacy
  - (B) Authentication and Non-repudiation
  - (C) Availability and Auditing
  - (D) Encryption and Compression
- 

100. In Public Key Cryptography (RSA), if 'A' wants to send a confidential message to 'B', 'A' should encrypt the message using:

- (A) A's Private Key
- (B) A's Public Key
- (C) B's Public Key
- (D) B's Private Key

---

**101. What is the size of the total address space in IPv4?**

- (A)  $2^{128}$
  - (B)  $2^{32}$
  - (C)  $2^{64}$
  - (D)  $2^{48}$
- 

**102. Which routing algorithm requires each router to inform all other routers in the network about its entire set of links and their current costs?**

- (A) Distance Vector Routing
  - (B) Link State Routing
  - (C) Path Vector Routing
  - (D) Flooding
- 

**103. In the ISO/OSI reference model, which layer is responsible for dialog control, token management, and synchronization?**

- (A) Presentation Layer
  - (B) Session Layer
  - (C) Transport Layer
  - (D) Data Link Layer
- 

**104. A web developer is creating a webpage where:**

- A heading is displayed at the top
- A paragraph of text follows
- A link is provided to navigate to another webpage

**Which of the following HTML code snippets correctly represents this structure?**

- (A) `<head> < h1> Title </h1> </head> <body> <p> Text </p> <a href="page.html"> Link </a> </body>`
  - (B) `<html> <h1> Title </h1> <p> Text </p> <a> Link </a> </html>`
  - (C) `<html> <body> <h1> Title </h1> <p> Text </p> <a href="page.html"> Link </a> </body> </html>`
  - (D) `<html> <title> Title </title> <p> Text </p> <link> page.html </link> </html>`
- 

**105. A developer is creating a data file to store structured information about books. The file must be self-descriptive, allow custom tags, and ensure that all tags are properly nested and closed. Which of the following XML snippets is well formed?**

- (A) `<book><title>XML Guide<title><author>John</author></book>`
  - (B) `<book><title>XML Guide</title><author>John</author></book>`
  - (C) `<book><title>XML Guide</author><author>John</title></book>`
  - (D) `<book><title>XML Guide</title><author>John</book>`
- 

**106. A user opens a web browser and requests a webpage. The request is sent to a remote machine, which processes the request and sends back the webpage content. In this scenario, which of the following correctly identifies the client and server roles?**

- (A) The web browser is the server, and the remote machine is the client.
  - (B) Both the web browser and remote machine act as servers.
  - (C) The web browser is the client, and the remote machines is the server.
  - (D) Both the web browser and remote machine act as clients.
- 

**107. In a client-server system, a company deploys a database application where multiple users and requests to access and update data stored in a centralized system. The system ensures that all users get consistent and updated information. Which of the following best describes the advantages of this client- server architecture?**

- (A) Clients performs all processing without relying on the server.
  - (B) No network is required for communication between clients and server.
  - (C) Centralized control of data ensures consistency and easier management.
  - (D) Data is stored separately on each client, improving redundancy.
- 

**108. In the context of the Client-Server model, which HTTP response status code indicates that the requested resource was not found on the server?**

- (A) 200
  - (B) 302
  - (C) 404
  - (D) 500
- 

**109. What is the primary purpose of the XML Document Type Definition (DTD)?**

- (A) To style the XML document for browser display.
  - (B) To define the legal building blocks and structure of an XML document.
  - (C) To compress the XML data for faster transmission.
  - (D) To convert XML data into a relational database format.
- 

**110. In a Client-Server computing model, "Stateful" servers are characterized by:**

- (A) Keeping track of the status of client interactions across multiple requests.
  - (B) Treating each request as an independent transaction with no context.
  - (C) Storing all client data only on the client-side machine.
  - (D) Using only UDP for communication to increase speed.
- 

**111. Let  $A, B$  be two events of a sample space such that  $P(A) = \frac{1}{2}$ ,  $P(A|B) = \frac{1}{4}$ , and  $P(B|A) = \frac{1}{2}$ . Then,  $P(\bar{A}|\bar{B}) = \underline{\hspace{2cm}}$ , where  $\bar{A}$  is the complement of  $A$ .**

- (A)  $\frac{2}{3}$
  - (B)  $\frac{1}{3}$
  - (C)  $\frac{3}{4}$
  - (D) 0
- 

112. Let  $1 < a < 7$  and  $b > 7$ . If both mean and median of the data set  $\{1, 7, -7, a, b\}$  are equal to 4, then the value of  $b$  is \_\_\_\_\_.

- (A) 20
  - (B) 15
  - (C) -1
  - (D) 5
- 

113. Let  $G = \mathbb{R}^* \times \mathbb{R}$ , where  $\mathbb{R}$  is the set of all real numbers and  $\mathbb{R}^* = \mathbb{R} - \{0\}$ . Define an operation  $\circ$  on  $G$  as  $(a, b) \circ (c, d) = (ac, bc + d)$ . Then, the identity element of the group  $(G, \circ)$  is \_\_\_\_\_.

- (A) (0, 0)
  - (B) (0, 1)
  - (C) (1, 0)
  - (D) (1, 1)
- 

114. In a Boolean algebra theorem which of the following is TRUE?

- (A)  $x + (x \cdot y) = y$
  - (B)  $x \cdot (x + y) = y$
  - (C)  $(x \wedge y) \vee x' \vee y' = 1$
  - (D)  $(x \vee y) \wedge ((x \wedge y') \vee y)' = 0$
- 

115. Define two relations  $\sigma_1$  and  $\sigma_2$  on the set of all real numbers  $\mathbb{R}$  as follows:

$a\sigma_1 b \iff a - b$  is a rational number

---

$a\sigma_2b \iff a - b$  is an integer

Which one of the following is correct?

- (A) Both  $\sigma_1$  and  $\sigma_2$  are equivalence relations
  - (B) Neither  $\sigma_1$  nor  $\sigma_2$  is an equivalence relation
  - (C)  $\sigma_1$  is an equivalence relation, but  $\sigma_2$  is not an equivalence relation
  - (D)  $\sigma_1$  is not an equivalence relation, but  $\sigma_2$  is an equivalence relation
- 

116. Consider the following system of equations:

$$\begin{pmatrix} 1 & 3 & 2 \\ 2 & 2 & -3 \\ 4 & 4 & -6 \\ 2 & 5 & 2 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \\ 2 \\ 1 \end{pmatrix}$$

The value of  $y^2 + z^2$  is \_\_\_\_\_.

- (A) 34
  - (B) 41
  - (C) 25
  - (D) 18
- 

117. With the initial guess of  $x_0 = 1, x_1 = 2$ , the first iteration value using secant method for  $f(x) = x^2 + 5x + 4$  will be \_\_\_\_\_.

- (A) 0.5
  - (B) -0.25
  - (C) -0.75
  - (D) -0.5
- 

118. Let  $f(x) = x^3 - x - 2$ . Using the bisection method on the interval  $[1, 2]$ , how many iterations are required to approximate a root correct to two decimal places?

- (A) 5
  - (B) 6
  - (C) 7
  - (D) 8
- 

**119. Consider the function  $f(x, y) = (x - 2)^2(y + 3)$ . Then:**

- (A) (2,-3) is not a stationary point of  $f$ .
  - (B)  $f$  has a local minimum at (2,-3).
  - (C)  $f$  has a local maximum at (2,-3).
  - (D)  $f$  has neither a local maximum nor a local minimum at (2,-3).
- 

**120. The value of the improper integral  $\int_0^1 \frac{1}{4\sqrt{1-x}} dx$  is equal to \_\_\_\_\_.**

- (A) 4
  - (B)  $\frac{1}{4}$
  - (C)  $\frac{1}{2}$
  - (D)  $\infty$
-