



DO NOT OPEN THE SEAL UNTIL INSTRUCTED TO DO SO

600189

Series :

a

Question Booklet No.

ESE/25/RT/CME/2025

**COMPUTER
ENGINEERING**

Invigilator's Signature

Candidate's Signature

Time : 3 Hours

Maximum Marks : 200

ROLL NO.

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10. In floating-point addition, the first step is
- [A] add significant
 - [B] add exponents
 - [C] align exponents
 - [D] normalize result
11. Which addressing mode is used when the operand is given explicitly in the instruction?
- [A] Immediate
 - [B] Direct
 - [C] Indirect
 - [D] Register
12. In a basic instruction cycle, the Instruction Register (IR) is loaded during which phase?
- [A] Decode
 - [B] Execute
 - [C] Fetch
 - [D] Memory Access
13. Which control technique uses firmware to execute instructions?
- [A] Hardware control
 - [B] Direct control
 - [C] Microprogrammed control
 - [D] Pipeline control
14. Which memory is fastest in access time but smallest in size?
- [A] RAM
 - [B] Cache
 - [C] ROM
 - [D] Hard disk

15. Which of the following **correctly** matches the instruction type with its operation?

- [A] Load → Store to memory, Add → Bring from memory, Branch → Arithmetic
- [B] Load → Bring from memory, Store → Store to memory, Add → Change flow, Branch → Arithmetic
- [C] Load → Arithmetic, Store → Register load, Add → Store to memory, Branch → Change flow
- [D] Load → Bring from memory, Store → Store to memory, Add → Arithmetic, Branch → Change flow



16. Which of the following options **correctly** matches CPU components with their primary functions?

- [A] ALU → Store instruction, Register File → Stores next address, Instruction Reg → Arithmetic, PC → Temporary data
- [B] ALU → Logic/arithmetic, Register File → Temp data, Instruction Reg → Stores instruction, PC → Next address
- [C] ALU → Next address, Register File → Permanent storage, Instruction Reg → Logic, PC → Instruction decoding
- [D] ALU → Data caching, Register File → Instruction decoding, Instruction Reg → Next address, PC → Logic

17. Which of the following **correctly** matches memory types with their characteristics?

- [A] RAM → Non-volatile, ROM → Temporary, Cache → Secondary, Secondary Storage → High speed
- [B] RAM → Volatile, ROM → Read-only, Cache → High speed small memory, Secondary → Large permanent storage
- [C] RAM → Stores instructions permanently, ROM → Volatile, Cache → Magnetic, Secondary → Temporary
- [D] RAM → Permanent, ROM → Writable, Cache → Backup, Secondary → Small fast access

18. In Direct Memory Access (DMA), the CPU handles each data transfer between I/O and memory.

- [A] True, because CPU has to supervise all memory transfers
- [B] True, because DMA interrupts CPU after each byte
- [C] False, because DMA uses CPU registers directly
- [D] False, because DMA bypasses the CPU for faster data transfers

19. Microprogrammed control units are easier to modify than hardwired control units.

- [A] True, because control logic is implemented using memory which can be updated
- [B] False, because memory-based logic is slower to access
- [C] False, because microprogramming requires rewriting hardware
- [D] True, because microcode executes faster than hardwired logic

20. In pipelining, a hazard occurs when the next instruction depends on the result of the previous one.

- [A] True, because this dependency creates a data hazard
- [B] False, because pipelining avoids such dependencies automatically
- [C] False, because hazards only occur during branching
- [D] True, because instruction fetching is delayed intentionally

21. Which of the following C functions modifies a variable passed to it only when passed by reference?

- [A] void update(int a)
- [B] void update(int *a)
- [C] void update(const int a)
- [D] void update(int a[])

22. What is the output of this C expression?

```
int a = 5;
printf("%d", a++ + ++a);
```

- [A] 11
- [B] 12
- [C] 10
- [D] Undefined



23. Which C++ concept enables functions with same name but different parameter lists?

- [A] Inheritance
- [B] Overriding
- [C] Overloading
- [D] Virtual function

24. Which C++ feature ensures that a class with at least one pure virtual function cannot be instantiated?

- [A] Virtual Constructor
- [B] Virtual Base Class
- [C] Abstract Class
- [D] Interface

25. In C, sizeof(char) is always equal to 2 bytes.

- [A] True, because ASCII characters require 16 bits
- [B] False, because it depends on the operating system's memory model
- [C] False, because sizeof(char) is always 1 byte by definition
- [D] True, because all data types are at least 2 bytes in C

26. Which of the following options **correctly** matches C programming concepts with their purposes?

- [A] malloc() → Deallocate, free() → Allocate, Pointer → Calls itself, Recursion → Holds address
- [B] malloc() → Allocate, free() → Deallocate, Pointer → Holds address, Recursion → Calls itself
- [C] malloc() → Address holder, free() → Calls itself, Pointer → Allocate, Recursion → Deallocate
- [D] malloc() → Temporary file, free() → Opens file, Pointer → File pointer, Recursion → Repeat loop

27. Which of the following options **correctly** matches C++ OOP terms with their descriptions?

- [A] Constructor → Deletes object, Destructor → Initializes object, Inheritance → Overloading, Polymorphism → Object creation
- [B] Constructor → Called at object creation, Destructor → Cleans up resources, Inheritance → Code reuse, Polymorphism → Many forms
- [C] Constructor → Overloads operator, Destructor → Compiles class, Inheritance → Cleans memory, Polymorphism → One form
- [D] Constructor → Cleans memory, Destructor → Object copy, Inheritance → Inlines function, Polymorphism → Class only

28. Which of the following options **correctly** matches C file-handling functions with their actions?

- [A] fopen() → Write file, fclose() → Skip character, fgetc() → Write char, fputc() → Read char
- [B] fopen() → Close file, fclose() → Open file, fgetc() → Print to screen, fputc() → Move file pointer
- [C] fopen() → Open file, fclose() → Close file, fgetc() → Read a character, fputc() → Write a character
- [D] fopen() → Read char, fclose() → Write char, fgetc() → Open file, fputc() → Close file



29. A pure virtual function makes a class abstract in C++.

- [A] False, because virtual functions do not affect class type
- [B] True, because abstract classes must have only pure virtual functions
- [C] True, because any class with at least one pure virtual function is abstract
- [D] False, because only interfaces can have pure virtual functions

30. In C, local variables declared in a function retain their values between calls if declared static.

- [A] True, because static stores the variable in heap memory
- [B] False, because all local variables are destroyed after function call
- [C] True, because static variables maintain state across function calls
- [D] False, because static is only used with global variables

31. Which of the following data structures is most suitable for implementing recursion?

- [A] Queue
- [B] Stack
- [C] Heap
- [D] Graph

32. Which sorting algorithm has the best worst-case time complexity among the following options?

- [A] Insertion Sort
- [B] Merge Sort
- [C] Bubble Sort
- [D] Selection Sort



33. What is the time complexity of building a binary heap from an unsorted array of n elements?

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

34. Which of the following problems is **not** solvable in polynomial time (P)?

- [A] Shortest path using Dijkstra's algorithm
- [B] Minimum Spanning Tree
- [C] Hamiltonian Cycle
- [D] Binary Search

35. Which of the following **correctly** matches data structures with their typical usages?

- [A] Queue $\rightarrow$ Undo operation, Stack $\rightarrow$ Routing, Hash Table $\rightarrow$ Sorting, Graph $\rightarrow$ Stack reversal
- [B] Queue $\rightarrow$ Printer scheduling, Stack $\rightarrow$ Undo operation, Hash Table $\rightarrow$ Constant time search, Graph $\rightarrow$ Route navigation
- [C] Queue $\rightarrow$ Binary Tree traversal, Stack $\rightarrow$ Recursion optimization, Hash Table $\rightarrow$ Tree traversal, Graph $\rightarrow$ Heap usage
- [D] Queue $\rightarrow$ File encryption, Stack $\rightarrow$ Tree navigation, Hash Table $\rightarrow$ Memory allocation, Graph $\rightarrow$ Code optimization

36. Which of the following options matches traversal types to their most suitable structures or use case?

- [A] Inorder → Linked List, BFS → DFS, DFS → Heap tree, Postorder → Cycle detection
- [B] Inorder → BST sorted output, BFS → Level-order traversal, DFS → Depth-first traversal, Postorder → Expression tree evaluation
- [C] Inorder → Postfix expression, BFS → Inorder traversal, DFS → Recursion, Postorder → Stack usage
- [D] Inorder → Tree deletion, BFS → Memory management, DFS → Shortest path, Postorder → Encryption

37. Which of the following **correctly** matches algorithm types with their underlying techniques?

- [A] Dijkstra's → Divide and Conquer, Merge Sort → Greedy, Floyd-Warshall → Brute Force, Kruskal's → Backtracking
- [B] Dijkstra's → Dynamic Programming, Merge Sort → Divide and Conquer, Floyd-Warshall → Greedy, Kruskal's → Recursive
- [C] Dijkstra's → Greedy, Merge Sort → Divide and Conquer, Floyd-Warshall → Dynamic Programming, Kruskal's → Greedy
- [D] Dijkstra's → Recursion, Merge Sort → Brute Force, Floyd-Warshall → DFS, Kruskal's → Stack

38. The worst-case time complexity of Quick Sort is $O(n^2)$.

- [A] True, because Quick Sort is not a stable algorithm
- [B] False, because Quick Sort always runs in $O(n \log n)$
- [C] False, because Quick Sort is recursive and has linear complexity



- [D] True, because poor pivot choices lead to unbalanced partitions

39. A tree with n nodes always has exactly $n - 1$ edges.

- [A] True, because trees are acyclic graphs with minimal connections
- [B] False, because it depends on tree height
- [C] True, because every graph with $n - 1$ edges is a tree
- [D] False, because trees can contain cycles if balanced

40. All NP-complete problems are NP-hard, but not all NP-hard problems are NP complete.

- [A] False, because NP-complete and NP-hard are equivalent classes
- [B] True, because NP-complete problems are both in NP and NP-hard
- [C] False, because NP-hard problems must be verifiable in polynomial time
- [D] True, because NP-complete is a subset of NP, but NP-hard may not even be decidable

41. A lexical analyzer uses a DFA with n states. What is the worst-case time complexity to tokenize an input string of length m ?

- [A] $O(n \times m)$
- [B] $O(m)$
- [C] $O(n + m)$
- [D] $O(m \log n)$

42. Which parsing approach can naturally handle ambiguous grammars by producing multiple parse trees simultaneously?

- [A] LL(1) parsing
- [B] LR(1) parsing
- [C] GLR parsing
- [D] Operator-precedence parsing



43. In an S-attributed definition, attributes can be evaluated during

- [A] bottom-up parsing only
- [B] top-down parsing only
- [C] both top-down parsing and bottom-up parsing
- [D] semantic analysis phase only

44. How does a stack link in an activation record help in accessing non-local variables?

- [A] By pointing to the global data segment
- [B] By pointing to the caller's activation record
- [C] By pointing to the lexically enclosing procedure's activation record
- [D] By pointing to the heap memory

45. Which intermediate code form best supports complex control flow like loops and conditionals?

- [A] Three-address code with jumps
- [B] High-level source code
- [C] Linear quadruples without jumps
- [D] Assembly code

46. When targeting a RISC architecture with few registers, which technique reduces load/store instructions?

- [A] Instruction scheduling
- [B] Register allocation by graph coloring
- [C] Dead code elimination
- [D] Lexical analysis

47. Partial Redundancy Elimination (PRE) differs from Common Subexpression Elimination (CSE) because it

- [A] only optimizes arithmetic operations
- [B] removes redundancy that occurs on some but not all execution paths
- [C] requires data flow analysis only on basic blocks
- [D] is a lexical analysis technique

48. Which data structure is most efficient for implementing the symbol table in lexical analysis?

- [A] Array
- [B] Linked list
- [C] Hash table
- [D] Stack

49. In LR parsing, the "shift/reduce" conflict occurs because

- [A] the parser cannot decide whether to shift the next input or reduce a production
- [B] the parser always reduces first
- [C] the parser cannot handle left recursion
- [D] the grammar is ambiguous

50. Which activation record field is essential for implementing recursion?

- [A] Return address
- [B] Static link
- [C] Dynamic link
- [D] Parameters

51. In an ER diagram, if a weak entity depends on multiple identifying entities, then how is its key defined?

- [A] It has a simple primary key unrelated to owners
- [B] It uses a composite key including partial keys of all owners
- [C] It uses foreign keys only
- [D] It does not have a key

52. Which relational algebra operation can be expressed entirely using natural join and projection?

- [A] Selection
- [B] Union
- [C] Division
- [D] Difference



53. In Tuple Relational Calculus, what does the following formula represent?

$$\{t \mid \exists s(R(s) \wedge s[A] = t[A] \wedge s[B] > 10)\}$$

- [A] All tuples t such that t is in R
- [B] Tuples t sharing attribute A with some tuple s having $B > 10$
- [C] Tuples s where attribute $B > 10$
- [D] Tuples t with $B > 10$

54. Which constraint type can ensure that an employee's salary is always greater than their department's average salary?

- [A] Key constraint
- [B] Domain constraint
- [C] Assertion (general constraint)
- [D] Foreign key constraint

55. Which normal form is violated if a non-key attribute determines another non-key attribute?

- [A] 1 NF
- [B] 2 NF
- [C] 3 NF
- [D] BCNF

56. Which SQL clause is necessary to remove duplicates from the result of a SELECT statement?

- [A] WHERE
- [B] GROUP BY
- [C] DISTINCT
- [D] HAVING

57. Which file organization is most suitable for range queries on a large dataset?

- [A] Heap file
- [B] Sorted file
- [C] Hash file
- [D] Indexed sequential file

58. Which property uniquely distinguishes a B^+ tree from a B tree?

- [A] Only B^+ trees keep all keys in internal nodes
- [B] Only B^+ trees store keys only in leaf nodes, with leaves linked sequentially
- [C] B -trees support only binary search
- [D] B^+ trees are unbalanced

59. Which property of transactions guarantees that if a transaction commits, its effects persist despite system crashes?

- [A] Atomicity
- [B] Consistency
- [C] Isolation
- [D] Durability

60. In two-phase locking (2PL), what happens if a transaction releases a lock before acquiring all others?

- [A] It follows strict 2PL
- [B] It can cause cascading aborts
- [C] It violates 2PL and may lead to non-serializable schedules
- [D] It improves concurrency without risk

61. Which technique is most effective to uncover tacit requirements that users may find hard to express explicitly?

- [A] Questionnaire
- [B] Observation
- [C] Document analysis
- [D] Interviews

62. In feasibility analysis, which aspect assesses whether the system will be accepted by users?

- [A] Technical feasibility
- [B] Operational feasibility
- [C] Economic feasibility
- [D] Legal feasibility

63. What does a data stored symbol in a DFD represent?

- [A] A process transforming data
- [B] An external entity interacting with the system
- [C] A repository where data is held temporarily or permanently
- [D] A data flow between processes

64. Which technique is best suited for specifying complex process logic in software design?

- [A] Structured English
- [B] Data dictionary
- [C] Decision tables
- [D] Entity-relationship diagrams



65. Which principle primarily improves user efficiency in input form design?

- [A] Consistency
- [B] Data validation
- [C] Minimizing keystrokes
- [D] Color coding

66. Which software development lifecycle model allows returning to previous phases even late in the project?

- [A] Waterfall model
- [B] V-model
- [C] Spiral model
- [D] Prototype model



67. In project management, what does the Critical Path Method (CPM) primarily determine?

- [A] Total cost of the project
- [B] Longest sequence of dependent tasks that determines project duration
- [C] Number of resources required
- [D] Stakeholder communication plan

68. What is the main advantage of modular design in software engineering?

- [A] Faster coding
- [B] Reduced documentation
- [C] Improved maintainability and reuse
- [D] Simpler user interfaces

69. Which testing technique focuses on the internal logic of the software rather than its functionality?

- [A] Black-box testing
- [B] Beta testing
- [C] White-box testing
- [D] System testing

70. Which type of maintenance involves modifying software to improve performance or maintainability without changing functionality?

- [A] Corrective maintenance
- [B] Adaptive maintenance
- [C] Perfective maintenance
- [D] Preventive maintenance

71. Which layering model explicitly separates connection establishment from data transfer in the transport layer?

- [A] OSI model
- [B] TCP/IP model
- [C] Hybrid layering model
- [D] None of the above

72. In Ethernet's CSMA/CD, what happens immediately after a collision is detected?

- [A] The stations continue transmitting
- [B] Stations stop transmitting and wait for a random backoff time
- [C] Stations reset their hardware
- [D] Stations broadcast a collision message

73. Which error control protocol ensures in-order, reliable delivery with minimal retransmissions?

- [A] Stop-and-wait ARQ
- [B] Go-Back-N ARQ
- [C] Selective Repeat ARQ
- [D] None of the above

74. In packet switching, what is the primary cause of packet delay in a congested network?

- [A] Propagation delay
- [B] Transmission delay
- [C] Queuing delay
- [D] Processing delay

75. Which IPv6 feature eliminates the need for Network Address Translation (NAT)?

- [A] Larger address space
- [B] Header simplification
- [C] Multicast support
- [D] Stateless address auto configuration (SLAAC)

76. What is a key advantage of link-state routing over distance vector routing?

- [A] Simpler implementation
- [B] Faster convergence and avoidance of routing loops
- [C] Requires less memory
- [D] Uses periodic broadcasts only

77. In link-state routing protocols, how does the use of Dijkstra's algorithm contribute to consistent routing across the network?

- [A] It prioritizes routes with the least number of hops
- [B] It relies on random updates to avoid predictability
- [C] It computes a complete map of the network and selects shortest paths deterministically
- [D] It discards outdated topology information aggressively to save memory

78. Which TCP congestion control phase rapidly increases the congestion window to probe available bandwidth?

- [A] Slow start
- [B] Congestion avoidance
- [C] Fast recovery
- [D] Timeout

79. Which protocol uses a push mechanism to send emails from client to server?

- [A] POP
- [B] SMTP
- [C] FTP
- [D] DNS



80. Which component in Public Key Infrastructure (PKI) binds a public key to an identity?

- [A] Firewall
- [B] Digital certificate
- [C] Digital signature
- [D] Symmetric key

81. Which HTML5 element is specifically designed to hold navigation links?

- [A] <nav>
- [B] <section>
- [C] <article>
- [D] <aside>

82. Which XML feature allows defining custom data types and enforcing structure on XML documents?

- [A] XML Schema (XSD)
- [B] DTD
- [C] XPath
- [D] XSLT

83. Which statement about client-server architecture is **true**?

- [A] The server initiates communication with clients
- [B] Clients store all data locally
- [C] Servers provide centralized resources accessible by multiple clients
- [D] Clients directly communicate with each other

84. Which of the following is **not** a typical use of client-side scripting?

- [A] Form validation
- [B] Dynamic content update
- [C] Database queries
- [D] User interface effects

85. What role does the JDBC Driver Manager play in JDBC architecture?

- [A] Manages database connection pooling
- [B] Loads and registers JDBC drivers
- [C] Executes SQL statements
- [D] Manages transactions

86. Which method of a HttpServlet class handles HTTP POST requests?

- [A] doGet()
- [B] doPost()
- [C] service()
- [D] init()

87. Which JSP element allows embedding Java code directly inside HTML?

- [A] <jsp:useBean>
- [B] <%! %>
- [C] <% %>
- [D] <jsp:scriptlet>

88. In a three-tier architecture, what is the main function of the middle tier?

- [A] Present data to users
- [B] Handle business logic and processing
- [C] Store persistent data
- [D] Manage network connections

89. Which type of JDBC statement allows execution of parameterized queries?

- [A] Statement
- [B] PreparedStatement
- [C] CallableStatement
- [D] ResultSet



90. Which servlet lifecycle method is called only once during servlet initialization?

- [A] service()
- [B] destroy()
- [C] init()
- [D] doGet()

91. IPv6 uses broadcast to communicate with all hosts in the network.

- [A] True, because IPv6 extends broadcast from IPv4
- [B] False, because IPv6 eliminates broadcast and uses multicast instead
- [C] True, because broadcast is required for ARP
- [D] False, because IPv6 uses only unicast communication

92. A firewall can block traffic based on source IP, destination port and application protocol.

- [A] True, because firewalls operate at multiple layers of the OSI model
- [B] False, because firewalls only filter based on IP address
- [C] False, because application protocols are encrypted
- [D] True, but only at the physical layer

93. In the ER-model, a multivalued attribute can be represented directly within a single relation in the relational model.
- [A] True, because relational databases support arrays and lists
 - [B] False, because multivalued attributes must be decomposed into separate relations
 - [C] False, because ER models don't allow multivalued attributes
 - [D] True, because multivalued attributes map to a single foreign key
94. In B^+ trees, all actual data records are stored only at the leaf level.
- [A] True, because internal nodes contain only keys and pointers
 - [B] False, because data is distributed across all levels
 - [C] False, because B^+ trees store indexes and data together in internal nodes
 - [D] False, because B^+ trees are used only for memory indexing
95. In C, when dynamic memory is allocated using `malloc()`, the memory is initialized to zero by default.
- [A] True, because `malloc()` guarantees zero-initialized memory
 - [B] False, because `malloc()` allocates uninitialized memory
 - [C] False, because memory in C is always garbage-filled
 - [D] True, because all heap memory is cleared by the OS
96. In C++, a class with at least one pure virtual function cannot be instantiated.
- [A] True, because it is an abstract class
 - [B] False, because constructors allow instantiation
 - [C] False, because the class can still inherit from interfaces
 - [D] True, because such classes are template-based
97. In C, the expression `arr[i]` is exactly equivalent to `*(arr + i)` for arrays.
- [A] False, because pointer arithmetic and indexing are different
 - [B] True, because array indexing is defined as pointer offset
 - [C] False, because `arr[i]` requires contiguous memory
 - [D] True, but only when $i = 0$
98. In C++, constructor overloading is an example of runtime polymorphism.
- [A] True, because constructors are virtual
 - [B] False, because overloading is resolved at compile time
 - [C] True, because constructors can be overridden
 - [D] False, because constructors can't be overloaded
99. In XML, attribute values can contain multiple nested elements to represent complex data hierarchies.
- [A] True, because XML attributes support embedded tags
 - [B] False, because attributes can only hold simple text values, not nested elements
 - [C] True, because XML schema defines nested attributes
 - [D] False, because nested elements must be inside CDATA sections
100. The Boolean expression $(A + B)(A + B')(A + B)$ simplifies to A .
- [A] True
 - [B] False
 - [C] True, only if $B = 1$
 - [D] False, it simplifies to $A + B$



SPACE FOR ROUGH WORK



FINAL ANSWER KEY OF
ARUNACHAL ENGINEERING SERVICE
(RECRUITMENT TEST) EXAMINATION-2025
COMPUTER ENGINEERING
SET- A

Q NO.	ANS
1	D
2	B
3	B
4	B
5	C
6	C
7	D
8	B
9	A
10	C
11	A
12	C
13	C
14	B
15	D
16	B
17	B
18	D
19	A
20	A
21	B
22	D
23	C
24	C
25	C

Q NO.	ANS
26	B
27	B
28	C
29	C
30	C
31	B
32	B
33	C
34	C
35	B
36	B
37	C
38	D
39	A
40	D
41	B
42	C
43	A
44	C
45	A
46	B
47	B
48	C
49	A
50	C

Q NO.	ANS
51	B
52	C
53	B
54	C
55	C
56	C
57	D
58	B
59	D
60	C
61	B
62	B
63	C
64	C
65	C
66	C
67	B
68	C
69	C
70	C
71	A
72	B
73	C
74	C
75	A

Q NO.	ANS
76	B
77	B
78	A
79	B
80	B
81	A
82	A
83	C
84	C
85	B
86	B
87	C
88	B
89	B
90	C
91	B
92	A
93	B
94	A
95	B
96	A
97	B
98	B
99	B
100	A