DO NOT OPEN THE SEAL UNTIL INSTRUCTED TO DO SO

Series : **a**

Question Booklet No.

600189

Invigilator's Signature

ESE/25/RT/CME/2025

COMPUTER ENGINEERING

Candidate's Signature

Time : 3 Hours **Maximum Marks : 200**

ROLL NO. | | | | | | |

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DO NOT OPEN THE SEAL UNTIL INSTRUCTED TO DO SO

1. What is the base-16 representation of the decimal number 43981?

[A] AABD

[B] ABAD

[C] AB1D

[D] ABCD

2. A hamming code can correct

[A] all double-bit errors

[B] all single-bit errors

[C] all burst errors

[D] all even parity errors

3. What is the output of the expression $(A + !(B.C)) + D$ when $A = 1$, $B = 0$, $C = 1$ and $D = 0$?

[A] 0

[B] 1

[C] Undefined

[D] Depends on gate delay

4. Which of the following is equivalent to $A + A'B$?

[A] B

[B] $A + B$

[C] $A' + B$

[D] $A \oplus B$

5. A 5-variable K-map has 32 cells. What is the maximum number of non-overlapping prime implicants possible?

[A] 6

[B] 10

[C] 16

[D] 32

6. In a 4-bit ripple carry adder, the worst-case delay is proportional to

[A] constant time

[B] $\log_2(n)$

[C] n

[D] n^2

7. A 16 : 1 multiplexer can be constructed using how many 4 : 1 multiplexers (minimum)?

[A] 2

[B] 3

[C] 4

[D] 5

8. A JK flip-flop is in toggle mode. If clock has frequency 4 MHz, then output frequency is

[A] 1 MHz

[B] 2 MHz

[C] 4 MHz

[D] 8 MHz

9. What is the IEEE 754 32-bit representation of –5.75?

[A] 11000000101110000000000000000000

[B] 10111111101110000000000000000000

[C] 11000000101100000000000000000000

[D] 11000000101111000000000000000000

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 → Undo operation, Stack → Routing, Hash Table → Sorting, Graph → Stack reversal

[B] Queue → Printer scheduling, Stack → Undo operation, Hash Table → Constant time search, Graph → Route navigation

[C] Queue → Binary Tree traversal, Stack → Recursion optimization, Hash Table → Tree traversal, Graph → Heap usage

[D] Queue → File encryption, Stack → Tree navigation, Hash Table → Memory allocation, Graph → 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-Bank-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 ink-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 $(A+B)$ $(A+B')$ $(A+B)$ $(A+B')$ simplifies to A.

[A] True

[B] False

[C] True, only if $B=1$

[D] False, it simplifies to $A+B$

SPACE FOR ROUGH WORK

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

Q NO.	ANS
1	D
2	B
3	A
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