

A1

VERSION
CODE

ELIGIBILITY EXAMINATION-2025

PAPER-2

Total Number of Questions : 100

Maximum Marks : 200

Subject : COMPUTER SCIENCE & APPLICATIONS

Subject Code : 24

Serial
Number :

MENTION YOUR REGISTER NUMBER

Paper
Code

CSA21125A

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1. Given $(\neg P \vee Q) \wedge (P \vee Q)$, which of the following mathematical logics is considered as equivalent?

(1) Q	(2) $P \wedge Q$
(3) P	(4) $\neg Q$

2. Match the following terms with their definitions:

a. Well-ordered Set	(i) A set where every pair of elements are comparable
b. Partial-ordered Set	(ii) Every non-empty subset has a least element
c. Totally-ordered Set	(iii) A set where every pair of elements not necessarily to be comparable
d. Empty Set	(iv) A set with no elements

(1) a – ii, b – iii, c – i, d – iv	(2) a – ii, b – i, c – iii, d – iv
(3) a – ii, b – iii, c – iv, d – i	(4) a – iv, b – iii, c – ii, d – i

3. Given $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$, Let $A = \{1, 2, 3, 4, 5\}$; $B = \{1, 2, 4, 8\}$; $C = \{1, 2, 3, 5, 7\}$ and $D = \{2, 4, 6, 8\}$. Determine $(A \cup B) - (C \cap D)$.

(1) $\{1, 3, 5, 7, 9, 10\}$	(2) $\{1, 3, 4, 5, 6, 7, 8, 9, 10\}$
(3) $\{1, 2, 3, 4, 5, 8\}$	(4) $\{1, 3, 4, 5, 8\}$

4. What is the probability of an odd sum when two dice are rolled?

(1) $12/36$	(2) $18/36$
(3) $24/36$	(4) $9/12$

5. A party of n persons sit at a round table, find the odd against two specific individuals sitting next to each other.

(1) $(n - 3) : 2$	(2) $(n - 3) : 8$
(3) $(n + 3) : 4$	(4) $(n + 3) : 16$

6. Consider a connected, undirected graph $G = (V, E)$ where $|V| = n$ and $|E| = m$. Which of the following statements must be true for a spanning tree of G ?
 - a. A spanning tree of G will always have exactly $m - n + 1$ edges
 - b. Any subgraph of G with exactly $n - 1$ edges is guaranteed to be a spanning tree
 - c. The number of spanning trees in G can be computed using Kirchhoff's matrix tree theorem
 - d. A spanning tree of G is always unique for any given graph

(1) (b) and (d) are correct	(2) only (c) is correct
(3) only (a) is correct	(4) (a) and (d) are correct

7. Let G be a group defined by $a * b = (ab/2)$; where the elements of G are nonzero real numbers. The solution of $3 * x = 4$ is given by

(1) $8/3$	(2) $-4/5$
(3) $-3/8$	(4) $4/3$

8. For a given Boolean expression, $F = X.Y.Z + X.Y.\bar{Z} + X.Y.Z + \bar{X}.Y$, the simplified Boolean expression is
- (1) $\bar{X}$ (2) Y
(3) $\bar{X} + Y$ (4) $X + \bar{Z}$
9. Consider a weighted complete graph G on the vertex set $\{V_1, V_2, V_3, V_4, \dots, V_n\}$ such that the weight of the edge (V_i, V_j) is $2|i - j|$. The weight of minimum spanning tree of G is
- (1) $n^2 - 1$ (2) $n^2/2$
(3) $2n - 2$ (4) n^2
10. For given $U = \{1, 2, 3, 4, \dots, 10\}$, Let $A = \{1, 2, 3, 4, 5\}$; $B = \{1, 2, 4, 8\}$; $C = \{1, 2, 3, 5, 7\}$ and $D = \{2, 4, 6, 8\}$. Determine the following $\overline{C \cup D}$.
- (1) $\{1, 3, 5, 7, 9, 10\}$ (2) $\{1, 3, 4, 5, 6, 7, 8, 9, 10\}$
(3) $\{1, 2, 3, 4, 5, 8\}$ (4) $\{1, 3, 4, 5, 8\}$
11. The decimal equivalent of the hexadecimal number F3E is
- (1) 8530 (2) 8544
(3) 3902 (4) 3888
12. Match the following :
- | List - I | List - II |
|----------|--|
| a. MAR | (i) Holds the address of the next instruction to fetch |
| b. MBR | (ii) Holds the instruction for decoding |
| c. IR | (iii) Holds the address of instruction or data |
| d. PC | (iv) Holds the data |
- (1) a - iii, b - iv, c - i, d - ii (2) a - iv, b - iii, c - i, d - ii
(3) a - iii, b - iv, c - ii, d - i (4) a - iv, b - iii, c - ii, d - i
13. "Sequential portion of the program does not change with respect to machine size, however, the parallel portion is evenly executed by 'n' processors results in a reduced time" is
- (1) Moore's Law (2) Flynn's Law
(3) Banker's Law (4) Amdahl's Law
14. The first machine cycle of an instruction is always a _____ cycle.
- (1) Memory read (2) Fetch
(3) I/O read (4) Memory write
15. If the operand is given explicitly in the instruction, the addressing mode is called
- (1) Immediate (2) Absolute
(3) Direct (4) Indirect

16. Consider cache with 128 blocks of 16 words, and main memory has 4096 blocks of 16 words, and assume 64 sets for the Set Associate Mapping. Match the addressing scheme for cache memory mapping :

- | | |
|--|--|
| a. Direct mapping | (i) 12 bit for tag and 4 bit for word |
| b. Associate mapping | (ii) 6 bit for tag, 6 bit for set and 4 bit for word |
| c. Set associate mapping | (iii) 5 bit for tag, 7 bit for block and 4 bit for word |
| (1) $a \rightarrow i, b \rightarrow ii, c \rightarrow iii$ | (2) $a \rightarrow iii, b \rightarrow ii, c \rightarrow i$ |
| (3) $a \rightarrow ii, b \rightarrow iii, c \rightarrow i$ | (4) $a \rightarrow iii, b \rightarrow i, c \rightarrow ii$ |

17. Match the following:

List-I

- a. Temporal locality of reference
- b. Spatial locality of reference
- c. Sequential locality of reference

- (1) $a - i, b - iii, c - ii$
- (3) $a - ii, b - iii, c - i$

List-II

- (i) If an instruction is executed now, more likely the instruction will be executed in future
- (ii) Instructions are executed one after the other
- (iii) If a group of instructions referred now, more likely that group of instructions will be referred in future

- (2) $a - iii, b - i, c - ii$
- (4) $a - ii, b - i, c - iii$

18. Match the following:

List-I

- a. DRAM
- b. DMA
- c. Associative mapping
- d. Memory-mapped I/O

- (1) $a - i, b - ii, c - iii, d - iv$
- (3) $a - iii, b - iv, c - ii, d - i$

List-II

- (i) Offloads data transfer main memory to devices bypassing CPU
- (ii) Dynamic memory
- (iii) I/O devices treated as memory locations
- (iv) Flexible cache mapping by content

- (2) $a - ii, b - i, c - iv, d - iii$
- (4) $a - iv, b - iii, c - i, d - ii$

19. In the absence of data and control hazards, the k-unit instruction unit pipeline with n instructions has speed up

- | | |
|--------------------------|--------------------------|
| (1) $nk / (k + (n - 1))$ | (2) $(k + (n - 1)) / nk$ |
| (3) $nk / ((k - 1) * n)$ | (4) $k + n / (nk)$ |

20. Consider the following statements regarding the interconnection topology.

- i. In star topology, if the master node is dead, the other nodes (processor) can still interact with each other.
- ii. In bus topology, only two processors can interact with each other at any one given point in time.
- iii. In hyper cube topology, two nodes are connected if there is change in two bits in their processor identity (processor id)

(1) (i) is true, (ii) and (iii) are false

(2) (i) and (ii) are true, (iii) is false

(3) (ii) is true, (i) and (iii) are false

(4) (i) and (iii) are true, (ii) is false

21. Match the following:

File Extension

- a. .wav
- b. .pdf
- c. .pcd
- d. .WMV

File Format

- (i) structured
- (ii) image
- (iii) video
- (iv) audio

(1) a – iv, b – i, c – ii, d – iii

(2) a – iii, b – ii, c – i, d – iv

(3) a – iii, b – i, c – ii, d – iv

(4) a – ii, b – i, c – iv, d – iii

22. What is the output of the following code snippet?

Public class Test

```
{
    Public int getData ()    || get data () 1
    {
        return 0;
    }
    Public long getData () || get data () 2
    {
        return 1;
    }
    Public static void main (string [] args)
    {
        Test t = new Test () ;
        System.out.println(t). getData();
    }
}
```

(1) 1

(2) 0

(3) Run time error

(4) Compilation error

23. What is the role of linker in compilation?

- (1) Translates source code to object code
- (3) Combines different compiled modules

- (2) Generates intermediate code
- (4) Performs code optimization

24. What will be the output of the following code snippet?

```
#include <stdio.h>

void solve ()
{
    int x=2;
    Printf ("% d ", (x<< 1) + (x>>1));
}

int main ()
{
    solve ();
    return 0;
}
```

(1) 5

(2) 4

(3) 2

(4) 1

25. What is the output of the following program?

```
#include <stdio.h>

int main ()
{
    struct emp
    {
        char name [20];
        int age;
        float sal;
    };

    struct emp e = {"computer", 0, 0};
    printf ("%d \t % f ", e.age, e.sal);
    return 0;
}
```

(1) Compiler error

(2) Computer, 0, 0.000000

(3) 0 0.000000

(4) 1 0.000000 computer

26. What is the output of the following code?

```
#include <stdio.h>

union u1
{
    int x;
    char y;
};

union u2
{
    int a[10];
    char y1;
};

int main (){
    printf("size of u1 = %ld/t", sizeof (union u1));
    printf("size of u2 = %ld", sizeof (union u2));
    return 0;
}
```

(1) 2, 20

(2) 4, 40

(3) 2, 40

(4) 4, 20

27. A 16×16 array having only black and white pixels could be represented by _____

(1) 32 bytes

(2) 64 bytes

(3) 96 bytes

(4) 128 bytes

28. Which of the following matrix represents a 2D rotation by an angle θ ?

(1) $\begin{pmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{pmatrix}$

(2) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

(3) $\begin{pmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{pmatrix}$

(4) $\begin{pmatrix} \sin \theta & \cos \theta \\ \cos \theta & -\sin \theta \end{pmatrix}$

29. How much memory is required to implement a z-buffer for a 512×512 image with 24-bit depth?

(1) 1 MB

(2) 1.5 MB

(3) 500 KB

(4) 768 KB

30. Given 3D-triangle with co-ordinate points A(3, 4, 1), B(6, 4, 2) and C(5, 6, 3). Apply the reflection on the XY plane and find out new co-ordinates of the object.

(1) A (3, 4, -1), B (6, 4, -2) and C (5, 6, -3)

(2) A (3, -4, 1), B (6, -4, 2) and C (5, -6, 3)

(3) A (-3, 4, 1), B (-6, 4, 2) and C (-5, 6, 3)

(4) A (3, 4, 1), B (6, 4, -2) and C (-5, 6, 3)

24

- ## A1

36. Match the following:

List-I

- a. BCNF iff
- b. 5 NF iff
- c. 1 NF iff
- d. 4 NF iff

- (1) a – iii, b – ii, c – i, d – iv
- (3) a – iv, b – i, c – iii, d – ii

List-II

- (i) every JD is implied by the candidate keys
- (ii) every MVD is implied by the candidate keys
- (iii) all underlying domains contain scalar values only
- (iv) every FD is implied by the candidate keys

- (2) a – iv, b – i, c – ii, d – iii
- (4) a – iv, b – iii, c – ii, d – i

37. Match the following:

List-I

- a. Data warehouse
- b. Data mining
- c. OLAP
- d. Aggregation

- (1) a – ii, b – iii, c – iv, d – i
- (3) a – iii, b – iv, c – ii, d – i

List-II

- (i) which allows users to analyse data from multiple database systems at once
- (ii) is the summarization of fact related data
- (iii) central repository of information that can be analyzed to make more informed decisions
- (iv) is a process used to discover patterns and relationships in datasets

- (2) a – iii, b – iv, c – i, d – ii
- (4) a – iii, b – ii, c – iv, d – i

38. Which of the following refers to the problem of finding abstracted patterns (structures) in the unlabelled data?

- (1) Supervised learning
- (3) Hybrid learning

- (2) Unsupervised learning
- (4) Reinforcement learning

39. Match the following relation R and S:

List-I

- a. Theta Join
- b. Equi Join
- c. Left outer Join
- d. Right outer Join

- (1) a – iv, b – iii, c – i, d – ii
- (3) a – iii, b – iv, c – i, d – ii

List-II

- (i) If no matching tuples found in S, then the attributes of S are filled with NULL
- (ii) If no matching tuples found in R, then the attributes of R are filled with NULL
- (iii) Combinations of tuples of R and S that satisfies join condition
- (iv) Combinations of tuples of R and S that satisfies equality comparisons

- (2) a – iv, b – iii, c – ii, d – i
- (4) a – iii, b – iv, c – ii, d – i

40. Given the following entries of a table:

State_tb	State_id	Region	Population
	UP	N	28
	MP	N	08
	KAR	S	06
	TN	S	07

the SQL statement

SELECT Sum (Population)

FROM State_tb

GROUP By Region;

- (1) is syntactically wrong
- (2) gives total sum of population of all the regions
- (3) gives sum of population of S and N separately
- (4) gives population of each state

41. In the process of macro expansion given:

S_1 : lexical substitution implies replacement of a character string by another string during program generation

S_2 : lexical substitution is employed to replace occurrences of formal parameters by some random values

Which of the following holds good?

- (1) Both S_1 and S_2 are true
- (2) Both S_1 and S_2 are false
- (3) S_1 is false and S_2 is true
- (4) S_1 is true and S_2 is false

42. Consider a single processor system with four processes A, B, C and D represented as given below, where for each process the first value is its arrival time and second value is its CPU burst time
A(0, 10), B(2, 6), C(4, 3) and D(6, 7)

Which of the following options gives the average waiting time when preemptive Shortest Remaining Time First (SRTF) and the Non-Preemptive Shortest Job First (NP-SJF) CPU scheduling algorithms are applied to the process?

- (1) SRTF = 6 NP-SJF = 7
- (2) SRTF = 6 NP-SJF = 7.5
- (3) SRTF = 7 NP-SJF = 7.5
- (4) SRTF = 7 NP-SJF = 8.5

43. Match the following:

List-I

- a. Critical region
- b. Wait signal
- c. Working set
- d. Deadlock

List-II

- (i) Hoarse's monitor
- (ii) Mutual exclusion
- (iii) Principle of locality
- (iv) Circular wait

- (1) a – iv, b – i, c – iii, d – ii
- (3) a – i, b – ii, c – iii, d – iv

- (2) a – ii, b – i, c – iii, d – iv
- (4) a – iv, b – iii, c – i, d – ii

44. In a system using paging with Translation Lookaside Buffer (TLB), what will be the Effective Memory Access Time (EMAT), if the memory access time is 100 ns, TLB access time is 20 ns, and the TLB hit ratio is 80%?

Assume TLB hit requires one memory access and TLB miss requires two.

- (1) 120 ns
- (2) 140 ns
- (3) 160 ns
- (4) 180 ns

45. Match the following with respect to various memory management:

List-I

- a. Demand paging
- b. Segmentation
- c. Dynamic partitions
- d. Fixed partitions

List-II

- (i) Degree of multiprogramming
- (ii) Working set
- (iii) Supports user view of memory
- (iv) Compaction

- (1) a – ii, b – iv, c – iii, d – i
- (2) a – ii, b – iii, c – i, d – iv
- (3) a – iv, b – iii, c – ii, d – i
- (4) a – ii, b – iii, c – iv, d – i

46. Which of the following is not correct about the virtual memory management?

- (1) It is not necessary to load all of the segments of a process
- (2) It has no internal fragmentation
- (3) It has large virtual address space
- (4) It provides lower degree of multiprogramming

47. Match the following:

List-I

- i. Kernel
- ii. Belady's anomaly
- iii. Paging
- iv. Free-space management

List-II

- (a) Ensures efficient storage utilization
- (b) Avoids external fragmentation
- (c) Provides basic low-level operations
- (d) Increase in the number of page frames leads to increase in the number of page faults

- (1) i – d, ii – c, iii – b, iv – a
- (3) i – c, ii – d, iii – b, iv – a

- (2) i – b, ii – d, iii – a, iv – c
- (4) i – b, ii – a, iii – d, iv – c

48. Match the following:

List-I

- i. Context switching
- ii. Semaphores
- iii. Process synchronization
- iv. Message passing

- (1) i – a, ii – b, iii – c, iv – d
- (3) i – c, ii – d, iii – b, iv – a

List-II

- (a) process communicate by sending and receiving messages
- (b) co-ordination of the execution of multiple processes sharing the resources
- (c) enables multiple processes to share a single CPU
- (d) helps to prevent race condition

- (2) i – b, ii – c, iii – d, iv – a
- (4) i – c, ii – d, iii – a, iv – b

49. Which of the following disk scheduling algorithms may result in starvation?

- (1) SCAN
- (2) LOOK
- (3) SSTF
- (4) C-SCAN

50. Match the following:

List-I

- i. User authentication
- ii. Firewalls
- iii. Access control
- iv. Encryption

- (1) i – b, ii – c, iii – d, iv – a
- (3) i – d, ii – a, iii – b, iv – c

List-II

- (a) controls incoming and outgoing traffic in a network
- (b) converts readable information into an unreadable format
- (c) process of verifying the identity of a user attempting to gain access to a computer network
- (d) authorizing the users to access the resources in a computer network

- (2) i – c, ii – a, iii – d, iv – b
- (4) i – c, ii – d, iii – a, iv – b

51. Arrange the component-based development process activities in the correct order:

- a. Requirement analysis
- b. Component qualification
- c. System design with reuse
- d. Component adaptation
- e. Component composition
- f. Component discovery
- g. System integration and testing

- (1) f, a, b, c, d, g, e
- (3) b, a, f, c, d, e, g

- (2) a, c, f, b, d, e, g
- (4) a, f, c, b, d, g, e

52. In a spiral model cycle, the probability of failure for each iteration due to risk is 10%. If there are 4 cycles, then what is the probability that the project completes all cycles without failure?

- (1) 0.6561
- (2) 0.9
- (3) 0.3439
- (4) 0.9999

53. Match the Agile practices with their corresponding principles or benefits:

a. Pair Programming

(i) Avoids integration issues by validating changes frequently in shared repositories.

b. Test-driven Development

(ii) Ensures correctness through automated specification before implementation.

c. Continuous Integration

(iii) Facilitates early problem discovery and real-time code review.

d. Refactoring

(iv) Improves internal code quality without altering external behaviour

(1) a→i, b→ii, c→iii, d→iv

(2) a→ii, b→iii, c→iv, d→i

(3) a→iv, b→i, c→ii, d→iii

(4) a→iii, b→ii, c→i, d→iv

54. Given below are two statements. One is labelled as Assertion and the other is labelled as Reason.

Assertion (A): High cohesion within a module and low coupling between modules result in increased maintainability and reusability of a software system.

Reason (R): High cohesion implies that each module performs multiple unrelated tasks, increasing its independence from other modules.

Choose the most appropriate answer from the following options.

(1) Both A and R are true, and R is the correct explanation of A

(2) Both A and R are true, but R is not the correct explanation of A

(3) A is true, but R is false

(4) A is false, but R is true

55. In basic path testing, the number of independent paths through the code is computed using cyclomatic complexity. Which of the following statements is correct regarding cyclomatic complexity?

(1) Cyclomatic complexity = number of nodes – number of edges + 1.

(2) Cyclomatic complexity provides an upper bound on the number of required performance tests.

(3) Cyclomatic complexity helps in identifying infeasible test cases for black-box testing.

(4) Cyclomatic complexity = $E - N + 2P$, where P is the number of connected components in the control flow graph.

56. Given below are two statements. One is labelled as Assertion and the other is labelled as Reason.

Assertion (A): White-box testing is essential for detecting logic errors that may not be exposed through black-box testing, especially in safety-critical systems such as avionics or medical devices.

Reason (R): White-box testing allows analysis of control structures including decision points, loops and internal data flow, ensuring thorough coverage of execution paths.

Choose the most appropriate answer from the options given below:

(1) Both A and R are true, and R is the correct explanation of A

(2) Both A and R are true, but R is not the correct explanation of A

(3) A is true, but R is false

(4) A is false, but R is true

57. Which of the following best describes the purpose of a Time-Line (Gantt) chart in project scheduling?
- (1) To define critical paths and slack times between tasks
 - (2) To graphically represent task dependencies with nodes and arrows
 - (3) To display resource availability across overlapping activities
 - (4) To map task durations along a horizontal time scale for visual tracking
58. Which of the following best captures the distinction between change control and version control in software configuration management?
- (1) Change control handles concurrent file updates, version control manages customer requirement changes.
 - (2) Change control deals with evaluating and approving changes, version control maintains the history and integrity of source artifacts.
 - (3) Change control is applied only during testing, version control is applied during development.
 - (4) Change control eliminates the needs, version control is applied in agile environments.
59. In object-oriented design, what is the primary purpose of information hiding?
- (1) Increase execution speed by avoiding modularization.
 - (2) Prevent subclassing and inheritance.
 - (3) Limit the exposure of internal module details to reduce system complexity and error propagation.
 - (4) Allow direct modification of all class members by other objects.
60. Assume a software team applies COCOMO II Early Design Model. If the system is later migrated to a cloud-native microservices architecture, then which cost driver becomes the most volatile and error-prone in recalculating effort?
- | | |
|-----------------------------------|-------------------------|
| (1) Product Complexity | (2) Platform Volatility |
| (3) Required Software Reliability | (4) Database Size |
61. Assume the following priorities in evaluating an expression (1) paranthesis (2) exponentiation (3) division and multiplication (4) addition and subtraction (5) assignment. What is the equivalent post-fix expression of the infix expression $a = b/c \wedge d * (e + f) - g/h$.
- (1) $a \ b \ c \ d \ \uparrow \ e \ f / + \ g \ h - * / =$
 - (2) $a \ b \ c \ d \ \uparrow / \ e \ f + * \ g \ h / - =$
 - (3) $a \ b \ c \ d \ \uparrow \ e \ f / * + \ g \ h / - =$
 - (4) $a \ b \ c \ d \ \uparrow \ e \ f / + * \ g \ h - / =$

66. Which one among the following is true about a binary tree?
- The indegree of the root is zero
 - The outdegree of a leaf node is zero
 - The maximum number of element a tree with depth d can have is $2^d - 1$
 - Is a subset of a graph
- (1) (a) and (c) are correct, (b) and (d) are false
 - (2) (a), (b) and (d) are correct, (c) is false
 - (3) (a), (b) and (c) are correct, (d) is false
 - (4) (a), (b), (c) and (d) are correct
67. The complexity of brute force algorithm to find all the substrings in a given string of 'm' characters and a substring of length 'n' (where $m \gg n$) is
- (1) $O(mn)$
 - (2) $O(m)$
 - (3) $O(n)$
 - (4) $O(mn^2)$
68. A model which uses the previously computed values for further computation is called
- (1) Greedy Algorithm
 - (2) Backtracking
 - (3) Branch and Bound
 - (4) Dynamic Programming
69. Match the following:
- | List-I | List-II |
|-------------------------|-------------------------|
| a. Prim's algorithm | (i) Dynamic Programming |
| b. Queen's problem | (ii) Divide and conquer |
| c. Quick sort | (iii) Greedy Algorithm |
| d. Binomial coefficient | (iv) Backtracking |
- (1) a - iii, b - iv, c - ii, d - i
 - (2) a - iii, b - iv, c - i, d - ii
 - (3) a - iii, b - ii, c - i, d - iv
 - (4) a - iv, b - ii, c - i, d - iii
70. In a multiprocessor environment, assume that there are $n = 8$ elements, and the number of processors given $N = 4$. If we use the Binary tree model to find the greatest of 'n' elements using parallel processing, then the time taken to find the greatest of 'n' elements is _____ (Assume the communication cost to be 0)
- (1) $O(\log_2 n)$
 - (2) $O(\log_2 N)$
 - (3) $O(N \log_2 n)$
 - (4) $O(n \log_2 N)$
71. Select the invalid paradox type from the following:
- (1) Falsidical
 - (2) Veridical
 - (3) Antinomy
 - (4) Opposidical

72. If the languages L and $\sim L$ are recursive enumerable, then L is
- (1) Regular
 - (2) Context-free
 - (3) Context-sensitive
 - (4) Recursive
73. A grammar is called ambiguous if
- (1) Two or more productions have the same non-terminal on the left-hand side.
 - (2) A derivation has more than one associated sentence
 - (3) A sentence having more than one derivation
 - (4) Productions having mostly terminal symbols
74. A context-sensitive language is accepted by
- (1) Finite automata
 - (2) Linear-bounded automata
 - (3) NFA
 - (4) DFA
75. Problems that can be solved in polynomial time are called
- (1) Tractable Problems
 - (2) Intractable Problems
 - (3) Decidable Problems
 - (4) Undecidable Problems
76. The time complexity of constructing an LR parser is _____, given $|n|$ is the size of the grammar.
- (1) $O(n)$
 - (2) $O(n \log n)$
 - (3) $O(2^{|n|})$
 - (4) $O(n^2)$
77. The grammar $S \rightarrow XYZ$
- Y.val = X.val
Y.val = S.val
Y.val = Z.val is
- (1) S-attributed Grammar
 - (2) L-attributed Grammar
 - (3) Neither S-attributed nor L-attributed Grammar
 - (4) Both S-attributed and L-attributed Grammar
78. Pick the right sequence of abstract machines according to their increasing order of the power.
- (1) $FA \rightarrow DPDA \rightarrow NDPDA \rightarrow TM$
 - (2) $FA \rightarrow NDPDA \rightarrow DPDA \rightarrow TM$
 - (3) $FA \rightarrow DPDA \rightarrow TM \rightarrow NDPDA$
 - (4) $TM \rightarrow DPDA \rightarrow NDPDA \rightarrow FA$
79. A symbol table in assembler contains
- (1) Mapping of variables and their memory addresses
 - (2) Program code and data
 - (3) Input and output instructions
 - (4) Machine instructions and opcodes.

80. Which of the following is not a common type of data flow analysis performed by compilers?
- (1) Constant propagation
 - (2) Dead code elimination
 - (3) Live variable analysis
 - (4) Type checking
81. A system transmits data at 1200 bytes per second using 4 bits per signal limit. What is the baud rate?
- (1) 2400 Baud
 - (2) 9600 Baud
 - (3) 38400 Baud
 - (4) 4800 Baud
82. _____ is a digital modulation technique where the amplitude of a carrier wave is varied in accordance with the digital data being transferred, while frequency and phase remain constant.
- (1) Amplitude shift keying
 - (2) Phase shift keying
 - (3) Frequency shift keying
 - (4) Quadrature amplitude modulation
83. The bandwidth of a noisy channel is 3000 Hz and whose signal to noise ratio is 3162. What will be the maximum data rate of the channel?
- (1) $\cong 37524$ bps
 - (2) $\cong 36523$ bps
 - (3) $\cong 35922$ bps
 - (4) $\cong 34890$ bps
84. A transmission uses CRC for error detection, the message is 1101011011 and the generator polynomial is $G(x) = x^4 + x + 1$. What will be appended at the end of the message?
- (1) 1111
 - (2) 1110
 - (3) 1101
 - (4) 1100
85. In a mesh topology with 100 devices, the number of physical connections required is _____.
- (1) 9900
 - (2) 4950
 - (3) 200
 - (4) 9801
86. If a file is encrypted and then transmitted over a network using TCP/IP, then which layer handles the encryption and which handles retransmission if the file is lost?
- (1) Application layer - Transport layer
 - (2) Presentation layer - Data link layer
 - (3) Session layer - Network layer
 - (4) Transport layer - Application layer

87. Match the following:

IP Address	Uses for
i. 0.0.0.0	(a) Documentation/examples (RFC 5737)
ii. 127.255.255.255	(b) Multicast address for all hosts on a subnet
iii. 192.0.2.0/24	(c) Unknown or default route address
iv. 224.0.0.1	(d) Local host loopback testing
(1) i – c, ii – d, iii – a, iv – b	(2) i – d, ii – a, iii – b, iv – c
(3) i – b, ii – c, iii – a, iv – d	(4) i – b, ii – a, iii – d, iv – c

88. In a columnar transposition cipher, the key is "LARGE". What will be the cipher text for the plain text "COMPUTERSCIENCE" (without space) using a simple columnar transposition?

- | | |
|---------------------|---------------------|
| (1) CTIOEEMRNPSCUCE | (2) MRNCTIPSCUCEOOE |
| (3) OEEUCEPSCCTIMRN | (4) CETMPOIRECUSENC |

89. In the RSA algorithm, let $N = P \times Q = 33$, and let the decryption key $D = 7$. If the ciphertext corresponds to the letter "E", determine the original plaintext letter.
(Assume $A = 1, B = 2, \dots, Z = 26$).

- | | |
|-------|-------|
| (1) S | (2) U |
| (3) N | (4) E |

90. Five channels, each with a 100 kHz bandwidth are to be multiplexed together. What is the minimum bandwidth of the link if there is a need for a guard band of 10 kHz between the channels to prevent interference?

- | | |
|-------------|-------------|
| (1) 500 kHz | (2) 540 kHz |
| (3) 550 kHz | (4) 100 kHz |

91. Determine which machine (M) passes the 'Turing Test', if it is subjected to 'imitation game'; conducted in 'Controlled Environment'.

- (1) M performs calculations quickly
- (2) M generates random responses
- (3) M identifies emotional intelligence
- (4) M engages in conversation without identified as non-human

92. Match the following 'Heuristic Search' with respect to "Hill climbing" Algorithm:

List-I	List-II
a. Steepest Ascent Hill Climbing	(i) Variant of "Generate and Test algorithm"
b. Hill Climbing Algorithm	(ii) Gradient search
c. Plateau	(iii) Area higher than surrounding
d. Ridge	(iv) Flat area of the search space
(1) a – ii, b – i, c – iv, d – iii	(2) a – i, b – iv, c – iii, d – ii
(3) a – i, b – ii, c – iii, d – iv	(4) a – iv, b – iii, c – ii, d – i

93. Relate the AI methodologies of knowledge representation in right match.

List-I

- a. NLP
- b. Representation in structured network
- c. Classes in ontology
- d. Expert system

- (1) a – iv, b – iii, c – ii, d – i
- (3) a – iii, b – iv, c – ii, d – i

List-II

- (i) Inference engine
- (ii) Abstract categories of related topics/concepts
- (iii) Semantic network
- (iv) Semantic analysis

- (2) a – iv, b – ii, c – iii, d – i
- (4) a – i, b – ii, c – iii, d – iv

94. If $f(x) = x$ is my friend, and $P(x) = x$ is perfect, then the correct logical translation of the statement "Some of my friends are not perfect" is _____.

- (1) $\forall x (f(x) \wedge \neg P(x))$
- (3) $\neg (f(x) \wedge \neg P(x))$

- (2) $\exists x (f(x) \wedge \neg P(x))$
- (4) $\exists x (\neg f(x) \wedge \neg P(x))$

95. Match the following List-I with List-II:

List-I

- a. Fuzzy system
- b. Expert system
- c. Genetic algorithm operator
- d. Supervised technique

- (1) a – iv, b – i, c – iii, d – ii
- (3) a – iii, b – iv, c – ii, d – i

List-II

- (i) Decision tree
- (ii) Inversion
- (iii) Inference engine
- (iv) Dendral

- (2) a – i, b – iv, c – ii, d – iii
- (4) a – ii, b – iii, c – i, d – iv

96. Given two Fuzzysets A and B with membership function $\mu_A(x) = \{0.6, 0.5, 0.1, 0.7, 0.8\}$.

$$\mu_B(x) = \{0.9, 0.2, 0.6, 0.8, 0.5\}.$$

Now calculate the value of $\mu(A \cup B)'(x)$.

- (1) $\{0.1, 0.5, 0.4, 0.2, 0.3\}$
- (2) $\{0.1, 0.5, 0.4, 0.2, 0.2\}$
- (3) $\{0.1, 0.5, 0.4, 0.3, 0.2\}$
- (4) $\{0.1, 0.5, 0.4, 0.3, 0.3\}$

97. Let the population of chromosomes in Genetic Algorithm is represented in terms of binary number. The strength of fitness of a chromosome in decimal form, x, is given by

$$Sf(x) = \frac{f(x)}{\sum f(x)} \text{ where } f(x) = x^2$$

And the population is given by P where

$$P = \{ (01101), (11000), (01000), (10011) \}$$

Calculate the strength of fitness of chromosome (11000).

- (1) 49.2%
- (2) 576.8%
- (3) 15.10%
- (4) 14.4%

98. Given a "feed forward" ANN with 'n' inputs, 'h' hidden units and 'm' outputs.

Compute how many trainable parameters (weights) are present in ANN, assuming there are no biases.

- | | |
|-----------------------------------|---------------------------|
| (1) $n + m \times h$ | (2) $n + h + m$ |
| (3) $(n \times h) + (h \times m)$ | (4) $n \times h \times m$ |

99. Match the following and choose the correct option:

- | Selection method | Noise level |
|------------------------------------|------------------------------------|
| i. Rank selection | (a) Higher Noise |
| ii. Tournament selection | (b) Lower Noise |
| iii. Roulette wheel | (c) No Noise |
| iv. Elitism | (d) Moderate to High |
| (1) i – c, ii – a, iii – b, iv – d | (2) i – b, ii – d, iii – a, iv – c |
| (3) i – a, ii – b, iii – c, iv – d | (4) i – d, ii – c, iii – b, iv – a |

100. The back propagation algorithm calculates the gradient of the 'Loss function' with respect to each weight in the network by which of the following mathematical techniques?

- | | |
|-------------------------|----------------------------|
| (1) Lagrange multiplier | (2) Gradient descent |
| (3) K means algorithm | (4) Chain rule of calculus |

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