राष्ट्रीय प्रौद्योगिकी संस्थान दिल्ली

NATIONAL INSTITUTE OF TECHNOLOGY DELHI

(शिक्षा मंत्रालय, भारत सरकार के अधीन एक स्वायत्त संस्थान)

(An autonomous Institute under the aegis of Ministry of Education (Shiksha Mantralaya), Govt. of India)

Plot No. FA7, Zone P1, GT Karnal Road, Delhi-110036, INDIA

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NOTICE

Advt. No. 08/ 2024: Answer Key and Representations Invited for the Domain

Knowledge Tests held on 17.02.2025

Position	Computer Science and Engineering: Assistant Professor Grade I (Pay Level 10) (On Contract Basis)
Date	17.02.2025 (Monday)
Examination Time	4:00 PM – 5:00 PM

Following is the attached answer key. If any appeared candidate for the domain knowledge test has any representations against the questions, may submit by filling up the following Google Form **on or before 20.02.2025 11:59 P**M. After that no representations will be considered.

Google Form Link:
https://docs.google.com/forms/d/e/1FAIpQLSdSL0LirlHEwHuM5H3WDc2ls6hztZlKe_SeUZG1XVxWfACQ7Q/viewform?usp=preview

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QUESTION PAPER FOR THE POST OF ASSISTANT PROFESSOR CSE
(PAY LEVEL 10)

Maximum Marks: 50   **Time: 60**
Minutes

Name of Candidate: _____ Roll No: _____

INSTRUCTIONS TO CANDIDATES

1. This question paper has 50 questions. Each question carries one mark. There are four choices for answer (A, B, C, D) to each question. Choose the correct answer (one only) for each question and write the answer in the space provided against each question.
2. Candidate must write Name, Roll No. and sign on each page of this booklet.
3. The candidate should check that the booklet does not have any unprinted or torn or missing pages or questions etc. If so, get it replaced with another question paper, before question paper starts.
4. One (1) mark will be awarded for each correct answer. There will be negative marking and (- ¼) mark will be awarded for each incorrect answer.
5. The unanswered questions will not attract negative marking
6. Return the Question Paper cum Answer Sheet to the invigilator after the examination is over.
7. **Mobile, Electronic Watch** and other **Electronic Gadgets** are prohibited in the examination.
8. There should not be any cutting or overwriting in the Answer.
9. Use of Unfair Means in Examination will lead to cancellation of candidature.

अभ्यर्थियों के लिए अनुदेश

1. इस प्रश्न पत्र में 50 प्रश्न हैं. प्रत्येक प्रश्न एक अंक का है। प्रत्येक प्रश्न के उत्तर के लिए चार विकल्प (A, B, C, D) हैं। प्रत्येक प्रश्न के लिए सही उत्तर (केवल एक) चुनें और प्रत्येक प्रश्न के सामने दिए गए स्थान पर उत्तर लिखें।
2. अभ्यर्थी को इस पुस्तिका के प्रत्येक पृष्ठ पर अपना नाम, रोल नंबर लिखना होगा तथा हस्ताक्षर करना होगा।
3. अभ्यर्थी को यह जांचना चाहिए कि पुस्तिका में कोई भी बिना छपा हुआ या फटा हुआ या गायब पृष्ठ या प्रश्न आदि नहीं है। यदि ऐसा है, तो प्रश्न पत्र शुरू होने से पहले इसे दूसरे प्रश्न पत्र से बदल लें।
4. प्रत्येक सही उत्तर के लिए एक (1) अंक दिया जाएगा। नकारात्मक अंकन होगा और प्रत्येक गलत उत्तर के लिए (- ¼) अंक दिया जाएगा।
5. अनुत्तरित प्रश्न नकारात्मक अंकन को आकर्षित नहीं करेंगे
6. परीक्षा समाप्त होने के बाद प्रश्न पत्र सह उत्तर पुस्तिका पर्यवेक्षक को लौटा दें।
7. मोबाइल, इलेक्ट्रॉनिक घड़ी और अन्य इलेक्ट्रॉनिक गैजेट्स परीक्षा में वर्जित हैं.
8. उत्तर में कोई कटिंग या ओवरराइटिंग नहीं होनी चाहिए.

10. The disjunctive normal form of $P \wedge (P \rightarrow Q)$ is

  a) $(P \vee \neg P) \wedge (P \wedge Q)$

  b) $(P \vee \neg P) \wedge (P \vee Q)$

  c) $(P \wedge Q)$

  d) $(P \wedge \neg P) \vee (P \wedge Q)$

11. Five coins are tossed simultaneously. The probability of at least one head turning up is

  a) $\dfrac{1}{32}$

  b) $\dfrac{1}{8}$

  c) $\dfrac{15}{16}$

  d) $\dfrac{31}{32}$

12. In a class of 100 students, 39 play Tennis, 58 play Cricket, 32 play Hockey, 10 play Cricket and Hockey, 11 play Hockey and Tennis and 13 play Tennis and Cricket. The number of students who play all three games is

  a) 4

  b) 5

  c) 6

  d) 7

13. Let A $= \{1, 2, 3, 4, 6\}$ and R be a relation on A defined by aR_b iff a is a multiple of b. Then the matrix of R will be

  a) null matrix

  b) diagonal matrix

  c) upper triangular matrix

  d) lower triangular matrix

14. If $g(x)$ is a polynomial satisfying $g(x)g(y) = g(x) + g(y) + g(xy) - 2$ for all real x and y and $g(2) = 5$, then $g(3)$ is equal to

  a) 10

  b) 24

c) 21

d) 15

6 15. If G is a graph then the inverse of every element in G is

a) unique

b) finite

c) infinite

d) non-unique

7 16. The sum of product form of $x + xy$ is

a) $x + y + x'$

b) $x \cdot y + x \cdot y'$

c) $x \cdot y + y \cdot x$

d) $x \cdot y$

8 17. The smallest value of r satisfying the inequality $^{10}C_{r-1} > 2 \, ^{10}C_r$ is

a) 7

b) 10

c) 9

d) 8

9 18. A simple graph (a graph without parallel edge or self loops) with n vertices and k components can have at most

a) n edges

b) $(n - k)$ edges

c) $(n - k)(n - k + 1)$ edges

d) $\dfrac{(n - k)(n - k + 1)}{2}$ edges

10 19. If $\begin{vmatrix} 1 & 3 & 9 \\ 1 & x & x^2 \\ 4 & 6 & 9 \end{vmatrix} = 0$,then

a) $x = 3 \, or \, 4$

b) $x = 3 \, or \, 6$

c) $x = \dfrac{3}{2}$ or 3

d) $x = 4$ or 6

20. Let A= $\begin{matrix} -1 & 1 \\ 1 & -1 \end{matrix}$ be a square matrix of order 2, then the eigen values are

a) 0, 5

b) 0, 3

c) 0, -2

d) 1, 2

21. $\displaystyle \lim_{x \to 0} \dfrac{tanx - sinx}{x^3} =$

a) $\dfrac{1}{2}$

b) 1

c) $-\dfrac{1}{2}$

d) -1

22. $\displaystyle \int_{0}^{\pi/2} \left(\sqrt{tanx} + \sqrt{cotx} \right) dx =$

a) $\dfrac{\pi}{\sqrt{2}}$

b) $\dfrac{\pi}{2\sqrt{2}}$

c) $\dfrac{1}{2\sqrt{2}}$

d) $\dfrac{1}{\sqrt{2}}$

23. If $tany = \dfrac{2t}{1 - t^2}$ and $sinx = \dfrac{2t}{1 + t^2}$ then the value of $\dfrac{dy}{dx}$ is

a) 0

b) 2

c) $\dfrac{3}{2}$

d) 1

24. 10's complement of 6 digit decimal number 090657 is

a) 809343

b) 909344

c) 809344

d) 909343

25. Boolean function is given as $F = B\bar{C}D + \bar{B}\bar{C}D + \bar{A}BC + A\bar{B}C + ABC$. The simplified expression is

a) $CD + (A + B)$

b) $\bar{C}D + (B + A)C$

c) $C\bar{D} + C$

d) $C\bar{D} + (B + A)C$

26. Convert decimal number 250.5 to base 16

a) $(EA.8)_{16}$

b) $(EA.2)_{16}$

c) $(EA.4)_{16}$

d) $(EA.6)_{16}$

27. Convert $(12121)_3$ to decimal number

a) 351

b) 251

c) 151

d) 451

28. An integrated Ckt RAM chip has a capacity of 1024 words of 8-bits each (1K * 8). How many chips are needed to construct a 16 K * 16 RAM?

a) 16

b) 24

c) 32

d) 40

29. A cache memory needs an access time of 20 ns and main memory 120 ns. What is the average access time of CPU (assume hit ratio = 80%)?

a) 30 ns

b) 44 ns

c) 35 ns

d) 45 ns

30. How many characters per second (7 bits + parity) can be transmitted over 2400 b/s line in synchronous mode having one start and one stop bit?

a) 300

b) 240'

c) 320

d) 280

31. If a cache has the capacity of 16 kbit and a line length of 128 bytes. How many sets does the cache have if it is 8-way set associative?

a) 64

b) 32

c) 16

d) 48

32. An address space is specified by 24-bit and the correspondence memory space is 16 bit. How many words are there in the memory space?

a) 16 m words

b) 64 k words

c) 4 k words

d) 4 m words

33. Evaluate the following postfix notation 6, 9, 2, + , *, 12, 3, /, −

a) 62

b) 66

c) 83

d) 78

34. Choose the equivalent prefix form of the following infix expression

$$a + (b - c) \overset{*}{} (d - e) / (f + g - h)$$

    a) * + a − bc/ − de − + fgh

    b) * + a − bc − /de − + fgh

    c) * + a − bc/ − ed + − fgh

    d) * + ab − c/ − ed + − fgh

35. A complete binary tree of depth 5 has

    a) 15 nodes

    b) 129 nodes

    c) 63 nodes

    d) 33 nodes

36. Which one of the following sequences of array elements form a heap?

    a) {23, 17, 14, 6, 13, 10, 1, 12, 7, 5}

    b) {23, 17, 14, 6, 13, 10, 1, 5, 7, 12}

    c) {23, 17, 14, 7, 13, 10, 1, 5, 6, 12}

    d) {23, 17, 14, 7, 13, 10, 1, 12, 5, 7}

37. The five items U, V, W, X and Y are pushed onto a stack one after the other starting from U. The stack is popped four times and each element is inserted in a queue. Then two elements are deleted from the queue and pushed back on the stack and then one item is popped from the stack. The popped item is

    a) U

    b) V

    c) W

    d) X

38. Time complexity of an algorithm $T(n)$, where n is the input size, is given by

$$T(n) = \begin{cases} T(n-1) + \frac{1}{n}; & if\ n > 1 \\ 1 & Otherwise \end{cases}$$

    The order of this algorithm is

    a) $log n$

    b) n

    c) n^2

d) n^n

39. Consider the table of 15 items as given below

AL, EX, FN, FV, IF, IW, LE, LO, NI, OP, OR, RD, RN, TE, TIB   y

using binary search method, after how many passes will the search for the item IF be determined?

a) 3

b) 4

c) 5

d) 6

40. The following context-free grammar

$$S \rightarrow aB \mid bA$$

$$A \rightarrow a \mid aS \mid bAA$$

$$B \rightarrow b \mid bS \mid aBB$$

generates the string of terminals that have

a) odd numbers of $a's$ and even numbers of $b's$

b) even numbers of $a's$ and even numbers of $b's$

c) odd numbers of $a's$ and odd numbers of $b's$

d) equal numbers of $a's$ and $b's$

41. How many variables remain in the grammar after removal of useless symbols?

$$S \rightarrow aBA, \ B \rightarrow bBC \mid b, \ C \rightarrow cC \mid D, \ A \rightarrow aAE \mid E, \ D \rightarrow aDD,$$
$$E \rightarrow ED \mid eE \mid e$$

a) 3

b) 4

c) 5

d) 6

42. How many states are present in the DFA constructed to accept "The set of all strings ending in 010"?

a) 3

b) 4

c) 5

d) 6

43. How many page fault occurs in the LRU page replacement algorithm for the following reference string, with four page frames?

$$7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1$$

a) 8

b) 7

c) 6

d) 9

44. A process refers to 5 pages A, B, C, D and E in the following order $A, B, C, D, A, B, E, A, B, C, D, E$. If the page replacement algorithm is FIFO, then the number of pages transfer with an empties internal store of 3 frame is

a) 10

b) 9

c) 8

d) 7

45. If the disk head is located initially at 32, find the number of disk moves required with FCFS, if the disk queue of I/O block requests are 98, 37, 14, 124, 65, 67.

a) 310

b) 324

c) 315

d) 343

46. At particular time of computation, the value of a counting semaphore is 7. Then 20 P operations and X V operations were computed on this semaphores. If the final value of the semaphore is 5, X will be

a) 22

b) 18

c) 15

d) 13

47. There are three IP addresses as given below:

X = 202.23.14.150

Y = 168.19.200.12

Z = 72.192.52.210

Which of the following statement is correct?

a) X is class A, Y is class B and Z is class C

b) X is class C, Y is class A and Z is class B

c) X is class C, Y is class B and Z is class A

d) X is class A, Y is class C and Z is class B

48. Suppose IP address is 124.133.112.66 and subnet mask is 255.255.224.0. Then the subnet address is

a) 124.133.0.0

b) 124.133.96.0

c) 225.225.0.0

d) 124.133.122.0

49. if there are n devices (nodes) in a network. What is the number of cable links required for a mesh and a star topology respectively?

a) n, $n-1$

b) $\dfrac{n(n-1)}{2}$, $n-1$

c) $n-1$, n

d) $n-1$, $\dfrac{n(n-1)}{2}$

Q. 41. Consider the relation schema R = {P, Q, R} and the set of functional dependencies F = {P®QR, Q®PR, R®PQ}. The canonical cover for F is

a) {P®Q, Q®R, R®Q}

b) {P®Q, Q®R, R®P}

c) {P®R, Q®P, R®P}

d) {P®R, Q®R, R®Q}

Q. 42. How many candidate keys exist for a relation schema R(P, Q, R, S, T) with set of functional dependencies F={PQ®R, RS®T, Q®S, T®P}?

a) 1

b) 2

c) 3

d) 4

Q. 43. Consider the following relation schema R{P, Q, R, S, T} with the set of functional dependencies F={P®QR, RS®T, Q®S, T®P}. Decomposition of R into R1{P, Q, R} and R2{P, S, T} is

a) Lossy and not Dependency Preserving

b) Lossless and Dependency Preserving

c) Lossless and not Dependency Preserving

d) Lossy and Dependency Preserving

Q. 44. What is the highest normal form for the relation schema R(P, Q, R) with the set of functional dependencies F={P®R, QR®P}

    a) 1 NF

    b) 2 NF

    c) 3 NF

    d) BCNF

Q. 45. Which of the following is a trivial multi-valued dependency for the relation schema R(A, B, C, D)?

    a) AB®®CD

    b) A®®BC

    c) AB®®D

    d) B®®AC

Q. 46. On termination of the following program segment, j will have the value:

```
i=6720, j=4;
while ((i % j) = = 0)
{ i = i / j;  j=j+1; }
```

    a) 7

    b) 8

    c) 9

    d) 6720

Q. 47. What will be the equivalent pointer expression for referring the array element a[i][j][k][l]?

    a) *(*(*(*(a + i) + j) + k) + l)

    b) **((**((a + i) + j) + k) + l)

    c) *(*(**((a + i) + j) + k) + l)

    d) **((*(*(a + i) + j) + k) + l)

Q. 48. On termination of the following program segment, the value of X, Y and Z will be:

main ( )

{ int X, Y, Z; Y=2; X = 2 * (Y++); Z = 2 * (++Y); }

    a) X = 6; Y = 4 ; Z = 8

    b) X = 4; Y = 4 ; Z = 8

    c) X = 4; Y = 3 ; Z = 6

    d) X = 3; Y = 4 ; Z = 8

Q. 49. What is the output of the following C program:

main ( )
{ unsigned int m=32; printf ("% X", ~ m); }

    a) ddfd

    b) ffdf

    c) ffff

    d) 0000

Q. 50. For the following C function, the value returned by f(1) is:

int f(n)
{ static int i=1; if (n $\geq$ 5) return n; n = n + i; i++; return f(n); }

    a) 5

    b) 6

    c) 7

    d) 8

Answer Key Computer Science and Engineering

1	d
2	d
3	b
4	d
5	a
6	a
7	b
8	d
9	d
10	c
11	c
12	a
13	b
14	d
15	b
16	b
17	a
18	c
19	c
20	b
21	b
22	c
23	c
24	a
25	a
26	c
27	c
28	d
29	a
30	b
31	d
32	b
33	b
34	b
35	b
36	d
37	b
38	c
39	b
40	b
41	b
42	c
43	c
44	c
45	a
46	c
47	a
48	b
49	b
50	c