

Test Booklet Code & Serial No.

प्रश्नपत्रिका कोड व क्रमांक

D

Paper-II

**COMPUTER SCIENCE AND APPLICATIONS**

**Signature and Name of Invigilator**

1. (Signature) .....

(Name) .....

2. (Signature) .....

(Name) .....

**MAR - 37223**

**Time Allowed : 2 Hours]**

**Number of Pages in this Booklet : 28**

Seat No.

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(In figures as in Admit Card)

Seat No. ....

(In words)

OMR Sheet No.

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(To be filled by the Candidate)

**[Maximum Marks : 200**

**Number of Questions in this Booklet : 100**

**Instructions for the Candidates**

1. Write your Seat No. and OMR Sheet No. in the space provided on the top of this page.
2. This paper consists of **100** objective type questions. Each question will carry **two** marks. All questions of Paper II will be compulsory.
3. At the commencement of examination, the question booklet will be given to the student. In the first 5 minutes, you are requested to open the booklet and compulsorily examine it as follows :
  - (i) To have access to the Question Booklet, tear off the paper seal on the edge of this cover page. Do not accept a booklet without sticker-seal or open booklet.
  - (ii) Tally the number of pages and number of questions in the booklet with the information printed on the cover page. Faulty booklets due to missing pages/questions or questions repeated or not in serial order or any other discrepancy should not be accepted and correct booklet should be obtained from the invigilator within the period of 5 minutes. Afterwards, neither the Question Booklet will be replaced nor any extra time will be given. The same may please be noted.
  - (iii) After this verification is over, the OMR Sheet Number should be entered on this Test Booklet.
4. Each question has four alternative responses marked (A), (B), (C) and (D). You have to darken the circle as indicated below on the correct response against each item.

**Example :** where (C) is the correct response.



5. Your responses to the items are to be indicated in the **OMR Sheet given inside the Booklet only**. If you mark at any place other than in the circle in the OMR Sheet, it will not be evaluated.
6. Read instructions given inside carefully.
7. Rough Work is to be done at the end of this booklet.
8. If you write your Name, Seat Number, Phone Number or put any mark on any part of the OMR Sheet, except for the space allotted for the relevant entries, which may disclose your identity, or use abusive language or employ any other unfair means, you will render yourself liable to disqualification.
9. You have to return original OMR Sheet to the invigilator at the end of the examination compulsorily and must not carry it with you outside the Examination Hall. You are, however, allowed to carry the Test Booklet and duplicate copy of OMR Sheet on conclusion of examination.
10. Use only Blue/Black Ball point pen.
11. Use of any calculator or log table, etc., is prohibited.
12. There is no negative marking for incorrect answers.

**विद्यार्थ्यासाठी महत्त्वाच्या सूचना**

1. परीक्षार्थीनी आपला आसन क्रमांक या पृष्ठावरील वरच्या कोप-न्यात लिहावा. तसेच आपांना दिलेल्या उत्तरपत्रिकेचा क्रमांक त्याखाली लिहावा.
2. सदर प्रश्नपत्रिकेते 100 बहुपर्यायी प्रश्न आहेत. प्रत्येक प्रश्नास दोन गुण आहेत. या प्रश्नपत्रिकेतील सर्व प्रश्न सोडविणे अनिवार्य आहे.
3. परीक्षा सुरु झाल्यावर विद्यार्थ्याला प्रश्नपत्रिका दिली जाईल. सुरुवातीच्या 5 मिनिटांमध्ये आपण सदर प्रश्नपत्रिका उघडून खालील बाबी अवश्य तपासून पहाव्यात.
  - (i) प्रश्नपत्रिका उघडण्यासाठी प्रश्नपत्रिकेवर लावलेले सील उघडावे. सील नसलेली किंवा सील उघडलेली प्रश्नपत्रिका स्वीकारू नये.
  - (ii) पहिल्या पृष्ठावर नमूद केल्याप्रमाणे प्रश्नपत्रिकेची एकूण पृष्ठे तसेच प्रश्नपत्रिकेतील एकूण प्रश्नांची संख्या पडताळून पहावी. पृष्ठे कमी असलेली/कमी प्रश्न असलेली/प्रश्नांचा चुकीचा क्रम असलेली किंवा इतर त्रुटी असलेली सदोष प्रश्नपत्रिका सुरुवातीच्या 5 मिनिटांतरच पर्यवेक्षकाला परत देऊन दुसरी प्रश्नपत्रिका मागवून घ्यावी. त्यानंतर प्रश्नपत्रिका बदलून मिळणार नाही तसेच वेळीची वाढवून मिळणार नाही याची कृपया विद्यार्थ्यानी नोंद घ्यावी.
  - (iii) वरीलप्रमाणे सर्व पडताळून पाहिल्यानंतरच प्रश्नपत्रिकेवर ओ.एम.आर. उत्तरपत्रिकेचा नंबर लिहावा.
4. प्रत्येक प्रश्नासाठी (A), (B), (C) आणि (D) अशी चार विकल्प उत्तरे दिली आहेत. त्यातील योग्य उत्तराचा रकाना खाली दर्शविल्याप्रमाणे ठळकपणे काढा/निळ्या करावा.
- उदा. : जर (C) हे योग्य उत्तर असेल तर.
5. या प्रश्नपत्रिकेतील प्रश्नांची उत्तरे ओ.एम.आर. उत्तरपत्रिकेतच दर्शवावीत. इतर ठिकाणी तिलहिलेली उत्तरे तपासली जाणार नाहीत.
6. आत दिलेल्या सूचना काळजीपूर्वक वाचाव्यात.
7. प्रश्नपत्रिकेच्या शेवटी जोडलेल्या को-या पानावरच कच्चे काम करावे.
8. जर आपण ओ.एम.आर. वर नमूद केलेल्या ठिकाणाव्यतिरिक्त इतर कोठेही नाव, आसन क्रमांक, फोन नंबर किंवा ओळख पटेल अशी कोणीही खूण केलेली आढळून आल्याआ अथवा असभ्य भाषेचा वापर किंवा इतर गैरमागचा अवलंब केल्यास विद्यार्थ्याला परीक्षेस अपात्र घरविण्यात येईल.
9. परीक्षा संपल्यानंतर विद्यार्थ्याने मूळ ओ.एम.आर. उत्तरपत्रिका पर्यवेक्षकांकडे परत करणे आवश्यक आहे. तथापि, प्रश्नपत्रिका व ओ.एम.आर. उत्तरपत्रिकेची द्वितीय प्रत आपल्याबरोबर नेण्यास विद्यार्थ्याना परवानगी आहे.
10. फक्त निळ्या किंवा काळजा बाल पेनचाच वापर करावा.
11. कॅलक्युलेटर किंवा लॉग टेबल वापरण्यास परवानगी नाही.
12. चुकीच्या उत्तरासाठी गुण कपात केली जाणार नाही.

**MAR - 37223/II—D**

## Computer Science and Applications

### Paper II

**Time Allowed : 120 Minutes]**

**[Maximum Marks : 200**

**Note :** This Paper contains **Hundred (100)** multiple choice questions. Each question carrying **Two (2)** marks. Attempt *All* questions.

- |  |   |
|--|---|
| <p>1. For a given max-heap, which is the <i>correct</i> answer ?</p> <ul style="list-style-type: none"> <li>(A) The leaf nodes have values greater than or equal to their parents</li> <li>(B) The leaf nodes have values less than or equal to their parents</li> <li>(C) The leaf nodes and their parents have same values</li> <li>(D) The leaf nodes have values different from their parents</li> </ul> <p>2. <math>B^+</math> trees are considered BALANCED because :</p> <ul style="list-style-type: none"> <li>(A) The lengths of the paths from the root to all leaf nodes are all equal</li> <li>(B) The lengths of the paths from the root to all leaf nodes differ from each other by at most 1</li> <li>(C) The number of children of any two non-leaf sibling nodes differ by at most 1</li> <li>(D) The number of records in any two leaf nodes differ by at most 1.</li> </ul> | <p>3. The in-order traversal output and pre-order traversal output of a binary tree are same, then the binary tree is :</p> <ul style="list-style-type: none"> <li>(A) Left skewed</li> <li>(B) Right skewed</li> <li>(C) Balanced</li> <li>(D) Completely balanced</li> </ul> <p>4. The two statements that can change the flow of control are :</p> <ul style="list-style-type: none"> <li>(A) if and switch</li> <li>(B) if and while</li> <li>(C) switch and do-while</li> <li>(D) break and continue</li> </ul> <p>5. A deque is :</p> <ul style="list-style-type: none"> <li>(A) A queue implemented with a doubly linked list</li> <li>(B) A queue implemented with both singly and doubly linked lists</li> <li>(C) Just a queue</li> <li>(D) A queue with insert and delete defined for both front and rear ends of the queue</li> </ul> |
|--|---|

6. The postfix form of  $A^*B+C/D$  is :

- (A) \* A B / C D +
- (B) A B \* C D / +
- (C) A \* B C + / D
- (D) A B C D + / \*

7. Let S be a sorted array of  $n$  integers.

Let  $T(n)$  denote the time taken by the most efficient algorithm to determine if there are two elements in S with sum greater than  $m$ , then :

- (A)  $T(n)$  is of  $\theta(1)$
- (B)  $T(n)$  is of  $\theta(m)$
- (C)  $T(n)$  is of  $\theta(n)$
- (D)  $T(n)$  is of  $\theta(\log n)$

8. Match the algorithms in Group 1 with the design strategy used by the algorithm in Group 2

**Group 1**

- P. Merge Sort
- Q. Insertion Sort
- R. Prim's algorithm
- S. Kruskal's algorithm

**Group 2**

- I. Greedy Strategy
- II. Dynamic Programming
- III. Divide and Conquer
- IV. Decrease and Conquer
  - (A) P→III, Q→II, R→I, S→IV
  - (B) P→I, Q→III, R→II, S→IV
  - (C) P→IV, Q→III, R→II, S→I
  - (D) P→III, Q→IV, R→I, S→II

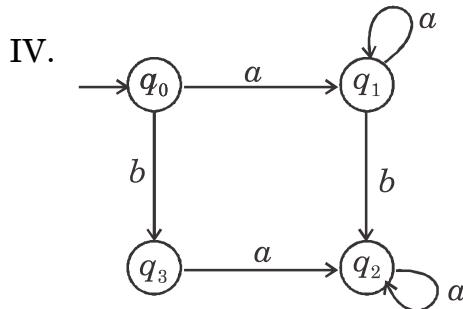
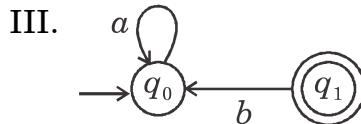
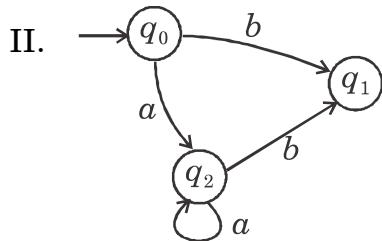
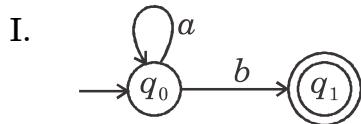
9. Which of the following is *not* true for the problem classes P, NP, NP-complete and NP-hard ?

- (A)  $P \subset NP$
- (B)  $NP\text{-complete} \subset NP$
- (C)  $NP\text{-hard} \subset NP$
- (D)  $NP\text{-complete} \subset NP\text{-hard}$

10. Maximum finding algorithm takes  $O(\log_2 n)$  parallel time with  $p \geq n/2$  processors using P-RAM model of parallel computation. If we have  $p < n/2$  processors in reality, then which condition will retain the parallel time complexity of  $O(\log n)$  extended with some constant factor.

- (A)  $(n - p(\lceil n/p \rceil)) \leq \lceil n/p \rceil$
- (B)  $(n - (p-1)\lceil n/p \rceil) \leq \lceil n/p \rceil$
- (C)  $n * (p-1)\lceil n/p \rceil \leq n/p$
- (D)  $n - \lceil n/p \rceil \leq \lceil n/p \rceil$

11. For the language  $L = \{a^n b / n \geq 0\}$  which of the following is/are DFA represents the above language ?



- (A) I and II only
- (B) I and III only
- (C) II and IV only
- (D) III and IV only

12. Consider the context free grammar with productions :

$$S \rightarrow ABa$$

A → aab

B → Ac

After constructing an equivalent grammar in Chomsky Normal form, the resulting grammar will contain .....productions.



13. For  $\Sigma$  to be an alphabet and  $L \subseteq \Sigma^*$  be a language A is said to be decidable if there exists a Turing machine M for every string  $\omega \in \Sigma^*$  with which of the following conditions.

- (i) If  $\omega \in L$ , the computation of TM M on input string  $\omega$  terminates in accept state
  - (ii) If  $\omega \notin L$  ( $\omega$  does not belong to  $L$ ) then computation of TM M on input string  $\omega$  terminates in reject state
  - (iii) If  $\omega \in L$  then computation of TM M on input string  $\omega$  terminates in reject state.

- (A) (iii) only
  - (B) (i) and (iii) only
  - (C) (i) and (ii) only
  - (D) (ii) and (iii) only

14. The decision problem "Given a Turing Machine M and a step-counting function "myfun", is the language accepted by M in Time (myfun) ?" is..... .

- ### (A) Stable

- (B) Unsolvable

- (C) Partially solvable

- (D) Solvable**

15. Consider the grammar  $G$  with productions  $S \rightarrow ACB/CbB/Ba,$

Which of the following is *correct* set  
for FIRST (S) ?

- (A)  $\{a, b, h, g\}$
  - (B)  $\{a, d, g, \in\}$
  - (C)  $\{g, d, b, h, \in\}$
  - (D)  $\{g, d, a, b, h, \in\}$

16. An attribute grammar in which all the attributes are.....is called an.....attributed grammar.
- (A) Synthesized, S  
(B) Inherited, S  
(C) Synthesized, L  
(D) Inherited, L
17. Which of the following parameter passing methods works with the idea that the argument is not evaluated until its actual use as a parameter in the called program ?
- (A) Pass by Value-Result  
(B) Pass by Name  
(C) Pass by Value  
(D) Pass by Reference
18. An.....is a data structure that is constructed from input data to a program and from which part or all of the output data of the program is constructed.
- (A) Symbol Table  
(B) Flow Graph  
(C) Intermediate Representation  
(D) Object File
19. Consider the following function with line numbers.
- ```
1. Int Myfunction( )  
2. {  
3.     int a = 24;  
4.     int b = 25;  
5.     int c;  
6.     if (a! = 24)  
7.         printf("Is less than or  
not equal to 24");  
8.         c = a << 2;  
9.     return c;  
10.    b = 24;  
11. }
```
- Which line numbers contain the dead code/dead variable/unreachable code in the above function definition ?
- (A) 4, 6, 7  
(B) 6, 7, 10  
(C) 4, 6, 7, 8, 10  
(D) 4, 6, 7, 10

20. Consider the grammar shown below

$$S \rightarrow AA$$

$$A \rightarrow aA/d$$

The grammar is :

- (A) LL(1)
- (B) SLR(1) but not LL(1)
- (C) LALR(1) but not SLR(1)
- (D) LR(1) but not LALR(1)

21. While linking to Anonymous FTP system which of the following anchors is correct ?

- (A) `<a href = "ftpto : // ftp.google.com"> google's public`  
FTP servers `</a>`
- (B) `<a href="ftp : // ftp.google.com">`  
google's public FTP servers  
`</a>`
- (C) `<a href : "ftp : //ftp.google.com">`  
google's public FTP servers  
`</a>`
- (D) `<a href : "ftp to : //ftp.google.com"> google's public`  
FTP servers `</a>'`

22. While virtualizing X-86 architecture,

type-I hypervisor :

- (A) Interact with OS through ABI and emulate the ISA for Guest OS
- (B) run directly on top of the hardware with ISA exposed by the hardware
- (C) is known as hosted virtual machine
- (D) run directly on top of the hardware with API exposed

23. The guard interval is provided in Orthogonal Frequency-Division Multiplexing (OFDM).

- (A) To eliminate the need of pulse shaping filter
- (B) To eliminate Inter Symbol Interface (ISI)
- (C) High symbol rate
- (D) Both (A) and (B)

24. The key length of a 3-key Triple Data Encryption Standard (3TDES) is :
- (A) 112 bits  
(B) 256 bits  
(C) 512 bits  
(D) 168 bits
25. Suppose we have to send an E-mail with an attachment of 2.5 kbyte with 1 Gbps bandwidth. Assume that the distance between the sender and the receiver is 12000 km and that light travels at  $2.4 \times 10^8$  m/s. What will be the transmission time ?
- (A) 50 ms  
(B) 2 ms  
(C) 0.020 ms  
(D) 0.2 ms
26. What is the minimum Hamming distance for detection of three errors or correction of two errors ?
- (A) 2  
(B) 3  
(C) 4  
(D) 5
27. Match the following OSI layers with protocols :
- (a) Layer 7 (Application)  
(b) Layer 4 (Transport)  
(c) Layer 3 (Network)  
(d) Layer 2 (Data Link)
- (i) IPv4  
(ii) UPP  
(iii) HTTP  
(iv) Ethernet, WiFi (802.11)
- (A) a-(iv), b-(iii), c-(i), d-(ii)  
(B) a-(iv), b-(iii), c-(ii), d-(i)  
(C) a-(iv), b-(ii), c-(iii), d-(i)  
(D) a-(iii), b-(ii), c-(i), d-(iv)
28. If the frame to be transmitted is 1101011011 and the CRC polynomial to be used for generating checksum is  $x^4 + x + 1$ , then what is the transmitted frame ?
- (A) 11010110111110  
(B) 11010110111011  
(C) 11010110111101  
(D) 11010110111001

29. In symmetric-key cryptography, how many keys are needed for more secure communication if Alice and Bob want to communicate with each other ?
- (A) 2  
(B) 3  
(C) 4  
(D) 8
30. Match the classes of IP addresses with their functional applications :
- (a) Class A (1) Multicast Services  
(b) Classs B (2) Reserved for future use  
(c) Class D (3) Large Organizations  
(d) Class E (4) Midsize Organizations
- (A) (a)-4, (b)-3, (c)-2, (d)-1  
(B) (a)-2, (b)-4, (c)-1, (d)-3  
(C) (a)-1, (b)-2, (c)-3, (d)-4  
(D) (a)-3, (b)-4, (c)-1, (d)-2
31. Which of the following is *not* an agent communication language ?
- (A) FIPA-ACL  
(B) KSE-KQML  
(C) KSE-KIF  
(D) FIPA-QIF
32. An intermediate form between syntactic and logical form used in Natural language processing is known as :
- (A) Quantified logical form  
(B) Quasi-logical form  
(C) Syntactic-logical form  
(D) Definite clause grammar
33. Forward state space search is also known as :
- (A) Regression planning  
(B) Progression planning  
(C) Contingency planning  
(D) Consistency planning

34. In the following knowledge representation using first order logic  
 $\forall \text{ person Indian } (\text{person}) \wedge \text{know}(\text{person}, \text{English}) \Rightarrow [\text{Mother tongue}(\text{person}, \text{lang}) \wedge \text{hate}(\text{person}, \text{lang})]$ , the number of predicates and variables are respectively :
- (A) 4, 2  
 (B) 4, 3  
 (C) 3, 4  
 (D) 5, 2
35. Which of the following statements are true for 'Rational Agents' ?
- (i) it perceives its environment through sensors  
 (ii) it acts upon the environment through actuators  
 (iii) it improves its performance through learning  
 (iv) it knows the actual outcome of its actions
- (A) (i) and (ii)  
 (B) (i), (ii) and (iii)  
 (C) (i), (ii) and (iv)  
 (D) (iii) and (iv)
36. Consider a non-binary genome of length  $l$ , over an alphabet of size  $p$  ( $p > 2$ ). How many different schemata are there ?
- (A)  $2^l$   
 (B)  $2^p$   
 (C)  $2^{p+l}$   
 (D)  $2^{p^2}$
37. If  $\underset{\sim}{A} = \left\{ \frac{1}{2} + \frac{0.5}{3} + \frac{0.3}{4} + \frac{0.2}{5} \right\}$  and  
 $\underset{\sim}{B} = \left\{ \frac{0.5}{2} + \frac{0.7}{3} + \frac{0.2}{4} + \frac{0.4}{5} \right\}$ ,  
 then  $A/B$  is :
- (A)  $\left\{ \frac{0.5}{2} + \frac{0.2}{3} + \frac{0.1}{4} + \frac{0.2}{5} \right\}$   
 (B)  $\left\{ \frac{0.5}{2} + \frac{0.2}{3} + \frac{0.1}{4} + \frac{0.6}{5} \right\}$   
 (C)  $\left\{ \frac{0.5}{2} + \frac{0.3}{3} + \frac{0.3}{4} + \frac{0.2}{5} \right\}$   
 (D)  $\left\{ \frac{0}{2} + \frac{0.5}{3} + \frac{0.2}{4} + \frac{0.4}{5} \right\}$

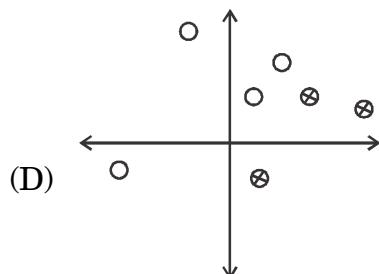
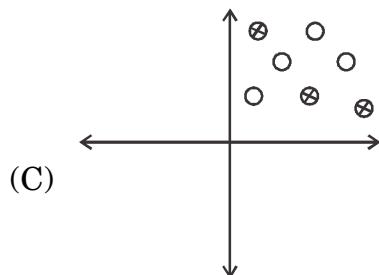
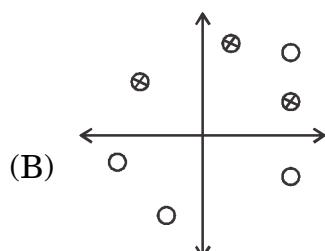
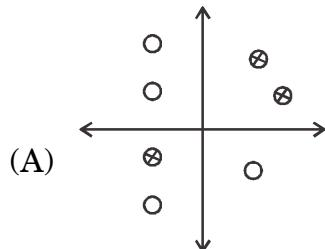
38. Functions that qualify as fuzzy intersections and fuzzy unions are referred to as :

- (A)  $t$ -norms &  $t$ -conorms
- (B)  $i$ -norms &  $v$ -conorms
- (C)  $t$ -norms &  $i$ -norms
- (D) None of the above

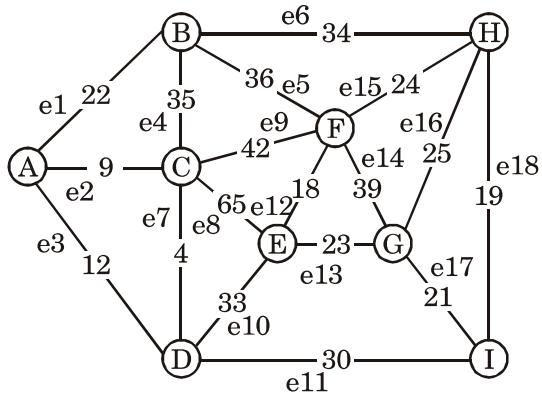
39. A single layer perception cannot compute the following logical function :

- (A) AND
- (B) OR
- (C) XOR
- (D) NOT

40. Which of the following data is linearly separable ?



41.



$$V = \{A, B, C, D, E, F, G, H, I\}$$

$$E = \{e1 = (A, B), e2 = (A, C), e3 = (A, D), e4 = (B, C), e5 = (B, F), e6 = (B, H), e7 = (C, D), e8 = (C, E), e9 = (C, F), e10 = (D, E), e11 = (D, I), e12 = (E, F), e13 = (E, G), e14 = (F, G), e15 = (F, H), e16 = (G, H), e17 = (G, I), e18 = (H, I)\}$$

$$W = \{22, 9, 12, 35, 36, 34, 4, 33, 30, 18, 23, 24, 39, 25, 21, 19\}$$

The weight of the shortest path from node A to I in the undirected graph is..... .

- (A) 2                   (B) 3  
 (C) 42                  (D) 43

42. Group code are generated using

$$G = \begin{bmatrix} 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 \end{bmatrix} \quad \text{for}$$

communication. Then..... is not code word.

- (A) 000000   (B) 000111  
 (C) 101100   (D) 111111

43. The number of code word possible

$$\text{using the generator } G = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \end{bmatrix}$$

is :

- (A) 1                   (B) 2  
 (C) 4                   (D) 8

44. Let X and Y be random variables with joint distribution :

$$\Pr(X = i, Y = j) =$$

$$\begin{cases} 1/6 \text{ for } i = 5, 6 \text{ and } j = 3, 6, 9 \\ 0 \text{ otherwise} \end{cases}$$

Then the conditional entropy  $H(X|Y) = \dots$ .

- (A) 0                   (B)  $\log(2)$   
 (C)  $\log(3)$            (D)  $\log(6)$

45. Let X and Y be random variable with the following distributions respectively :

|   |     |     |     |     |     |
|---|-----|-----|-----|-----|-----|
| X | 1   | 2   | 3   | 4   | 5   |
| P | 0.1 | 0.2 | 0.4 | 0.2 | 0.1 |

|   |     |     |     |     |     |
|---|-----|-----|-----|-----|-----|
| Y | 10  | 20  | 35  | 50  | 60  |
| P | 0.1 | 0.2 | 0.4 | 0.2 | 0.1 |

- (A) Skewness of X and Y are same, Coefficient of Variations are the same
- (B) Skewness of distribution of X and Y are not same, Coefficient of Variations are the same
- (C) Skewness of distribution of X and Y are same, Coefficient of Variations are not same
- (D) Skewness of distribution of X and Y are not same, Coefficient of Variations are not same

46. Notation :

$$C(n, r) = n!/(r!*(n-r)!))$$

$n!$  is factorial  $n$ .

$|A|$  cardinality of set A

$\bar{s}$  is negation of  $s$

The number of ways to place  $r$  indistinguishable balls in  $n$  ( $n < r$ ) distinct boxes, with no box left empty, is.....

- (A)  $C(r - 1, n - 1)$   
 (B)  $C(n + r - 1, n - 1)$   
 (C)  $C(n + r - 1, r - 1)$   
 (D)  $C(n - 1, r - 1)$

47. Consider the following Linear Programming Problem :

$$\text{Maximize : } Z = 5x_1 + 6x_2 + 4x_3$$

$$\text{Subject to } 3x_1 + x_2 + 4x_3 \leq 60$$

$$2x_1 + 3x_2 + 3x_3 \leq 75$$

$$x_1, x_2, x_3 \geq 0$$

The value of the decision variables after the first iteration will be :

- (A)  $x_1 = 0, x_2 = 0, x_3 = 25$   
 (B)  $x_1 = 0, x_2 = 25, x_3 = 0$   
 (C)  $x_1 = 20, x_2 = 0, x_3 = 0$   
 (D)  $x_1 = 0, x_2 = 37.5, x_3 = 0$

48. Consider the following Linear Programming Problem :

$$\text{Maximize : } Z = 5x_1 + 10x_2$$

$$\text{Subject to : } \begin{aligned} x_1 &\leq 4 \\ x_2 &\geq 2 \end{aligned}$$

$$x_1 + x_2 = 5, \quad x_1, x_2 \geq 0$$

The dual of this problem is given by :

$$\begin{aligned} (\text{A}) \quad \text{Maximize : } Z' &= 4y_1 + 2y_2 \\ &\quad + 5y_3 - 5y_4 \end{aligned}$$

Subject to :

$$y_1 + y_3 - y_4 \geq 5$$

$$-y_2 + y_3 - y_4 \geq 10$$

$$y_1, y_2, y_3, y_4 \geq 0$$

$$\begin{aligned} (\text{B}) \quad \text{Minimize : } Z' &= 4y_1 + 2y_2 \\ &\quad + 5y_3 - 5y_4 \end{aligned}$$

Subject to :

$$y_1 + y_3 - y_4 \geq 5$$

$$-y_2 + y_3 - y_4 \geq 10$$

$$y_1, y_2, y_3, y_4 \geq 0$$

$$\begin{aligned} (\text{C}) \quad \text{Maximize : } Z' &= 4y_1 + 2y_2 \\ &\quad + 5y_3 \end{aligned}$$

Subject to :  $y_1 + y_3 \geq 4$

$$y_2 + y_3 \geq 2$$

$$y_1 + y_2 + y_3 = 5$$

$$y_1, y_2, y_3 \geq 0$$

- (D) The dual cannot be written as there are mixed constraints.

49. The transportation problem of  $m$  resources and  $n$  destinations can be written as Linear Programming Problem with :

- (A)  $mn$  decision variables and  $mn$  constraints

- (B)  $(m + n)$  decision variables and  $(m + n)$  constraints

- (C)  $(m + n)$  decision variables and  $mn$  constraints

- (D)  $(mn)$  decision variables and  $(m + n)$  constraints

50. The optimal solution to the following assignment problem

|                | J <sub>1</sub> | J <sub>2</sub> | J <sub>3</sub> | J <sub>4</sub> |
|----------------|----------------|----------------|----------------|----------------|
| M <sub>1</sub> | 10             | 9              | 8              | 7              |
| M <sub>2</sub> | 3              | 4              | 5              | 6              |
| M <sub>3</sub> | 2              | 1              | 1              | 2              |
| M <sub>4</sub> | 4              | 3              | 5              | 6              |

is given by :

- (A) M<sub>1</sub> → J<sub>3</sub>, M<sub>2</sub> → J<sub>2</sub>, M<sub>3</sub> → J<sub>1</sub>, M<sub>4</sub> → J<sub>4</sub>

- (B) M<sub>1</sub> → J<sub>4</sub>, M<sub>2</sub> → J<sub>1</sub>, M<sub>3</sub> → J<sub>2</sub>, M<sub>4</sub> → J<sub>3</sub>

- (C) M<sub>1</sub> → J<sub>4</sub>, M<sub>2</sub> → J<sub>1</sub>, M<sub>3</sub> → J<sub>3</sub>, M<sub>4</sub> → J<sub>2</sub>

- (D) M<sub>1</sub> → J<sub>3</sub>, M<sub>2</sub> → J<sub>4</sub>, M<sub>3</sub> → J<sub>2</sub>, M<sub>4</sub> → J<sub>1</sub>

51. A switch debouncer circuit is an application of :
- (A) The gated SR latch
  - (B) The  $\bar{S}\bar{R}$  latch
  - (C) SR latch
  - (D) The gated D latch
52. The ASCII code for decimal digit 9 with an even parity, placing the parity bit in the most significant position is :
- (A) 00111001
  - (B) 10111001
  - (C) 00100101
  - (D) 11000110
53. The 15's complement of  $A9B_H$  is :
- (A)  $B02_H$
  - (B)  $173_H$
  - (C)  $CD2_H$
  - (D)  $564_H$
54. The write pulse width ( $t_{wp}$ ) is the time for which :
- (A)  $\overline{WR}$  goes high
  - (B)  $\overline{WR}$  goes low
  - (C) WR goes high
  - (D) WR goes low
55. The speed of information being transferred in and out of memory depends on which of the following parameters ?
- (i) Access time  $t_A$
  - (ii) Cycle time  $t_c$
  - (iii) Access rate  $r_A$
  - (iv) Bandwidth  $r_c$
- (A) (i) & (ii)
  - (B) (ii) & (iii)
  - (C) (i), (ii) & (iii)
  - (D) (i), (ii), (iii) & (iv)
56. Which of the following assembler directives can be used to define & re-define numeric constants ?
- (i) EQU
  - (ii) % assign
  - (iii) % define
- (A) (i) & (ii) only
  - (B) (ii) & (iii) only
  - (C) (i) & (iii) only
  - (D) (i), (ii) & (iii)

57. A horizontal micro-programmed control unit supports the following. Identify the *correct* ones.
- (i) Longer control word
  - (ii) Used in parallel processing applications
  - (iii) Allows high degree of parallelism
  - (iv) Requires no additional hardware (decoders)
- (A) (i), (ii) & (iii)  
(B) (i), (iii) & (iv)  
(C) (i), (ii), (iii) & (iv)  
(D) (ii), (iii), (iv)
58. Which of the following are representative application areas where vector processing is used ?
- (i) AI & Expert systems
  - (ii) Seismic Data Analysis
  - (iii) Petroleum Explorations
  - (iv) Medical Diagnosis
- (A) (i), (ii), (iii) & (iv)  
(B) Only (i)  
(C) Only (ii) & (iv)  
(D) None of the above
59. A computer has 512 KB, 4-way set associative, write back data cache with block size of 32 bytes. The processor sends 32 bit addresses to the cache controller. Each cache tag directory entry contains, in addition to address tag, 2 valid bits, 1 modified bit and 1 replacement bit. The number of bits in the tag field of an address is :
- (A) 80      (B) 32  
(C) 64      (D) 15
60. Why do race conditions occur ?
- (i) Values of memory locations replicated in registers during execution.
  - (ii) Content switches at arbitrary times during execution.
  - (iii) Threads can see stale memory values in registers.
- (A) Only (ii)  
(B) Only (iii)  
(C) (i) & (ii)  
(D) (i), (ii) & (iii)

61. A normalised heterogeneous abstract syntax tree must :
- (i) Trees with magnitude of node type are called heterogeneous tree
  - (ii) Normalised heterogeneous tree use a normalised list of children like homogeneous tree
  - (iii) Nodes have irregular children
  - (iv) Use more than a single node data type but with normalised child list representation.
- (A) (i), (ii) and (iv)  
(B) (i) and (ii)  
(C) (ii) and (iv)  
(D) (iv) only
62. Which of the following comparison between static and dynamic type checking is correct ?
- (i) dynamic type checking slow down execution
  - (ii) dynamic type checking offers more flexibility to the programmers
  - (iii) Dynamic type checking is more reliable
  - (iv) Unlike static type checking the dynamic type checking is done during compilations.
- (A) (i) and (ii)  
(B) (i) and (iii)  
(C) (ii) and (iii)  
(D) (iv) only

63. Consider the following ‘C’ program fragment :

```
int i = 5;  
do  
{  
    putchar (i + 100);  
    printf ("%d", i...);  
} while (i);
```

results in the following output :

- (A) i 5 h 4 g 3 f 2 e 1  
(B) i 4 h 3 g 2 f 1 e 0  
(C) An error message will come  
(D) Went into infinite loop

64. The object-oriented programming can be seen as an attempt to enhance opportunities for code reuse by making it easier to define new abstractions as :
- (A) Extension or refinement  
(B) Independence  
(C) Containment  
(D) Facult containment

65. Exception handling is not meant to handle problems for which case ?
- (i) termination of program
  - (ii) handle return value representing error
  - (iii) hand return a legal value and leave the program in an illegal state
  - (iv) call an error handler function
- (A) (i) and (ii)
- (B) (ii) and (iii)
- (C) (iv) only
- (D) (i), (ii) and (iv)
66. The scope rules, especially the rules for nested type ensures that the resulting multitude of.....type do not interface with each other.
- (A) Enumerated
- (B) Inherited
- (C) Encapsulated
- (D) Contained
67. Most of recent browsers support an additional ENCTYPE of multipart/form-data, which statements out of the following correctly define it ?
- (i) This encoding transmit each field as a separate part of MIME compatible document automatically
  - (ii) MIME compatible document automatically use POST to submit data in multipart
  - (iii) This attribute specifies the way in which data is enclosed
  - (iv) This encoding sometime makes it easier for server side program to handle complex data.
- (A) (i) and (ii)
- (B) (ii) and (iv)
- (C) (iii) and (iv)
- (D) (i), (ii) and (iv)
68. Identify odd one from the following :
- (A) Digitizer
- (B) Touch panel
- (C) Plotter
- (D) Trackball

69. The transformation matrix

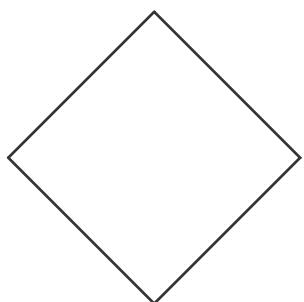
$$\begin{bmatrix} 0 & -1 & 0 \\ -1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

is used to obtain the reflection about the..... .

- (A) Y-axis, flipping  $x$ -coordinates
- (B) line  $Y = 0$
- (C) Diagonal line  $Y = -x$
- (D) Diagonal line  $Y = x$

70. Given  $r_x = r_y$ , the following super ellipse has the parameter value

$\rho = \dots \dots \dots$



- (A) 0.5      (B) 1
- (C) 1.5      (D) 2

71. Data integrity constraints are used for :

- (i) Establishing limits on allowable property values
  - (ii) Specifying a set of acceptable, predefined options to property values
  - (iii) Ensuring that duplicate values are not entered in the table
  - (iv) Controlling that data is accessed by authorised users
- (A) (i) & (ii)
  - (B) (i), (ii) & (iii)
  - (C) (iii) & (iv)
  - (D) (i), (ii), (iii) & (iv)

72. Match the following statements in Group 1 with database objects in Group 2 :

**Group 1**

- P. View
- Q. Table
- R. Role
- S. Function

**Group 2**

- I. that which contains data
  - II. that which returns a value
  - III. that helps in managing groups of privileges
  - IV. that which contains only a stored SQL statement
- (A) P→I, Q→II, R→III, S→IV
  - (B) P→II, Q→I, R→IV, S→III
  - (C) P→IV, Q→I, R→III, S→II
  - (D) P→IV, Q→III, R→I, S→II

73. Every table with two single valued attributes is in :
- (A) 2NF
  - (B) 3NF
  - (C) BCNF
  - (D) All of the above
74. Database contains two tables : Employee (id, name, salary, did) and Dept. (did, dname). Which of the following is an *incorrect* SQL query ?
- (A) Select name, dname from employee natural join Dept;
  - (B) Delete from employee where did in (Select did from Dept);
  - (C) Update employee set salary = salary \* 1.03 where salary > 100000;
  - (D) Insert values into employee (1, 'vijay', 100000, 12);
75. Which keyword is used to rename a field name in SQL query ?
- (A) AS
  - (B) ALTER
  - (C) LIKE
  - (D) FROM
76. Which amongst the following statements are *correct* ?
- (i) Writing a database object without reading its initial value is called Blind write
  - (ii) In wound wait technique, the number of rollback is low
  - (iii) In wait-die technique, the younger transaction is never rolled back
  - (iv) The different locks in 2PL mechanism are shared, read, write and unlock.
- (A) (i), (ii) and (iii)
  - (B) (i) & (ii)
  - (C) (i), (ii) and (iv)
  - (D) (ii), (iii) and (iv)
77. An association rule which involves numeric attributes having implicit ordering among values is known as.....association rule.
- (A) Multivalued
  - (B) Ordered
  - (C) Numeric
  - (D) Quantitative

78. Agglomerative approach of clustering is one of the.....methods.
- (A) Density  
(B) Partitioning  
(C) Hierarchical  
(D) Model based
79. What is the default replication factor in HDFS for a hadoop cluster having 100 data nodes ?
- (A) 1  
(B) 2  
(C) 3  
(D) 4
80. Which of the following is a wide column store ?
- (A) Cassandra  
(B) Riak  
(C) Mango DB  
(D) Redis
81. Consider a system having ' $m$ ' resources of the same type. These resources are shared by three processes P1, P2 and P3 which have peak demands of 2, 5 and 7 resources respectively. For what value of ' $m$ ' deadlock will not occur ?
- (A) 70  
(B) 14  
(C) 13  
(D) 7
82. A virtual memory has a page size of 1K words. There are eight pages and four blocks. The associative memory page table contains the following entries :
- | Page | Block |
|------|-------|
| 0    | 3     |
| 2    | 1     |
| 5    | 2     |
| 7    | 0     |
- Which of the following lists of virtual addresses (in decimal) will NOT cause any page fault if referenced by the CPU ?
- (A) 1024, 3072, 4096, 6144  
(B) 1234, 4012, 5000, 6200  
(C) 1020, 3012, 6120, 8100  
(D) 2021, 4050, 5112, 7100
83. A memory management system has 64 pages with page size of 512 bytes. Physical memory consists of 32 page frames. Number of bits required in logical and physical address are respectively :
- (A) 14 and 15  
(B) 14 and 29  
(C) 15 and 14  
(D) 16 and 32

84. A FAT (File Allocation Table) based file system is being used and the total overhead of each entry in the FAT is 4 bytes in size. Given a  $100 \times 10^6$  bytes disk on which the file system is stored and data block size is  $10^3$  bytes, the maximum size of a file that can be stored on this disk in units of  $10^6$  bytes is..... .
- (A) 99.55 to 99.65  
(B) 100.5 to 101.4  
(C) 97.2 to 98.5  
(D) 89.1 to 91.2
85. A computer has twenty physical page frames which contain pages numbered 101 through 120. Now a program accesses the pages numbered 1, 2,....., 100 in that order, and repeats the access sequence THRICE. Which one of the following page replacement policies experiences the same number of page faults as the optimal page replacement policy for this program ?
- (A) Least-recently-used  
(B) First-in-first-out  
(C) Last-in-first-out  
(D) Most-recently-used
86. We need to design a filesystem to store image files having maximum one block size. Which of the following disk space allocation methods is most appropriate to meet this requirement ?
- (A) Contiguous Allocation  
(B) Linked Allocation  
(C) Indexed Allocation  
(D) Hashed Allocation
87. Which type of encryption is preferred to encrypt the data stored on a conventional hard-disk ?
- (A) Symmetric-key cryptography  
(B) Asymmetric-key cryptography  
(C) Hashing  
(D) Quantum cryptography
88. Which system call replaces a current process in Linux ?
- (A) pipe  
(B) fork  
(C) exec  
(D) dup

89. Which of the following is *not* an Inter-process-communication mechanism in Linux ?

- (A) Pipe
- (B) Redirection
- (C) Socket
- (D) Signal

90. Windows operating system use the following two modes to protect user applications from accessing and/or modifying critical operating system data :

- (A) Normal user mode and Administrator mode
- (B) User mode and Kernel mode
- (C) Hardware mode and Software mode
- (D) Hardware interrupt mode and Software interrupt mode

91. In software development process, ..... is a design strategy that tries to address the design and implementation complications associated with such inter-dependencies by explicitly introducing aspects as system characteristics.

- (A) Agile development model
- (B) Evolutionary development model
- (C) Rapid linear sequence development model
- (D) Aspect-oriented development model

92. In software development process, which is not one of the key questions that is answered by each team member at each daily Scrum meeting ?
- (A) What did you do since the last meeting ?  
(B) What obstacles are you encountering ?  
(C) What is the cause of the problems you are encountering ?  
(D) What do you plan to accomplish at the next team meeting ?
93. A user is describing a real-life example during requirement gathering stage of a software development project.  
This most appropriately represents which requirement discovery technique ?
- (A) Viewpoint  
(B) Interview  
(C) Scenario  
(D) Use-case
94. Cohesion is.....and coupling is..... .
- (A) Intra-module, Inter-module  
(B) Inter-module, Intra-module  
(C) Intra-module, Intra-module  
(D) Inter-module, Inter-module
95. One of the following is most desirable when using LOC as a size oriented metric ?
- (A) LOC is language dependent  
(B) LOC is language independent  
(C) LOC can be computed before design phase  
(D) LOC can be easily computed
96. Which of the following is *not* a size metric ?
- (A) LOC  
(B) Function Count  
(C) Program Length  
(D) Cyclomatic Complexity

97. An independent path is a path through the program that introduces set of..... .
- (i) new conditions  
(ii) processing statements
- (A) (i) only  
(B) (ii) only  
(C) (i) or (ii) or both  
(D) Neither (i) nor (ii)
98. Software Configuration Management (SCM) provides systematic evolution of a software under development and provides for :
- (i) Visibility  
(ii) Controlled change  
(iii) Traceability  
(iv) Monitoring
- (A) (i), (ii) and (iii)  
(B) (i), (ii) and (iv)  
(C) (i), (ii), (iii) and (iv)  
(D) (ii) and (iii)
99. When error occurs, the process of anticipating such errors through setting up error handling paths to reroute or terminating processing cleanly is known as..... .
- (A) Debugging  
(B) Redebugging  
(C) Predebugging  
(D) Antibugging
100. Which is the correct evolutionary path of five level capability maturity model ?
- (A) initial, defined, repeatable, managed, optimizing  
(B) initial, repeatable, defined, managed, optimizing  
(C) initial, defined, managed, optimizing, repeatable  
(D) initial, repeatable, managed, defined, optimizing

**MAR - 37223/II—D**

**ROUGH WORK**

**MAR - 37223/II—D**

**ROUGH WORK**