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**COMPUTER SCIENCE AND APPLICATIONS**

**PAPER II**

**Time Allowed : 2 Hours]**

**[Maximum Marks : 200**

**Instruction for the Candidates**

1. Write your Roll Number in the space provided on the top of this page. Do not write anything else on the Test Booklet except in the space provided for rough work.
2. This paper consists of **one hundred (100)** multiple-choice type of questions. **All** questions carry equal marks.
3. At the commencement of the examination, the question booklet will be given to you. In the first 5 minutes, you are requested to open the booklet and compulsorily examine it as below :
  - (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 and do not accept an 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 pages/questions missing or duplicate or not in serial order or any other discrepancy should be got replaced immediately by a correct booklet from the invigilator within the period of 5 minutes. Afterwards, neither the Question Booklet will be replaced nor any extra time will be given.**
4. Each item has four alternatives response marked (A), (B), (C) and (D). You have to darken the circle as indicated below for the correct response against each item completely with **Blue/Black ball point pen** as shown below. H.B. Pencil should not be used in blackening the circle to indicate responses on the answer sheet.

Example :      (A) ● (C) (D)      Where (B) is correct response.
5. Your responses to the each item are to be indicated in the **OMR** Sheet provided to you only. If you mark your response 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 in the end of this booklet.
8. **If you write your Name, Roll 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, such as change of response by scratching or using white fluid, you will render yourself liable to disqualification.**
9. You have to return the original OMR Sheet to the invigilators at the end of the examination compulsorily and must not carry it with you outside the Examination Hall. You are however, allowed to carry original question booklet and duplicate copy of OMR Sheet on conclusion of examination.
10. **Use of any calculator or log table etc., is prohibited.**
11. **There are no negative marks for incorrect answers.**
12. **CARRYING AND USE OF ELECTRONICS/COMMUNICATION DEVICES IN EXAMINATION HALL IS NOT ALLOWED.**

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# COMPUTER SCIENCE AND APPLICATIONS

## Paper II

Time Allowed : 2 Hours]

[Maximum Marks : 200

Note :— This question paper contains **One hundred (100)** multiple choice questions.  
Each question carries **two (2)** marks. Attempt *all* questions.

- P and Q are two propositions. Which of the following logical expressions are equivalent ?
  - $P \vee \sim Q$
  - $\sim (\sim P \wedge Q)$
  - $(P \wedge Q) \vee (P \wedge \sim Q) \vee (\sim P \wedge \sim Q)$
  - $(P \wedge Q) \vee (P \wedge \sim Q) \vee (\sim P \wedge Q)$

(A) Only (I) and (II)                      (B) Only (I), (II) and (III)  
(C) Only (I), (II) and (IV)              (D) (I), (III) and (IV)
- Let N denotes the set of all natural numbers and R be the relation on  $N \times N$  defined by  $(a, b) R (c, d) \Leftrightarrow a + d = b + c, \forall (a, b), (c, d) \in N \times N$ .  
Then R is :
  - Reflexive but not symmetric
  - Not reflexive but symmetric
  - Symmetric but not transitive
  - Equivalence relation
- Everybody in a room shakes hands with everybody else. The total number of handshakes is 66. The total number of persons in the room is :
  - 11
  - 12
  - 13
  - 14

There are 3 coins in a box. One is a two-headed coin, another is a fair coin and third is a biased coin that comes up heads 75 percent of the time. When one of the three coins is selected at random and flipped, it shows heads. What is the probability that it was the two-headed coin ?

(A)  $\frac{1}{9}$

(B)  $\frac{2}{9}$

(C)  $\frac{4}{9}$

(D)  $\frac{5}{9}$

5. Let  $G = \{1, -1, i, -i\}$  be a group w.r.t. multiplication. The order of  $i$  is :  
(where  $i = \sqrt{-1}$ )

(A) 2

(B) 3

(C) 4

(D) 5

6. Let  $G$  be a finite group on 10 elements. Let  $H$  be a subgroup of  $G$  and  $H \neq G$ . The size of a largest possible subgroup  $H$  of  $G$  is :

(A) 4

(B) 5

(C) 7

(D) 9

7. If  $G$  is a graph with  $e$  edges and  $n$  vertices, the sum of the degree of all vertices in  $G$  is :

(A)  $e$

(B)  $e/2$

(C)  $2e$

(D)  $2/e$

8. A connected planar simple graph has 20 vertices, each of degree 3. Into how many regions does a representation of this planar graph split the plane ?

(A) 12

(B) 30

(C) 60

(D) 20



9. In a critical path analysis, CPM is :
- (A) Event oriented (B) Probabilistic in nature  
 (C) Deterministic in nature (D) Dynamic in nature

10. Consider the following Linear Programming Problem (LPP) :

$$\text{Max. } Z = 2x_1 + 4x_2$$

$$\text{S.t. } x_1 + 2x_2 \leq 5$$

$$x_1 + x_2 \leq 4$$

$$x_1, x_2 \geq 0$$

The above LPP has a/an :

- (A) Unique solution (B) Infinite solution  
 (C) Unbounded solution (D) Infeasible solution
11. Match the following :

**List-I**

**List-II**

- |                         |                                    |
|-------------------------|------------------------------------|
| (a) 2421 Code           | (i) Cache memory                   |
| (b) Control memory      | (ii) Storage unit                  |
| (c) Register            | (iii) Self complementing           |
| (d) Associative mapping | (iv) Micro-programmed control unit |

**Codes :**

- |           |       |       |      |
|-----------|-------|-------|------|
| (a)       | (b)   | (c)   | (d)  |
| (A) (i)   | (ii)  | (iii) | (iv) |
| (B) (iii) | (iv)  | (ii)  | (i)  |
| (C) (iv)  | (iii) | (ii)  | (i)  |
| (D) (iv)  | (iii) | (i)   | (ii) |

12. Evaluate the following postfix expression ABCDE  $\times/- +$ , if A = 10, B = 12, C = 70, D = 5 and E = 7 :

- (A) 31 (B) 30  
(C) 20 (D) 21

13. Match addressing mode to the location of the operand :

**List-I**

**List-II**

**Addressing mode**

**Location of operand**

- |                       |  |
|-----------------------|--|
| (a) Implied           | (i) Registers in CPU                                       |
| (b) Immediate         | (ii) Register specifies the address of the operand         |
| (c) Register          | (iii) Operand is part of instruction                       |
| (d) Register Indirect | (iv) Specified implicitly in the definition of instruction |

**Codes :**

- |           |       |       |      |
|-----------|-------|-------|------|
| (a)       | (b)   | (c)   | (d)  |
| (A) (i)   | (ii)  | (iii) | (iv) |
| (B) (iv)  | (iii) | (ii)  | (i)  |
| (C) (iii) | (iv)  | (ii)  | (i)  |
| (D) (iv)  | (iii) | (i)   | (ii) |

14. Which of the following statements are *true* ?
- (i) Programmed I/O is more efficient than interrupt initiated I/O in terms of CPU utilization.
  - (ii) Interrupt initiated I/O is more efficient than programmed I/O in terms of CPU utilization.
  - (iii) DMA transfer is based on the checking of input and output flags by the CPU.
  - (iv) DMA transfer is used to perform data transfer between memory and I/O directly.
- (A) (i) and (iii) only                      (B) (i) and (iv) only  
(C) (ii) and (iii) only                      (D) (ii) and (iv) only
15. What is the radix (base) of the numbers, if the solution of quadratic equation  $x^2 - 10x + 36 = 0$  is  $x = 8$  and  $x = 6$  ?
- (A) 15    (B) 14  
(C) 13    (D) 12
16. Which of the following is (are) CISC characteristic(s) in Computer Architecture ?
- (i) Variable length instruction formats
  - (ii) A large variety of addressing modes
  - (iii) Single cycle instruction execution
- (A) (i) and (ii) only                      (B) (i) only  
(C) (iii) only                                      (D) (i), (ii) and (iii)

17. A computer uses a memory unit with 256 K words of 32 bits each. A binary instruction code is stored in one word of memory. The instruction has four parts : an indirect bit, an operation code, a register part to specify one of 64 registers and an address part. How many bits are there in operation code ?

- (A) 7 (B) 8  
(C) 10 (D) 12

18. Consider the following two level implementations :

- (i) AND-OR  
(ii) NAND-NAND  
(iii) NOR-NOR

The sum of products form of Boolean function can be implemented using :

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

19. The time delay of the four segments in the pipeline are as follows :  $t_1 = 50$  ns,  $t_2 = 30$  ns,  $t_3 = 95$  ns and  $t_4 = 45$  ns. The interface delay time  $t_r = 5$  ns. How long will it take to complete 100 tasks in the pipeline ?

- (A) 10200 ns (B) 10300 ns  
(C) 10400 ns (D) 10500 ns

20. A two-way set associative cache memory uses block of four words. The cache can accommodate a total of 2048 words from main memory. The main memory size is  $128\text{ K} \times 32$ . How many bits are there in the Tag, set and word field of Address format ?

	Tag	Set	Word
(A)	7	8	2
(B)	8	7	2
(C)	9	6	2
(D)	10	5	2

21. In regard to XML DTD and XML scheme, which is *not* correct ?
- (A) Both are used to validate XML documents
  - (B) Both work on well formed XML documents
  - (C) Both are themselves XML complaint
  - (D) Both are based on the tree data model
22. Which of the following shows the *correct* hierarchy of arithmetic operations in C ?
- (A)  $/ + * -$
  - (B)  $* - / +$
  - (C)  $+ - / *$
  - (D)  $* / + -$
23. Which of the following points lies on the other side of the origin with reference to the line  $4x + 3y = 12$  ?
- (A) (2, 1)
  - (B) (1, 3/2)
  - (C) (3, 1)
  - (D) (1, 1)
24. The executable statement  $x = 8 + 2\% - 8$  evaluates to :
- (A) 2
  - (B) 10
  - (C) 8
  - (D) 0



25. Which storage class should be preferred for the variables that are used by almost all functions in a program ?
- (A) Static (B) Extern  
(C) Auto (D) Register
26. Javascript can be coded in HTML :
- (A) In the <html> section but outside the <body> section  
(B) Either in the <head> or the <body> section  
(C) As an external file and then include in the <body> section  
(D) In the <title> section only
27. Which of the following is (are) *true* for a C++ constructor ?
- (i) Constructor is called once for a global object.  
(ii) Constructor is called once for a static local object.  
(iii) Constructor is called each time the object declaration is encountered for local objects.
- (A) (i) and (ii) only (B) (i) and (iii) only  
(C) (ii) and (iii) only (D) (i), (ii) and (iii)
28. When the access specifier for a base class is public :
- (i) All protected members of the base become protected members of the derived class.  
(ii) All public members of the base become public members of the derived class.  
(iii) Base's private members remain private and not accessible by members of the derived class.
- (A) (i), (ii) and (iii) are correct (B) Only (ii) and (iii) are correct  
(C) Only (iii) is correct (D) Only (i) is correct

29. When HTTP calls for a servlet that is not yet loaded, the steps followed in sequence are :
- (A) Load, create, initialize and service  
 (B) Service only  
 (C) Initialize and service  
 (D) Create, initialize and service
30. Match the following lists :

**List-I**

- (a) Applet  
 (b) Javascript  
 (c) Servlet  
 (d) CGI

**List-II**

- (i) Server side, heavyweight  
 (ii) Client side, uncompiled java code  
 (iii) Client side, compiled java code  
 (iv) Server side, lightweight

**Codes :**

- |           |       |      |      |
|-----------|-------|------|------|
| (a)       | (b)   | (c)  | (d)  |
| (A) (iii) | (ii)  | (i)  | (iv) |
| (B) (iii) | (i)   | (ii) | (iv) |
| (C) (ii)  | (iii) | (iv) | (i)  |
| (D) (iii) | (ii)  | (iv) | (i)  |

31. Which of the following is *true* about the Impedance Mismatch problem ?
- (A) It is handled by OODBs by storing persistent objects beyond program execution.  
 (B) It arises when the data structures of the programming language are incompatible with the data structures of DBMS.  
 (C) Both (A) and (B)  
 (D) Neither (A) nor (B)

32. Which of the following is *NOT* true about NOSQL ?
- (A) It is a class of non-relational data storage system
  - (B) Relaxes the ACID properties
  - (C) It requires a fixed Table Schema
  - (D) May be of the type key/value or schema-less
33. Consider the following statements :
- (i) Candidate key is any minimal set of attributes that functionally determine all attributes.
  - (ii) Primary key is used to uniquely identify each tuple in a relation.
  - (iii) Primary key may be composite.
- Which of the following is *true* ?
- (A) Only (ii) and (iii)
  - (B) Only (i) and (ii)
  - (C) Only (ii)
  - (D) (i), (ii) and (iii)
34. Which of the following is *True* ?
- (A) Given a populated relation, we can determine the functional dependencies of the relation.
  - (B) The higher the Normal Form of the relation, the more efficient it is.
  - (C) If an attribute is removed from a superkey, it will cause the superkey to cease to be a superkey.
  - (D) An attribute that is not the member of any candidate is the non-prime attribute.
35. Functional Dependency  $X \rightarrow A$  holds in a relation schema R, where X is not a superkey and A is a prime attribute. Which is *true* ?
- (A) R will be in 3 NF but not in BCNF
  - (B) R will be in 3 NF as well as in BCNF
  - (C) R is in 4 NF
  - (D) R will be in 2 NF but not in 3 NF

36. Which is *false* about Native XML Databases ?
- (A) They are based on the hierarchical tree model
  - (B) They work on specialized indexing and querying techniques
  - (C) They include data compression techniques to reduce the size of the documents for storage
  - (D) They store XML documents in text fields

37. Let Relation R be

AI	AII	AIII
1	2	3
4	5	6
7	8	9

and Relation S be

AIV	AV
3	1
6	2

The  $\theta$ -join of relation R and S, given by  $R \bowtie_{2<1} S$  is the following :

(A)	AI	AII	AIII	AIV	AV	(B)	AI	AII	AIII	AIV	AV
	1	2	3	3	1		1	2	3	3	1
	1	2	3	6	2		1	2	3	6	2
	4	5	6	6	2						

(C) No tuples get selected

(D)	AI	AII	AIII	AIV	AV
	7	8	9	6	2
	7	8	9	3	1



38. SELECT branch\_name, max (loan\_amount) FROM loan\_details :
- (A) Displays the branch name and loan amount of the branch that took the maximum loan
- (B) Displays the name of all branches that took the maximum loan. Does not display the loan\_amount
- (C) Displays an error
- (D) Displays all tuples from the table loan\_details

39. SELECT branch\_name FROM loan\_details WHERE loan\_amount =  
(SELECT min (loan\_amount)  
FROM loan-details)

- (A) Invalid Query
- (B) Displays the branch\_name(s) only of the branch(es) with minimum loan amount. Does not display the minimum loan amount
- (C) Displays branch\_name and loan\_amount of the branch(es) with minimum loan amount
- (D) Displays minimum loan\_amount only of the branch(es) with minimum loan amount. Does not display the branch\_name
40. Match the following lists :

**List-I**

- (a) Association Rule Mining
- (b) Classification
- (c) Clustering
- (d) Regression

**List-II**

- (i) Predicts class labels
- (ii) Frequent patterns
- (iii) Predicts continuous valued functions
- (iv) Groups similar data

**Codes :**

- |     |       |       |      |       |
|-----|-------|-------|------|-------|
|     | (a)   | (b)   | (c)  | (d)   |
| (A) | (ii)  | (iii) | (iv) | (i)   |
| (B) | (iv)  | (iii) | (i)  | (ii)  |
| (C) | (iii) | (i)   | (ii) | (iv)  |
| (D) | (ii)  | (i)   | (iv) | (iii) |

41. Effective transfer rate of a storage device is defined as the :
- (A) Ratio of total bytes per total seconds excluding overhead time
  - (B) Ratio of total bytes per total seconds including overhead time
  - (C) Ratio of total bytes per total seconds
  - (D) Total bytes transferred
42. Indexed allocation strategy is suitable :
- (i) If file is large
  - (ii) If file is usually accessed randomly
  - (iii) If file is small
  - (iv) If file is usually accessed sequentially
- (A) Only (i) and (ii)
  - (B) Only (ii)
  - (C) Only (iii)
  - (D) Only (ii) and (iii)
43. Consider the following four processes with the length of the CPU burst time given in milliseconds (ms) :

Process	Arrival Time	Burst Time
P <sub>1</sub>	0	8
P <sub>2</sub>	1	4
P <sub>3</sub>	2	9
P <sub>4</sub>	3	5

What will be the average waiting time in case of preemptive and non-preemptive shortest job first scheduling algorithm ?

- (A) 6.5 ms and 7.75 ms
- (B) 6.00 ms and 7.00 ms
- (C) 9.25 ms and 10.20 ms
- (D) 7.25 ms and 8.21 ms

44. A process is defined as :

- (A) A program under execution
- (B) A program residing in secondary memory
- (C) A job in primary memory
- (D) A program in high level language kept on secondary storage

45. When a process creates a new process, following possibilities exist in terms of the address space of the new process :

- (i) The child has the same program and data as the parent.
- (ii) The child process has a new program loaded into it.

Which of the above statement(s) is/are *true* ?

- (A) Only (i)
- (B) Only (ii)
- (C) Both (i) and (ii)
- (D) Neither (i) nor (ii)

46. Each log record describes a single operation of a translation write and has the following fields :

- (i) New value
- (ii) Old value
- (iii) Data item name
- (iv) Translation name

Which of the above are *true* ?

- (A) Only (iii) and (iv)
- (B) Only (i) and (ii)
- (C) Only (i), (ii) and (iii)
- (D) (i), (ii), (iii) and (iv)

47. Match the items of List-I with the items of List-II :

List-I	List-II
<b>Page replacement algorithms</b>	<b>Suffer from Belady's anomaly</b>
(a) Optimal	(i) No
(b) LRU	(ii) Yes
(c) Second-chance	
(d) FIFO	

**Codes :**

	(a)	(b)	(c)	(d)
(A)	(i)	(i)	(ii)	(ii)
(B)	(i)	(i)	(ii)	(i)
(C)	(ii)	(i)	(ii)	(i)
(D)	(i)	(ii)	(i)	(ii)

48. If preemption is required to deal with deadlocks, then the following issues need to be addressed :

- (A) Only 'Selecting a victim'
- (B) Only 'Rollback'
- (C) Only 'Starvation'
- (D) 'Selecting a victim', 'Rollback' and 'Starvation'





52. Which of the following statements are true in the context of Agile Software Development ?
- (i) It is Linear Development.
  - (ii) It is Incremental Development.
  - (iii) It is Iterative Development.
- (A) Only (i) and (ii)                      (B) Only (i) and (iii)  
(C) Only (ii) and (iii)                      (D) (i), (ii) and (iii)
53. In the McCall's software quality model, software quality factor 'Reliability' consists of the following :
- (i) Consistency
  - (ii) Accuracy
  - (iii) Error tolerance
  - (iv) Simplicity
- (A) Only (i) and (ii)                      (B) Only (i) and (iii)  
(C) Only (i) and (iv)                      (D) Only (i), (ii) and (iii)
54. Which of the following statements are *correct* ?
- (i) Defect prevention is a quality assurance activity
  - (ii) Inspection is a quality control activity
  - (iii) Training is a quality control activity
  - (iv) Checkpoint review is a quality control activity
- (A) Only (i)                                      (B) Only (i), (ii) and (iv)  
(C) Only (iv)                                      (D) Only (i) and (iv)

55. Real time performance shortfalls risk in software can be handled by using :
- (A) Simulation and modeling (B) Task analysis  
 (C) Cost benefit analysis (D) Team building
56. Which of the following is a non-functional testing ?
- (A) Pair-wise testing (B) Cause-Effect Graphing  
 (C) Boundary Value Analysis (D) Mutation Testing
57. Which one of the following is the lowest level of cohesion ?
- (A) Functional (B) Sequential  
 (C) Coincidental (D) Temporal
58. Match the items of List-I with the items of List-II :

**List-I**

**Process Models**

- (a) Waterfall model  
 (b) Prototyping model  
 (c) Iterative model  
 (d) Timeboxing model

**List-II**

**Types of Projects**

- (i) Short delivery  
 (ii) User interface is important  
 (iii) Existing manual system  
 (iv) Requirements are not known in advance

**Codes :**

- |     |       |       |       |       |
|-----|-------|-------|-------|-------|
|     | (a)   | (b)   | (c)   | (d)   |
| (A) | (iii) | (ii)  | (iv)  | (i)   |
| (B) | (i)   | (ii)  | (iii) | (iv)  |
| (C) | (iv)  | (iii) | (ii)  | (i)   |
| (D) | (ii)  | (iv)  | (i)   | (iii) |

59. Which of the following is *not* a software configuration management activity ?

- (A) Auditing (B) Status Accounting  
(C) Control (D) Bug fixing

60. Basic execution time model was developed by :

- (A) R. Pressman (B) S. Yamada  
(C) Victor Baisili (D) J.D. Musa

61. Let double hashing use a hash function of the form :

$$h(k, i) = [h_1(k) + ih_2] \text{ mod } m$$

where

$$h_1(k) = k \text{ mod } m$$

$$h_2(k) = 1 + (k \text{ mod } m_1)$$

$$m = 701 \text{ and } m_1 = 700$$

For key  $k = 124858$ , the first probe is to position 80, and then every ..... is examined until the key is found or every slot is examined.

- (A) 257th slot (modulo  $m$ ) (B) 275th slot (modulo  $m$ )  
(C) 337th slot (modulo  $m$ ) (D) 355th slot (modulo  $m$ )

62. The reverse polish notation equivalent to the infix expression :

$$((a + b) * c + d)/(e + f + g)$$

is :

- (A)  $ab + c * d + ef + g + /$  (B)  $ab + cd * + ef + g + /$   
(C)  $ab + c * d + efg + + /$  (D)  $ab + c * d + e + fg + /$

63. The solution to the recurrence relation

$$P(n) = \begin{cases} 1, & n = 1 \\ \sum_{k=1}^{n-1} P(k)P(n-k), & n \geq 2 \end{cases}$$

is :

- (A)  $O(n^2)$  (B)  $O(n^4)$   
(C)  $\Omega(n^3)$  (D)  $\Omega(2^n)$



64. The Huffman coding is used to encode the message before transmitting over the network. Suppose the message contains the following characters with their frequency :

Character	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>
Frequency	10	14	17	18	21	50

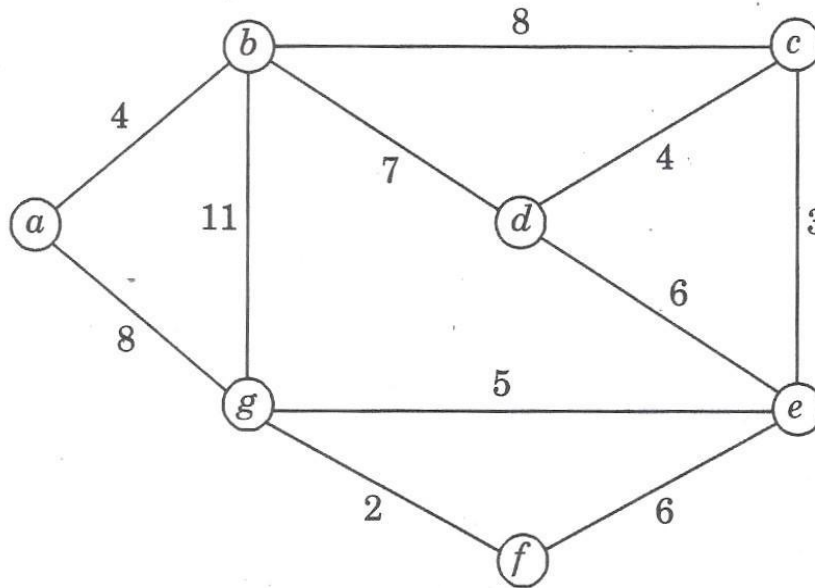
Assume, each character in input message takes 1 byte. How many bits will be saved in the message if Huffman coding is used for transmission ?

- (A) 314 (B) 1040  
 (C) 726 (D) 414

65. The number of different binary trees with 5 nodes is :

- (A) 252 (B) 51  
 (C) 42 (D) 24

66. For the graph given below, what is weight of minimum spanning tree ?



- (A) 24 (B) 25  
 (C) 26 (D) 27

67. Given the following algorithms :

(i) Floyd-Warshall

(ii) Transitive closure

Which of the algorithm(s) is(are) used to complete shortest paths between an two vertices of a given graph ?

(A) Only (i)

(B) Only (ii)

(C) Both (i) and (ii)

(D) Neither (i) nor (ii)

68. Match the two lists :

**List-I (Algorithm)**

**List-II (Time)**

(a) Knuth-Morris-Pratt

(i)  $\theta(n)$

(b) Fast Fourier Transform

(ii)  $\theta(n^2)$

(c) Floyd-Warshall

(iii)  $\theta(n \lg n)$

(d) Longest Common Subsequence

(iv)  $\theta(n^3)$

**Codes :**

(a) (b) (c) (d)

(A) (iii) (i) (iv) (ii)

(B) (i) (iii) (iv) (ii)

(C) (iii) (i) (ii) (iv)

(D) (i) (iii) (ii) (iv)

69. Consider the following statements :

$S_1$  : Las Vegas algorithms always produce correct or optimum results.

$S_2$  : Monte-Carlo algorithms produce correct or optimum result with some probability.

Which of the following is *correct* ?

(A) Only  $S_1$

(B) Only  $S_2$

(C) Both  $S_1$  and  $S_2$

(D) Neither  $S_1$  nor  $S_2$

70. Consider the following problems :

(i) Vertex cover problem  $\in$  NPC

(ii) Clique problem  $\in$  NPC

Which of the following is *correct* ?

(A) Only (i)

(B) Only (ii)

(C) Both (i) and (ii)

(D) Neither (i) nor (ii)

71. The smallest finite automation which accepts the language  $L = \{W \mid \text{length of } W \text{ is divisible by } 5\}$  has :

(A) 4 states

(B) 5 states

(C) 6 states

(D) 7 states

72. Which of the following definitions below generates the same language as  $L = \{a^n b^n \mid n \geq 1\}$  ?
- (i)  $A \rightarrow aAb \mid ab$
  - (ii)  $ab \mid (a^+ a b^+ b)$
  - (iii)  $a^+ b^+$
- (A) (i) and (ii) only                      (B) (ii) and (iii) only  
 (C) (i) only                                  (D) (ii) only
73. Let  $\Sigma_1$  and  $\Sigma_2$  be finite alphabets and let  $\#$  be a symbol outside both  $\Sigma_1$  and  $\Sigma_2$ . Let  $f$  be a total function from  $\Sigma_1^*$  to  $\Sigma_2^*$ . We say  $f$  is computable if there exists a turning machine  $M$  which given an input  $x$  in  $\Sigma_1^*$ , always halts with  $f(x)$  on its tape. Let  $L$  denote the language  $\{x \# f(x) \mid x \in \Sigma_1^*\}$ . Which of the following is correct ?
- (A) If  $f$  is computable then  $L$  is recursively enumerable, but not conversely
  - (B) If  $f$  is computable then  $L$  is recursive, but not conversely
  - (C)  $f$  is computable if and only if  $L$  is recursively enumerable
  - (D)  $f$  is computable if and only if  $L$  is recursive
74. Consider the following :
- (i) Dynamic memory allocation
  - (ii) Inline expansion
  - (iii) Type checking
- Which of the above is performed during compilation ?
- (A) (i) and (ii) only                      (B) (i) and (iii) only  
 (C) (ii) and (iii) only                      (D) (i), (ii) and (iii)



75. Match the following :

**List-I**

**List-II**

- |                          |                          |
|--------------------------|--------------------------|
| (a) Top down parsing     | (i) Type checking        |
| (b) Runtime environments | (ii) Activation records  |
| (c) Semantic analysis    | (iii) Finite automation  |
| (d) Lexical analysis     | (iv) Leftmost derivation |

**Codes :**

- |           |       |      |       |
|-----------|-------|------|-------|
| (a)       | (b)   | (c)  | (d)   |
| (A) (i)   | (iii) | (ii) | (iv)  |
| (B) (iii) | (ii)  | (i)  | (iv)  |
| (C) (i)   | (ii)  | (iv) | (iii) |
| (D) (iv)  | (ii)  | (i)  | (iii) |

76. Consider the following problems :

- (i) Whether a given context free language is regular
- (ii) Membership problem for type-0 languages

Which of the above are undecidable ?

- |                       |                          |
|-----------------------|--------------------------|
| (A) Only (i)          | (B) Only (ii)            |
| (C) Both (i) and (ii) | (D) Neither (i) nor (ii) |

77. Let  $L$  be any language. Define language  $\text{chop}(L)$  by removing the two leftmost symbols of every string in  $L$  given by

$$\text{Chop}(L) = \{W | vW \in L \text{ with } |v| = 2\}$$

We define another language  $\text{even}(L)$  as the strings obtained by extracting from  $L$  the letters in the even-numbered positions and  $\text{even}(L) = \{\text{even}(W) | W \in L\}$ .

If  $L$  is regular language, then :

- (A)  $\text{Even}(L)$  is regular and  $\text{chop}(L)$  is not regular
  - (B)  $\text{Even}(L)$  is not regular and  $\text{chop}(L)$  is regular
  - (C) Both  $\text{even}(L)$  and  $\text{chop}(L)$  are regular
  - (D) Both  $\text{even}(L)$  and  $\text{chop}(L)$  are not regular
78. Consider the following types of languages :

$L_1$  : Regular

$L_2$  : Context free

$L_3$  : Recursive

$L_4$  : Recursively enumerable

Which of the above is *not* true ?

- (A)  $\bar{L}_3 \cup L_4$  is recursively enumerable
- (B)  $L_1 \cup \bar{L}_2$  is context free
- (C)  $L_1^* \cap L_2$  is context free
- (D)  $\bar{L}_2 \cup L_3$  is recursive

79. Consider a context free grammar with the following productions :

$$S \rightarrow AA|B$$

$$A \rightarrow aA|Aa|b$$

$$B \rightarrow aBaa|b$$

Where S is the start symbol, A and B are non-terminals and  $a$  and  $b$  are the terminals. The language generated by this grammar is :

(A)  $\{a^i ba^j ba^k \mid i, j, k \geq 0\} \cup \{a^n ba^{2n} \mid n \geq 0\}$

(B)  $\{a^i ba^{2j} ba^k \mid i, j, k \geq 0\} \cup \{a^n ba^{2n} \mid n \geq 0\}$

(C)  $\{a^{2i} ba^j ba^k \mid i, j, k \geq 0\} \cup \{a^n ba^{2n} \mid n \geq 0\}$

(D) The set of all strings over  $\{a, b\}$  containing at least two  $a$ 's

80. Which of the following statements are *true* ?

$S_1$  : Every left-recursive grammar can be converted to a right-recursive grammar and vice-versa.

$S_2$  : The derivation trees of strings generated by a context-free-grammar in Chomsky normal form are always almost complete binary trees.

$S_3$  : Every subset of a recursively enumerable set is recursive.

(A) Only (i)

(B) Only (i) and (ii)

(C) Only (i) and (iii)

(D) (i), (ii) and (iii)

81. Which of the following layers of OSI reference model is also called end-to-end layer ?

(A) Data link layer

(B) Network layer

(C) Transport layer

(D) Session layer

82. Using RSA algorithm, what is the value of cipher text C, if the plain text M = 'N' and  $p = 3$ ,  $q = 11$  and  $d = 7$  ?

- (A) Z (B) E  
(C) F (D) A

83. Suppose we want to send a sequence of images of  $60 \times 40$  pixels, each pixel being 8 bit, at the rate of 10 images per second. What is required bit rate of the channel ?

- (A) 512 kbps (B) 1.248 Mbps  
(C) 192 kbps (D) 1.536 Mbps

84. Match the following :

**List-I**

- (a) Application layer  
(b) Transport layer  
(c) Network layer  
(d) Data link layer

**List-II**

- (i) TCP  
(ii) SLIP  
(iii) HTTP  
(iv) BGP

**Codes :**

- |           |      |      |       |
|-----------|------|------|-------|
| (a)       | (b)  | (c)  | (d)   |
| (A) (ii)  | (i)  | (iv) | (iii) |
| (B) (iii) | (iv) | (i)  | (ii)  |
| (C) (iii) | (i)  | (iv) | (ii)  |
| (D) (ii)  | (iv) | (i)  | (iii) |

85. Suppose that instead of using 16 bits for network part of class B address, 18 bits had been used. How many class B networks would have been then ?

- (A) 16384 (B) 65536  
(C) 16382 (D) 65534





91. Which of the following statements is(are) *not* correct ?
- (i) A context free grammar is also called as Phrase Structured Grammar  
(ii) A context free grammar is suitable for free word order language  
(iii) A context free grammar is Positional Grammar
- (A) (i) only (B) (ii) only  
(C) (iii) only (D) (i), (ii) and (iii)
92. What is relationship between car and automobile ?
- (A) Car is hyponym of automobile (B) Car is hypernym of automobile  
(C) Car is meronym of automobile (D) Car is synonym of automobile
93. Local maximum, plateau, ridges are difficulties in which search algorithms ?
- (A) Hill climbing (B) Best first search  
(C) Breadth first search (D) Depth first search
94. Which of the following statements are *true* with respect to a game search tree ?
- (i) A utility function gives values to the terminal states.  
(ii) A terminal test determines when game is over.  
(iii) A successor function returns a list of (move, state) pairs, each indicating a legal move and resulting state.
- (A) (i) and (ii) only (B) (ii) and (iii) only  
(C) (i) and (iii) only (D) (i), (ii) and (iii)
95. Ontology Mapping is also referred as :
- (A) Ontology Taxonomy (B) Ontology Integration  
(C) Ontology Enumeration (D) Ontology Alignment
96. A Horn clause is a clause with ..... positive literal.
- (A) At least one (B) At most one  
(C) At least two (D) At most two

97. Consider the following two relations :

$R_1$	$Y_1$	$Y_2$	$Y_3$	$Y_4$
$X_1$	0.9	0.7	0.5	0.5
$X_2$	0.7	0.4	1.0	0.2
$X_3$	0.8	0.9	0.4	0.1

$R_2$	$Z_1$	$Z_2$	$Z_3$	$Z_4$
$Y_1$	0.9	0.7	0.6	0.5
$Y_2$	0.8	0.3	0.2	0.7
$Y_3$	0.9	0.3	1.0	0.9
$Y_4$	0.8	0.9	0.7	0.8

What will be the value of  $\mu_{R_1 \circ R_2}(X_1, Z_1)$  using max product composition ?

- (A) 0.81 (B) 0.81, 0.63, 0.54, 0.49  
 (C) 0.81, 0.63, 0.72 (D) 0.81, 0.63, 0.72, 0.49

98. A 3-input 2-output NN (Neutral Network) has weigh values  $w_{11} = 0.6$ ,  $w_{12} = 1.1$ ,  $w_{21} = 0.7$ ,  $w_{22} = 0.5$ ,  $w_{31} = 0.8$  and  $w_{32} = 0.2$ . It is given an input of  $[0.3 \ 0.7 \ 1.6]^T$ . What is the output of NN if binary step function is used. Assume threshold = 1.5.

- (A) [1 0] (B) [1 1]  
 (C) [0 1] (D) [0 0]

99. Which is a refutation complete inference procedure for propositional logic ?

- (A) Clauses (B) Variables  
 (C) Propositional Resolution (D) Proposition

100. The term Roulette wheel, windowing, Boltzmann are related to which phase of Genetic Algorithm ?

- (A) Selection (B) Crossover  
 (C) Mutation (D) Encoding