

Roll No.

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(Write Roll Number from left side exactly as in the Admit Card)

Signature of Invigilator

Question Booklet Series

X

PAPER-II

Question Booklet No.

Subject Code : 22

COMPUTER SCIENCE

Time : 2 Hours

Maximum Marks: 200

Instructions for the Candidates

- Write your Roll Number in the space provided on the top of this page as well as on the OMR Sheet provided.
- 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 verify it:
 - To have access to the Question Booklet, tear off the paper seal on the edge of this cover page.
 - Faulty booklet, if detected, should be got replaced immediately by a correct booklet from the invigilator within the period of 5 (five) minutes. Afterwards, neither the Question Booklet will be replaced nor any extra time will be given.
 - Verify whether the Question Booklet No. is identical with OMR Answer Sheet No.; if not, the full set is to be replaced.
 - After this verification is over, the Question Booklet Series and Question Booklet Number should be entered on the OMR Sheet.
- This paper consists of One Hundred (100) multiple-choice type questions. All the questions are compulsory. Each question carries *two* marks.
- Each Question has four alternative responses marked: (A) (B) (C) (D) . You have to darken the circle as indicated below on the correct response against each question.
Example: (A) (B) (C) (D) , where (C) is the correct response.
- Your responses to the questions are to be indicated correctly in the OMR Sheet. If you mark your response at any place other than in the circle in the OMR Sheet, it will not be evaluated.
- Rough work is to be done at the end of this booklet.
- If you write your Name, Phone Number or put any mark on any part of the OMR Sheet, except in 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.
- Do not tamper or fold the OMR Sheet in any way. If you do so, your OMR Sheet will not be evaluated.
- You have to return the 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 question booklet and duplicate copy of OMR Sheet after completion of examination.
- Use only **Black Ball point pen**.
- Use of any calculator, mobile phone, electronic devices/gadgets etc. is strictly prohibited.
- There is no negative marks for incorrect answer.

PAPER II
(COMPUTER SCIENCE)

1. The number of leaf nodes in a complete binary tree of depth d is

- (A) $2d$
- (B) $2(d-1) + 1$
- (C) $2(d+1) - 1$
- (D) $2d + 1$

2. What will be the output of following C-program?

```
#include<stdio.h>
void print(int n)
{if(n > 4000)
    return;
    printf("%d",n);
    print(2*n);
    printf("%d",n);
}
int main()
{
    print(1000);
    getchar();
    return 0;
}
```

- (A) 1000 2000 4000
- (B) 1000 2000 4000 4000 2000 1000
- (C) 1000 2000 4000 2000 1000
- (D) 1000 2000 2000 1000

3. Data warehouse design that supports high volume query access is based upon the concept of

- (A) Entity Relationship modeling
- (B) Dimensional modeling
- (C) OLAP
- (D) Object Oriented Data model

4. Consider a hash function that distributes keys uniformly. The hash table size is 20. After hashing of how many keys will the probability that any new key hashed collides with an existing one exceed 0.5?

- (A) 5
- (B) 6
- (C) 7
- (D) 10

5. What is the bottom-up parsing method also known as?

- (A) Predictive Parsing
- (B) Shift-Reduce Parsing
- (C) Recursive Descent Parsing
- (D) Lookahead Parsing

6. How many memory chips of size $16K \times 8$ will be needed to form a memory of size $1M \times 64$?

- (A) 256
- (B) 512
- (C) 1024
- (D) 2048

7. An algorithm which tries all the possibilities unless results are satisfactory is

- (A) Brute Force algorithm
- (B) Divide and Conquer algorithm
- (C) Dynamic Programming algorithm
- (D) Greedy algorithm

8. Match the following:

- | | |
|------------|------------------------|
| (a) RAID 0 | (i) Parallel Access |
| (b) RAID 1 | (ii) Striping |
| (c) RAID 2 | (iii) Use Hamming Code |
| (d) RAID 3 | (iv) Mirrored |

Codes:

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

9. Which one from the following is highly associated activity of project planning?

- (A) Keep track of the project progress
- (B) Compare actual and planned progress and costs
- (C) Identify the activities, milestones and deliverables produced by a project
- (D) Both (A) and (B)

10. Which of the following is NOT among the building blocks of the best practices every successful cloud-computing platform should follow?

- (A) World-class security
- (B) Complete disaster recovery
- (C) High availability
- (D) Resource utilization

11. Consider the recurrence relation $T(n) = T(n-1) + n^3$, $n \geq 1$ integer. $T(0) = 0$, then $T(n)$ is

- (A) $\frac{n(n+1)}{2}$
- (B) $\frac{n(n+1)(2n+1)}{6}$
- (C) $\left\{ \frac{n(n+1)}{2} \right\}^2$
- (D) $\left\{ \frac{n(n-1)}{2} \right\}^2$

12. Consider the following declaration of a two-dimensional array in C:

`char a[100][100];`

Assuming that the main memory is byte-addressable and that the array is stored starting from memory address 0, the address of `a[40][50]` in column major order is

- (A) 4040
- (B) 4050
- (C) 5040
- (D) 5050

13. Which of the following requirements are not well captured in use-case diagram?

- (A) Functional requirements
- (B) Non-functional requirements
- (C) User interactions
- (D) Hardware interactions

14. Consider a relation schema $R = (A, B, C, D)$ on which the following functional dependencies hold:

$$\{AB \rightarrow D, CB \rightarrow D, A \rightarrow C, C \rightarrow A\}.$$

The highest normal form of this relation schema is

- (A) 2NF
- (B) 3NF
- (C) BCNF
- (D) 4NF

15. Given the inorder and postorder traversal of a binary tree as DBGEACHFI and DGEBHIFCA, respectively. What would be the preorder traversal of the binary tree?

- (A) ABDGECHFI
- (B) ABDEGCFHI
- (C) ADBGECHFI
- (D) ABDGECFHI

16. Which of the following is an advantage of a Reduced Instruction Set Computer (RISC) architecture?

- (A) It has a larger instruction set for more complex computations.
- (B) It typically requires fewer clock cycles per instruction.
- (C) It provides a more flexible and extensible architecture.
- (D) It is more suitable for memory-intensive applications.

17. Consider the grammar

$$S \rightarrow PQ \mid SQ \mid PS$$

$$P \rightarrow x$$

$$Q \rightarrow y$$

To get a string of n terminals, the number of productions to be used is

- (A) n^2
- (B) $n + 1$
- (C) $2n$
- (D) $2n - 1$

18. In distributed systems, link and site failure are detected by

- (A) Polling
- (B) Handshaking
- (C) Token passing
- (D) Message passing

19. Which of the following is *not* an informed search method?

- (A) Best First Search
- (B) A* Search
- (C) Memory Bound Heuristic Search
- (D) Linear Search

20. In which type of testing, software is compiled as product and then it is tested as a whole?

- (A) Integration testing
- (B) System testing
- (C) Regression testing
- (D) Unit testing

21. For the IEEE 802.11 MAC protocol for wireless communication, which of the following statement(s) is/are *true*?

- (I) At least 3(three) non-overlapping channels are available for transmissions.
 - (II) The RTS-CTS mechanism is used for collision detection.
 - (III) Unicast frames are acknowledged.
- (A) All (I), (II) and (III)
 - (B) (I) and (III) only
 - (C) (II) and (III) only
 - (D) (II) only

22. How many conditions have to be met if an NP-complete problem is polynomially reducible?

- (A) 4
- (B) 3
- (C) 2
- (D) 1

23. Consider a program P that consists of two source modules M1 and M2 contained in two different files. If M1 contains a reference to a function defined in M2, the reference will be resolved at

- (A) Edit-time
- (B) Compile-time
- (C) Link-time
- (D) Load-time

24. Which of the following property allows us to infer that different members of classes have some common characteristics?

- (A) Specialization
- (B) Generalization
- (C) Aggregation
- (D) Dependency

25. Suppose Module A requires M units of time to be executed, where M is a constant. Let n is the size of the input data and b is the positive integer greater than 1.

Algorithm Test

```
{
  j = 1
  Repeat while (j ≤ n)
  {
    Module A
    j = 3 * j
  }
}
```

The worst case time complexity $T(n)$ of the above algorithm test is

- (A) $O(n \log_{10} n)$
- (B) $O(\log_2 n)$
- (C) $O(\log_j n)$
- (D) $O(\log_3 n)$

26. Consider the following statements:

- I. T-flip flop can be made from J-K flip flop by connecting J and K terminals.
 - II. D-flip flop can be constructed from J-K flip flop by connecting J terminal with K terminal through a NOT gate.
- (A) Only statement I is correct.
 - (B) Only statement II is correct.
 - (C) Both statements are correct.
 - (D) Both statements are false.

27. Consider the following context free grammar:

$$S \rightarrow aB \mid bA$$

$$A \rightarrow b \mid aS \mid bAA$$

$$B \rightarrow a \mid bS \mid aBB$$

It generates strings of terminals that have

- (A) equal number of a's and b's.
- (B) odd number of a's and even number of b's.
- (C) even number of a's and odd number of b's.
- (D) unequal number of a's and b's.

28. Which of the following offers packet mode data transfer service over the cellular network?

- (A) GSM
- (B) GPRS
- (C) TCP
- (D) UDP

29. A neuron with 3 inputs has the weight vector $[-0.3 \ 0.2 \ 0.2]$ and a bias $\theta = 0$. If the input vector is $X = [0.2 \ 0.3 \ 0.4]$ then the cumulative input to the neuron is

- (A) 0.2
- (B) 0.01
- (C) 0.1
- (D) 0.04

30. In a software project, COCOMO (Constructive Cost Model) is used to estimate

- (A) effort and duration based on the size of the software.
- (B) size and duration based on the effort of the software.
- (C) effort and cost based on the duration of the software.
- (D) size, effort and duration based on the cost of the software.

31. Two hosts are connected via a packet switch with 10^7 bits per second links. Each link has a propagation delay of 20 microseconds. The switch begins forwarding a packet 35 microseconds after it receives the same. If 10000 bits of data are to be transmitted between the two hosts using a packet size of 5000 bits, the time elapsed between the transmission of the first bit of data and the reception of the last bit of the data in microseconds is _____.

- (A) 1000 μ s
- (B) 1575 μ s
- (C) 2755 μ s
- (D) 3175 μ s

32. If there are m sources and n destinations in a transportation matrix, the total number of basic variables in a basic feasible solution is

- (A) $m + n$
- (B) $m + n + 1$
- (C) $m + n - 1$
- (D) m

33. Which of the following statements regarding the features of the object-oriented approach to databases are *true*?

- (a) The ability to develop more realistic models of the real world.
- (b) The ability to represent the world in a non-geometric way.
- (c) The ability to develop databases using natural language approaches.
- (d) The need to split objects into their component parts.
- (e) The ability to develop database models based on location rather than state and behaviour.

- (A) a, b, c
- (B) b, c, d
- (C) a, d, e
- (D) a, c, d

34. The set difference operation between two relations r and s in relational algebra of DBMS to be valid if and only if

- (A) r, s have the same arity and attributes of r and s are compatible.
- (B) r, s have the same arity and attributes of r and s may not be compatible.
- (C) r, s have the same arity.
- (D) r, s have not the same arity and attributes of r and s may not be compatible.

35. For which value of d we can write

$$T(n) \leq \frac{3}{16}dn^2 + cn^2 \leq dn^2$$

- (A) $d \leq \frac{16}{13}c$
- (B) $d < \frac{1}{13}c$
- (C) $d > c$
- (D) $d \geq \frac{16}{13}c$

36. For a paged system, TLB hit ratio is 0.9. Let the RAM access time ' t ' be 20 ns and the TLB access time ' T ' be 100 ns. The effective memory access with TLB will be

- (A) 120 ns
- (B) 200 ns
- (C) 130 ns
- (D) 150 ns

37. Suppose a memory system contains the cache, main memory and secondary storage, access time of which are 5 nanoseconds, 100 nanoseconds and 10 milliseconds respectively. If cache hit rate is 0.8 and main memory hit ratio is 0.995, then what is the average memory access time?

- (A) 125 ns
- (B) 1025 ns
- (C) 10025 ns
- (D) 100025 ns

38. Consider the intermediate code below:

- I. $i = 1$
- II. $j = 1$
- III. $t_1 = 5 * i$
- IV. $t_2 = t_1 + j$
- V. $t_3 = 4 * t_2$
- VI. $t_4 = t_3$
- VII. $a[t_4] = -1$
- VIII. $j = j + 1$
- IX. if $j <= 5$ goto (III)
- X. $i = i + 1$
- XI. if $i < 5$ goto (II)

The number of nodes and edges respectively in the Control Flow Graph constructed for the above code are

- (A) V and VII
- (B) VI and VII
- (C) V and V
- (D) VII and VIII

39. Suppose that two parties A and B wish to set up a common secret key (D-H key) between themselves using the Diffie-Hellman key exchange technique. They agree on 7 as the modulus and 3 as the primitive root. Party A chooses 2 and party B chooses 5 as their respective secrets. Their D-H key is

- (A) 3
- (B) 4
- (C) 5
- (D) 6

40. In propositional calculus, the material implication $P \Rightarrow Q$ is equivalent to

- (A) $P \text{ OR NOT } (Q)$
- (B) $\text{NOT } (P) \text{ OR } Q$
- (C) $P \text{ AND NOT } (Q)$
- (D) $\text{NOT } (P) \text{ AND } Q$

41. Consider a CSMA/CD network that transmits data at a rate of 100 Mbps over a 1 km cable with no repeaters. If the minimum frame size required for this network is 1250 bytes, what is the signal speed (km/sec) in the cable?

- (A) 8000
- (B) 10000
- (C) 16200
- (D) 20000

42. Consider three processes, all arriving at time zero, with total execution time of 10, 20 and 30 units, respectively. Each process spends the first 20% of execution time doing I/O, the next 70% of time doing computation and the last 10% of time doing I/O again. The OS uses a shortest remaining compute time first scheduling algorithm and schedules a new process either when the running process gets blocked on I/O or when the running process finishes its compute burst.

Assume all I/O operations can be overlapped as much as possible. For what percentage of time does the CPU remain idle?

- (A) 0%
- (B) 10.6%
- (C) 30.0%
- (D) 89.4%

43. A PERT network has 9 activities on its critical path. The standard deviation of each activity on the critical path is 3. The standard deviation of the critical path is

- (A) 81
- (B) 27
- (C) 09
- (D) 03

44. Match List-I with List-II:

List-I

List-II

- | | |
|---------------------------------|--|
| (a) Canny Edge Detection | (i) produces thin, well connected edges with low false positives and false negatives. |
| (b) Sobel Operator | (ii) uses a pair of simple 2×2 convolution kernels to estimate gradients in the horizontal and vertical directions. |
| (c) Robert Operator | (iii) highlights zero-crossings in the image, indicating edges. |
| (d) Laplacian of Gaussian (LOG) | (iv) calculates gradient magnitudes and orientations and uses them to detect edges. |

Codes:

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

45. Which operation in relational algebra of the DBMS is correct among following?

- (A) $r \cap s = r - (r \times s)$
 (B) $r \cap s = r - (r - s)$
 (C) $r \cap s = r - (r \cup s)$
 (D) $r \cap s = r - (r \div s)$

46. For all real x which condition is *true*?

- (A) $x < \lfloor x \rfloor \leq x \leq \lceil x \rceil < x + 1$
 (B) $x < \lfloor x \rfloor \leq x \leq \lceil x \rceil < x$
 (C) $x - 1 < \lfloor x \rfloor \leq x \leq \lceil x \rceil < x + 1$
 (D) $x - 1 < \lceil x \rceil \leq x \leq \lfloor x \rfloor < x + 1$

47. By using Booth's Multiplication algorithm, following two numbers are multiplied:

Multiplicand : 0111 0111 1011 1011

Multiplier : 0101 1010 1110 1110

How many additions/subtractions are required for the multiplication of the above two numbers?

- (A) 10
 (B) 7
 (C) 13
 (D) 8

48. Match the following:

- | | |
|---|-----------------------|
| (a) Graph Isomorphism | (i) Undecidable |
| (b) Subset sum problem | (ii) NP-hard |
| (c) Recursive enumerable Languages | (iii) NP-complete |
| (d) The language of all valid arithmetic expression | (iv) Turing decidable |

Codes:

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

49. If h_1 and h_2 are two admissible heuristic functions, then which of the following may *not* be admissible?

- (A) $\min(h_1, h_2)$
 (B) $\max(h_1, h_2)$
 (C) $\frac{h_1 + h_2}{2}$
 (D) $h_1 + h_2$

50. Regression testing is primarily related to

- (A) Functional testing
 (B) Development testing
 (C) Data Flow testing
 (D) Maintenance testing

51. A broadcast channel has 10 nodes and total capacity of 10 Mbps. It uses pooling of medium access. Once a node finishes transmission, there is a pooling delay of $80 \mu\text{s}$ to poll the next node. Whenever a node is pooled, it is allowed to transmit a maximum of 1000 bytes. The maximum throughput of the broadcast channel is

- (A) $\frac{1}{11}$ Mbps
 (B) $\frac{100}{11}$ Mbps
 (C) $\frac{10}{11}$ Mbps
 (D) 100 Mbps

52. Consider the following snapshot of a system. Which of the following is *true*?

	Allocation				Max				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P ₁	0	0	1	2	0	0	1	2	1	5	2	0
P ₂	1	0	0	0	1	7	5	0				
P ₃	1	3	5	4	2	3	5	6				
P ₄	0	6	3	2	0	6	5	2				
P ₅	0	0	1	4	0	6	5	6				

- (I) The system is in a safe state.
 (II) If a request from process P, arrives for (0, 4, 2, 0), then the request can be granted.
 (A) Only I
 (B) Only II
 (C) Both I and II
 (D) Neither I nor II

53. Bag 1 contains 4 white and 6 black balls while another bag 2 contains 4 white and 3 black balls. One ball is drawn at random from one of the bags and it is found to be black. Find the probability that it was drawn from bag 1.

- (A) $\frac{12}{13}$
 (B) $\frac{5}{12}$
 (C) $\frac{7}{11}$
 (D) $\frac{7}{12}$

54. Match the following:

- (a) Scatter plot (i) Downward closed
 (b) Box plot (ii) Frequency of categorical attributes
 (c) Pie chart (iii) Distribution of numerical attribute
 (d) Find maximal frequent item sets (iv) Illustrates linear correlation

Codes:

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

55. Let $f(n) = n^3 + n^2 + n + 1$ and $g(n) = 2n^2 + 4n + 1$. Choose the correct one.

- (A) $f(n) = \Omega(g(n))$, for all $n \geq 1$
 (B) $f(n) = \Omega(g(n))$, for all $n \geq 2$
 (C) $f(n) = \Omega(g(n))$, for all $n \geq 3$
 (D) $f(n) = \Omega(g(n))$, for all $n \geq 4$

56. Which of the following is the correct order of an SQL statement?

- (A) SELECT, GROUP BY, WHERE, HAVING
- (B) SELECT, WHERE, GROUP BY, HAVING
- (C) SELECT, HAVING, WHERE, GROUP BY
- (D) SELECT, WHERE, HAVING, GROUP BY

57. Which of the following actions is/are typically *not* performed by the operating system when switching context from process A to process B?

- (A) Saving current register values and restoring saved register values for process B
- (B) Changing address translation tables
- (C) Invalidating the translation look-aside buffer
- (D) Swapping out the memory image of process A to the disk

58. Which of the following is an example of a semantic rule violation?

- (A) Using a reserved keyword as an identifier
- (B) Misspelling a variable name
- (C) Omitting a return statement in a function
- (D) Forgetting a closing brace in a block

59. Which of the following is the correct sequence of micro-operations to add a number to the AC when the operand is a direct address operand and store the final result to AC?

- (A) $MAR \leftarrow (IR(address))$
 $MBR \leftarrow \text{memory}$
 $R1 \leftarrow (AC) + (MBR)$
- (B) $MAR \leftarrow (IR(address))$
 $MBR \leftarrow \text{Memory}(MAR)$
 $R1 \leftarrow (MBR)$
 $R2 \leftarrow (AC) + (R1)$
 $AC \leftarrow (R2)$
- (C) $MAR \leftarrow (IR(address))$
 $MBR \leftarrow \text{Memory}(MAR)$
 $AC \leftarrow (AC) + (MAR)$
- (D) $MAR \leftarrow IR(address)$
 $MBR \leftarrow MAR$
 $R1 \leftarrow (MBR)$
 $R2 \leftarrow (AC) + (R1)$
 $AC \leftarrow R2$

60. Let the predicate $A(x)$ denotes “ x is intelligent” and the statement $B(x)$ denotes “ x is your friend”, then which of the following is equivalent predicate logic expression for the statement “some of your friends are intelligent”?

- (A) $\forall x(B(x) \rightarrow A(x))$
- (B) $\exists x(B(x) \rightarrow A(x))$
- (C) $\forall x(B(x) \wedge A(x))$
- (D) $\exists x(B(x) \wedge A(x))$

61. Which of the following models don't necessitate defining requirements at the earliest in the life cycle?

- (A) RAD & Waterfall
- (B) Prototyping & Waterfall
- (C) Spiral & Prototyping
- (D) Spiral & RAD

62. Which of the following are features of link state routing?

- (I) In the first step, discover all the routers in the subnet and find their network addresses.
 - (II) Measure cost/delay to the neighbours.
 - (III) Transmit the information as obtained in (II) across the subnet.
 - (IV) Thus by-pass the necessity for shortest path algorithm.
- (A) I and II
(B) II and III
(C) III and IV
(D) I and IV

63. Consider the following table of arrival time and burst time for three processes P1, P2 and P3

Process	Arrival time	Burst time
P1	0 ms	9 ms
P2	1 ms	4 ms
P3	2 ms	9 ms

The pre-emptive shortest job first scheduling algorithm is used. Scheduling is carried out only at arrival or completion of a processes. What is the average waiting time for the three processes?

- (A) 5.0 ms
(B) 4.33 ms
(C) 6.33 ms
(D) 7.33 ms

64. There are 50 many coloured balls in a box with 15 Red balls, 23 Green balls and rest being Blue balls. In how many ways 11 balls may be picked up comprising 3 many Red balls, 5 many Green balls and 3 many Blue balls?

- (A) $\binom{15}{3} \binom{12}{5} \binom{23}{3}$
(B) $\binom{15}{5} \binom{12}{3} \binom{23}{3}$
(C) $\binom{15}{3} \binom{23}{5} \binom{12}{3}$
(D) $\binom{15}{3} \binom{23}{3} \binom{12}{5}$

65. Generalization has been implemented in OOP language by using the concept of

- (A) Encapsulation
(B) Overloading
(C) Inheritance
(D) Data hiding

66. Data scrubbing is a process to

- (A) delete data from the data warehouse and to create the necessary indices.
(B) load data from the data warehouse and to create the necessary indices.
(C) upgrade the quality of data after it is moved into a data warehouse.
(D) upgrade the quality of data before it is moved into a data warehouse.

67. Which of the following statement(s) is/are true?

Statement 1 : DFS uses the stack data structure.

Statement 2 : BFS uses the queue data structure.

Statement 3 : DFS uses a backtracking technique.

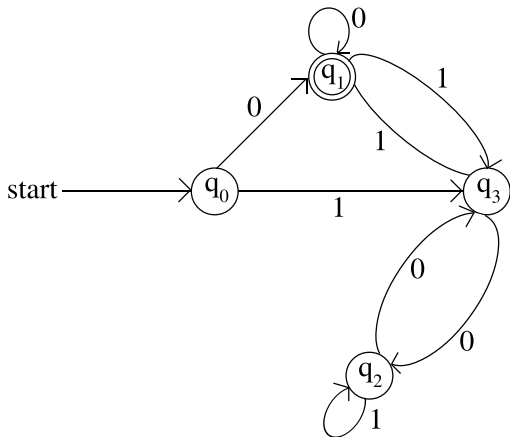
Statement 4 : BFS uses the Branch-and-Bound traverse technique.

- (A) Only Statement 1
(B) Only Statement 1 and Statement 2
(C) Only Statement 1, Statement 2 and Statement 3
(D) Statement 1, Statement 2, Statement 3 and Statement 4

68. Which of the following acts as a temporary storage location to hold an intermediate result in mathematical and logical calculations?

- (A) RAM
(B) Accumulator
(C) Program Counter
(D) Memory Address Register (MAR)

69. The language accepted by the DFA is:



- (A) $L = \{ \text{set of all strings ending with 0} \}$
 (B) $L = \{ w : |w| \text{ is not divisible by 2} \}$
 (C) $L = \{ w : \text{the value of binary number } w \bmod 3 = 0 \}$
 (D) $L = \{ w : \text{the value of binary number } w \bmod 5 = 0 \}$

70. Which of the following techniques can help mitigate the vanishing gradient problem in a deep multilayer perceptron (MLP)?

- (A) Weight decay
 (B) Dropout regularization
 (C) Gradient clipping
 (D) Batch normalization

71. Which one of the following is *not* desired in a good software requirement specifications (SRS) document?

- (A) Functional Requirements
 (B) Non-Functional Requirements
 (C) Goals of implementation
 (D) Algorithms for software implementation

72. Match the layers with possible security methods in those layers:

- | | |
|-----------------------|---|
| (a) Data link layer | (i) user authentication |
| (b) Network layer | (ii) use firewalls |
| (c) Transport layer | (iii) encryption of connections |
| (d) Application layer | (iv) point to point encryption of a data stream |

Codes:

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

73. Let the time taken to switch between user and kernel modes of execution be t_1 while the time taken to switch between two processes be t_2 . Which of the following is *true*?

- (A) $t_1 > t_2$
 (B) $t_1 = t_2$
 (C) $t_1 < t_2$
 (D) Nothing can be said about the relation between t_1 and t_2 .

74. Suppose for integer $n \geq 1$, $A_n = \left[-\frac{1}{n}, \frac{1}{n} \right]$

and $B_n = \left[-\frac{1}{n^2}, \frac{1}{n^2} \right]$, then $\lim_{n \rightarrow \infty} (A_n \cap \bar{B}_n)$ is

- (A) ϕ (Null set)
 (B) $\{0\}$ (Singleton set with element 0)
 (C) \mathbb{R} (Set of all real numbers)
 (D) Cannot be determined

75. Which among the following cannot be used for the concept of polymorphism?

- (A) Static member function
- (B) Constructor overloading
- (C) Member function overloading
- (D) Global member function

76. Which of the following statement(s) is/are *false*?

- (I) Spinlocks are not appropriate for single-processor system.
 - (II) Mailboxes may be used for synchronization.
 - (III) Message passing and semaphores do not have equivalent functionality.
- (A) I only
 - (B) III only
 - (C) I and III
 - (D) I, II and III

77. Challenge of using NoSQL database is:

- (A) Limited scalability.
- (B) Limited support for unstructured data.
- (C) Strict schema enforcement.
- (D) Limited query capabilities.

78. Which of the following is *true* about linked list implementation of stack?

- (A) In push operation, new nodes are inserted at the beginning of linked list, and in POP operation, nodes must be removed from end.
- (B) In push operation, new nodes are inserted at the end, and in POP operation, nodes must be removed from the beginning.
- (C) The overflow situation cannot arise during push operation.
- (D) In push operation, new nodes are inserted at the beginning of linked list, and in POP operation, nodes must be removed from beginning.

79. A stack organized computer is characterized by instructions with

- (A) Indirect addressing
- (B) Direct addressing
- (C) Zero addressing
- (D) Index addressing

80. Which of the following is an example of a recursively enumerable language?

- (A) The language accepted by a Turing machine that halts on all inputs.
- (B) The language accepted by a Turing machine that loops indefinitely on all inputs.
- (C) The language accepted by a Turing machine that halts on some inputs and loops on others.
- (D) The language accepted by a Turing machine that accepts all inputs.

81. Which of the following search method takes less memory space?

- (A) Depth First Search
- (B) Breadth First Search
- (C) Linear Search
- (D) Optimal Search

82. The _____ model is preferred for software development when the requirements are *not* clear.

- (A) RAD
- (B) Rational Unified Process
- (C) Evolutionary
- (D) Waterfall

83. Consider a 100 meter 10 mbps token ring containing 10 stations, each transmitting with equal priority. Each station can transmit 4 bytes before giving up the token. Token holding time per station is 10 ns. Also, propagation speed is 200 m/s. Assume that the ring monitor has created a new token, how long does it take for the token to come back to the Ring monitor if no station uses the token?

- (A) 2.25 μ sec
- (B) 3.64 μ sec
- (C) 4.65 μ sec
- (D) 2.93 μ sec

84. A computer installation has 1000 K of main memory. The jobs arrive and finish in the following sequence:

- (I) Job 1 requiring 200 K arrives
- (II) Job 2 requiring 350 K arrives
- (III) Job 3 requiring 300 K arrives
- (IV) Job 1 finishes
- (V) Job 4 requiring 120 K arrives
- (VI) Job 1 requiring 150 K arrives
- (VII) Job 1 requiring 80 K arrives

Among best-fit and first-fit, which performs better for this sequence?

- (A) First-fit
- (B) Best-fit
- (C) Both First-fit and Best-fit perform the same
- (D) Neither First-fit nor Best-fit performs good

85. The boolean function $A + \bar{A}B$ is a reduced form of

- (A) $(A + B)(\bar{A} + C)$
- (B) $(A + \bar{B})(A + \bar{C})$
- (C) $A\bar{B} + AB + \bar{A}BC + \bar{A}\bar{B}\bar{C}$
- (D) $ABC + \bar{A}\bar{B}\bar{C}$

86. Which algorithm is commonly used for line rasterization in computer graphics?

- (A) DDA algorithm
- (B) Midpoint line algorithm
- (C) Cohen-Sutherland algorithm
- (D) Bresenham's line algorithm

87. What should be stored onto stack during the conversion of Infix to Postfix expression?

- (A) Operand and left parenthesis
- (B) Operator and Operand
- (C) Operator and left parenthesis
- (D) Operator

88. How does Hadoop ensure data reliability in HDFS?

- (A) By replicating each data block to multiple nodes in the cluster.
- (B) By compressing the data before it is stored in HDFS.
- (C) By encrypting the data before it is stored in HDFS.
- (D) By distributing the data across multiple data centers.

89. Which of the following statements is *true* about the relationship between context-free languages and decidable languages?

- (A) All context-free Languages are decidable.
- (B) All decidable Languages are context-free.
- (C) Context-free languages are a proper subset of decidable Languages.
- (D) Decidable Languages are a proper subset of context-free Languages.

90. What are the RGB co-ordinates of a colone at (0.25, 0.65, 0) in CMY space?

- (A) (0.75, 0.35, 1)
- (B) (0.65, 0.25, 0)
- (C) (0.75, 0.25, 1)
- (D) (0.85, 0.25, 0)

91. _____ is *not* considered as an activity of Structured Analysis (SA).

- (A) Transformation of a textual problem description into a graphic model
- (B) Functional decomposition
- (C) All the functions represented in the DFD are mapped to a module structure
- (D) All the functions represented in the DFD are not mapped to a module structure

92. Which of the following scheduling algorithms is non-preemptive?

- (A) Round-Robin
- (B) First-in First-out
- (C) Multilevel Queue Scheduling
- (D) Multilevel Queue Scheduling with Feedback

93. An unbiased coin is tossed n times. The probability of appearance of at least r ($r \leq n$) many 'Head's is _____.

- (A) $\frac{n-r+1}{n+1}$
- (B) $\frac{r}{2^n}$
- (C) $\frac{r+1}{2^n}$
- (D) $\frac{\sum_{k=r}^n \binom{n}{k}}{2^n}$

94. Consider the following three relations in a banking database system:

customer (c_name, c_street, c_city)

depositor (c_name, acc_no)

borrower (c_name, loan_no)

Find all customers who have a loan at the bank but do not have an account at the bank.

- (A) (select distinct c_name from borrower)
where c_name not in (select c_name from depositor)
- (B) (select distinct c_name from depositor)
intersect (select distinct c_name from borrower)
- (C) (select c_name from depositor)
except (select c_name from borrower)
- (D) select distinct c_name from borrower
where c_name in (select c_name from depositor)

95. What is the maximum height of any AVL-tree with 7 nodes? Assume that the height of a tree with a single node is 0.

- (A) 2
- (B) 3
- (C) 4
- (D) 5

96. For predicates P and Q, $\neg((\neg P \wedge Q) \vee (P \wedge \neg Q))$ is equivalent to

- (A) $(\neg P \wedge \neg Q) \vee (P \wedge Q)$
- (B) $(\neg P \wedge \neg Q)$
- (C) $(P \wedge Q)$
- (D) $(\neg P \vee \neg Q) \wedge (P \vee Q)$

97. Which of the following code optimization techniques transforms a loop with a fixed number of iterations into a sequence of independent instructions?

- (A) Loop unrolling
- (B) Loop peeling
- (C) Loop fission
- (D) Loop interchange

98. Consider a software project with the following information domain characteristic for calculation of function point metric:

Number of external inputs (I) = 30

Number of external output (O) = 60

Number of external interfaces (N) = 02

Number of external inquiries (E) = 23

Number of files (F) = 08

It is given that the complexity weighting factors for I, O, E, F and N are 4, 5, 4, 10 and 7 respectively. It is also given that, out of fourteen value adjustment factors that influence the development effort, four factors are not applicable, each of the other four factors have value 3 and each of the remaining factors have value 4. The computed value of function point metric is

- (A) 612.06
- (B) 212.05
- (C) 305.09
- (D) 806.9

99. A shared variable x initialized to '0' (zero), is operated on by 4 (four) concurrent processes W, X, Y, Z as follows. Each of the processes W and X reads x from memory, decrements by two, stores it to memory, and then terminates. Each process before reading x invokes the P operation (i.e. wait) on a counting semaphore S and involves the V operation (i.e. signal) on the semaphore S after storing x to memory. Semaphore S is initialized to two. What is the maximum possible value of x after all processes complete execution?

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

100. Let L_1, L_2 be any two context-free languages and R be any regular language. Which of the following statement is correct?

- (A) $L_1 \cup L_2$ and $L_1 - R$ are context-free.
- (B) $L_1 \cup L_2$ and \bar{L}_1 are context-free.
- (C) $L_1 \cup L_2$, $L_1 \cap L_2$ and $L_1 - R$ are context-free.
- (D) $L_1 \cup L_2$, $L_1 \cap L_2$, \bar{L}_1 and $L_1 - R$ are context-free.

Space for Rough Work

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