Sample Paper

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CS: Computer Sc. and Information Technology

Q.No. 1 Which one of the following regular expressions represents the set of all binary strings with an odd number of 1' s?

(A) $((0+1)^*1(0+1)^*1)^*10^*$

(B) $(0^*10^*10^*)^*0^*1$

(C) $10^*(0^*10^*10^*)^*$

(D) $(0^*10^*10^*)^*10^*$

Answer: (D)

Q.No. 2 Consider the following grammar and the semantic actions to support the inherited type declaration attributes. Let X_1, X_2, X_3, X_4, X_5, and X_6 be the placeholders for the non-terminals D, T, L or L1 in the following table:

Production rule	Semantic action
D → T L	X_1.type = X_2.type
T → int	T.type = int
T → float	T.type = float
L → L_1 , id	X_3.type = X_4.type addType(id.entry, X_5.type)
L → id	addType(id.entry, X_6.type)

Which one of the following are the appropriate choices for $X1$, $X2$, $X3$ and $X4$?

(A) $X_1 = L$, $X_2 = T$, $X_3 = L1$, $X_4 = L$

(B) $X_1 = T$, $X_2 = L$, $X_3 = L1$, $X_4 = T$

(C) $X_1 = L$, $X_2 = L$, $X_3 = L1$, $X_4 = T$

(D) $X_1 = T$, $X_2 = L$, $X_3 = T$, $X_4 = L_1$

Answer: (A)

Q.No. 3 Which one of the following is used to represent the supporting many-one relationships of a weak entity set in an entity-relationship diagram?

(A) Diamonds with double/bold border

(B) Rectangles with double/bold border

(C) Ovals with double/bold border

(D) Ovals that contain underlined identifiers

Answer: (A)

Q.No. 4 When two 8-bit numbers A7...A0 and B7....B0 in 2's complement representation (with A0 and B0 as the least significant bits) are added using a ripple-carry adder. the sum bits obtained are S7....S0 and the bits are C7……. C0 . An overflow is said to have occurred if:

(A) The carry C7 bit is 1.

(B) All the carry bits (C7……. C0) is 1.

(C) (A7.B7.$\bar{S}$7 + $\bar{A}$7.$\bar{B}$7.S7) is 1.

(D) (A0.B0.$\bar{S}$0 + $\bar{A}$0.$\bar{B}$0.S0) is 1.

Answer: (C)

Q.No. 5 A lexical analyzer uses the following patterns to recognize three tokens T_1, T_2, and T_3 over the alphabet {a,b,c}. T_1: a? (b|c)$*a$ T_2: b? (a|c)$*b$ T_3: c? (b|a)$*c$ Note that 'x?' means 0 or 1 occurrence of the symbol x. Note also that the analyzer outputs the token that matches the longest possible prefix. If the string *bbaacabc* is processed by the analyzer, which one of the following is the sequence of tokens it outputs?

(A) $T_1T_2T_3$

(B) $T_1T_1T_3$

(C) $T_2T_1T_3$

(D) T_3T_3

Answer: (D)

Q.No. 6 Let T be a binary search tree with 15 nodes. The minimum and maximum possible heights Of T are: Note: The height of a tree with a single node is 0.

(A) 4 and 15 respectively

(B) 3 and 14 respectively

(C) 4 and 14 respectively

(D) 3 and 15 respectively

Answer: (B)

Q.No. 7 Consider the following statements about the functionality of an IP based router. A router does not modify the IP packets during forwarding. I. It is not necessary for a router to implement any routing protocol. II. A router should reassemble IP fragments if the MTU of the outgoing link is larger than the size of the incoming IP packet. Which of the above statements is/are TRUE?

(A) I and II only

(B) I only

(C) II and Ill only

(D) II only

Answer: (D)

Q.No. 8 Let c1,.....,cn be scalars, not all zero, such that $\sum_{t=1}^{n} c_i a_i = 0$ where ai, are column vectors in Rn Consider the set of linear equations Ax=b Where A= $b = \sum_{i=1}^{n} a_i$. The set of operations has:

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(A) a unique solution at x = Jn where J denotes a n -dimensional vector of all 1.

(B) no solution

(C) Infinitely many solutions.

(D) Finitely many solutions.

Answer: (C)

Q.No. 9 The statement (-p) => (-q) is logically equivalent to which of the statements below? I. p => q II. q => p III. (-q) v p IV. (-p) v q

(A) I only

(B) I and IV only

(C) II only

(D) II and III only

Answer: (D)

Q.No. 10 Consider the following two statements about database transaction schedules: I. Strict two-phase locking protocol generates conflict serializable schedules that are also recoverable. II. Timestamp-ordering concurrency control protocol with Thomas' Write Rule can generate view serializable schedules that are not conflict serializable. Which of the above statements is/are TRUE?

(A) I only

(B) II only

(C) Both I and II

(D) Neither I nor II

Answer: (C)

Q.No. 11 For $\Sigma = \{a, b\}$, let us consider the regular language $L = \{ x \mid x = a^{2+3k}$ or $x = b^{10+12k}, k \geq 0\}$. Which one of the following can be a pumping length (the constant guaranteed by the pumping lemma) for L ?

(A) 3

(B) 5

(C) 9

(D) 24

Answer: (D)

Q.No. 12 Let N be an NFA with n states. Let k be the number of states of a minimal DFA which is equivalent to N. Which one of the following is necessarily true?

(A) $k \geq 2n$

(B) $k \geq n$

(C) $k \leq n2$

(D) $k \leq 2n$

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Answer: (D)

Q.No. 13 A computer system with a word length of 32 bits has a 16 MB byte-addressable main memory and a 64 KB, 4-way set associative cache memory with a block size of 256 bytes. Consider the following four physical addresses represented in hexadecimal notation. A1 = 0x42C8A4, A2=0x546888, A3 = 0x6A289C, A4= 0x5E4880 Which one of the following is TRUE?

(A) A1 and A4 are mapped to different cache sets.

(B) A2 and A3 are mapped to the same cache set.

(C) A3 and A4 are mapped to the same cache set.

(D) A1 and A3 are mapped to the same cache set.

Answer: (B)

Q.No. 14 Consider a matrix P whose only eigenvectors are the multiples of $\begin{bmatrix}1\\4\end{bmatrix}$ Consider the following statements. (I) P does not have an inverse (II) P has a repeated eigenvalue (III) P cannot be diagonalized Which one of the following options is correct?

(A) Only I and III are necessarily true

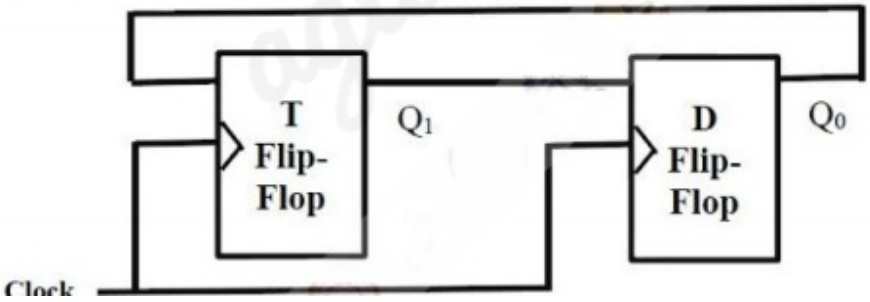
(B) Only II is necessarily true

(C) Only I and II are necessarily true

(D) Only II and III are necessarily true

Answer: (D)

Q.No. 15 Consider a combination of T and D flip-flops connected as shown below. The output of the D flip-flop is connected to the input Of the T flip-flop and the output Of the T flip-flop is connected to the input of the D flip-flop.



Initially, both Qo and QI are set to I (before the 1 clock cycle). The outputs

(A) Q1 Q0 after the 3rd are 11 and after the 4th cycle are 00 respectively.

(B) Q1 Q0 after the 3rd cycle are 11 and after the cycle are 01 respectively.

(C) Q1 Q0 after the 3rd cycle are 00 and after the 4th cycle are 11 respectively.

(D) Q1 Q0 after the 3rd cycle are 01 and after the cycle are 01 respectively.

Answer: (B)

Q.No. 16 A sender S sends a message m to receiver R. which is digitally signed by S with its private key. In this scenario. one or more of the following security violations can take place. (I) S can launch a birthday attack to replace m with a fraudulent message. (II) A third party attacker can launch a birthday attack to replace m with a fraudulent message. (Ill) R can launch a birthday attack to replace m with a fraudulent message. Which of the following are possible security violations?

(A) (I) and (II) only

(B) (I) only

(C) (II) only

(D) (II) and (III) only

Answer: (B)

Q.No. 17 Let G — (V, E) be any connected undirected edge-weighted graph. The weights of the edges in E are positive and distinct. Consider the following statements: (l) Minimum Spanning Tree Of G is always unique. (II) Shortest path between any two vertices Of G is always unique. Which of the above statements is/are necessarily true?

(A) (I) only

(B) (II) only

(C) both (I) and (II)

(D) neither (I) nor (II)

Answer: (A)

Q.No. 18 Consider the following C program.

```
#include<stdio.h>
struct Ournode{
    char x,y,z;
};

int main(){
    struct Ournode p = {'1', '0', 'a'+2};
    struct Ournode *q = &p;
    printf ("%c, %c", *((char*)q+1), *((char*)q+2));
    return 0;
}
```

The output of this program is:

(A) 0, c

(B) 0, a+2

(C) '0', 'a+2'

(D) '0', 'c'

Answer: (A)

Q.No. 19 Consider the language $\{a^n | n \geq 0\} \cup \{a^n b^n | n \geq 0\}$ and the following statements. I. L is deterministic context-free. II. L is context-free but not deterministic context-free. III. L is not LL(k) for any k. Which of the above statements is/are TRUE?

(A) I only

(B) II only

(C) I and III only

(D) III only

Answer: (C)

Q.No. 20 Which one of the following predicate formulae is NOT logically valid? Note that W is a predicate formula without any free occurrence of x.

(A) $\forall x(p(x) \vee W) \equiv \forall x p(x) \vee W$

(B) $\exists x(p(x) \wedge W) \equiv \exists x p(x) \wedge W$

(C) $\forall x(p(x) \rightarrow W) \equiv \forall x p(x) \rightarrow W$

(D) $\exists x(p(x) \rightarrow W) \equiv \forall x p(x) \rightarrow W$

Answer: (C)

Q.No. 21 What is the worst case time complexity of inserting n elements into an empty linked list, if the linked list needs to be maintained in sorted order?

(A) θ(n)

(B) θ(n log n)

(C) θ(n^2

(D) θ(1)

Answer: (C)

Q.No. 22 Let A and B be finite alphabets and let # be a symbol outside both .4 and B. Let f be a total function from A toB . We say fis computable if there exists a Turing machine M which given an input x in A , always halts with fix) on its tape. Let L denote the language {x# f(x) | x ∈ A*} which of the following statements is true:

(A) fis computable if and only if Lf is recursive.

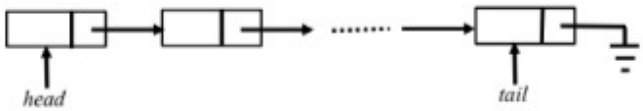
(B) fis computable if and only if Lf is recursively enumerable.

(C) If fis computable then Lf is recursive. but not conversely.

(D) If fis computable then Lf is recursively enumerable. but not conversely.

Answer: (A)

Q.No. 23 A queue is implemented using a non-circular singly linked list. The queue has a head pointer and a tail pointer, as shown in the figure. Let n denote the number of nodes in the queue. Let enqueue be implemented by inserting a new node at the head, and dequeue be implemented by deletion of a node from the tail.



Which one of the following is the time complexity of the most time-efficient implementation of enqueue and dequeue, respectively, for this data structure?

(A) θ(1), θ(1)

(B) θ(1), θ(n)

(C) θ(n), θ(1)

(D) θ(n), θ(n)

Answer: (B)

Q.No. 24 Let G be an arbitrary group. Consider the following relations on G: R_1: $\forall a, b \in G$, $a\ R_1 b$ if and only if $\exists g \in G$ such that $a = g_{-1}bg$ R_2: $\forall a, b \in G$, $a\ R_2 b$ if and only if $a = b_{-1}$ Which of the above is/are equivalence relation/relations?

(A) R_1 and R_2

(B) R_1 only

(C) R_2 only

(D) Neither R_1 nor R_2

Answer: (B)

Q.No. 25 Assume that multiplying a matrix G_1 of dimension $p \times q$ with another matrix G_2 of dimension $q \times r$ requires pqr scalar multiplications. Computing the product of n matrices $G_1G_2G_3\ldots G_n$ can be done by parenthesizing in different ways. Define G_i, G_i+1 as an explicitly computed pair for a given parenthesization if they are directly multiplied. For example, in the matrix multiplication chain $G_1G_2G_3G_4G_5G_6$ using parenthesization $(G_1(G_2G_3))(G_4(G_5G_6))$, G_2G_3 and G_5G_6 are the only explicitly computed pairs. Consider a matrix multiplication chain $F_1F_2F_3F_4F_5$, where matrices F_1, F_2, F_3, F_4 and F_5 are of dimensions 2×25, 25×3, 3×16, 16×1 and 1×1000, respectively. In the parenthesization of $F_1F_2F_3F_4F_5$ that minimizes the total number of scalar multiplications, the explicitly computed pairs is/are

(A) F_1F_2 and F_3F_4 only

(B) F_2 F_3 only

(C) F_3F_4only

(D) F_1F_2 and F_4 F_5 only

Answer: (C)

Q.No. 26 In a database system. unique timestamps are assigned to each transaction using Lamport's logical clock. Let TS(T1) and TS(T2) be the timestamps of transactions T1 and T2 respectively. Besides.T1 holds a lock on the resource R, and T2 has requested a conflicting lock on the same resource R. The following algorithm is used to prevent deadlocks in the database system assuming that a killed transaction is restarted with the same timestamp. if TS(T2) < TS(T1) then Tl is killed else T2 waits. Assume any transaction that is not killed terminates eventually, which of the following is TRUE about the database system that uses the above algorithm to prevent deadlocks?

(A) The database system is both deadlock-free and starvation-free.

(B) The database system is deadlock-free, but not starvation-free.

(C) The database system is starvation-free. but not deadlock-free.

(D) The database system is neither deadlock-free nor starvation-free.

Answer: (A)

Q.No. 27 Consider the C functions foo and bar given below: int foo (int val) { int x = 0; while (val > O) { x= x + foo (val - -); } return val; } int bar (int val) { int x = 0; while (val > O) x = x + bar (val-1) ; } return val; } Invocations of foo (3) and bar (3) will result in:

(A) Return of 6 and 6 respectively.

(B) Infinite loop and abnormal termination respectively.

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(C) Abnormal tennination and infinite loop respectively.

(D) Both terminating abnormally.

Answer: (C)

Q.No. 28 The n-bit fixed-point representation of an unsigned real number X uses f bits for the fraction part. Let i = n - f. The range of decimal values for X in this representation is

(A) 2-f to 2i

(B) 2-f to (2i - 2-f)

(C) 0 to 2i

(D) 0 to (2i - 2-f)

Answer: (D)

Q.No. 29 In a balanced binary search tree with n elements, what is the worst case time complexity of reporting all elements in range [a, b]? Assume that the number of reported elements is k.

(A) θ(log n)

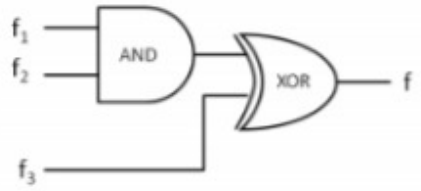
(B) θ(log n + k)

(C) θ(k log n)

(D) θ(n log k)

Answer: (B)

Q.No. 30 Consider three 4-variable functions f1, f2, and f3, which are expressed in sum-of-minterms as $f_1 = \Sigma$ (0, 2, 5, 8, 14), $f_2 = \Sigma$(2, 3, 6, 8, 14, 15), $f_3 = \Sigma$(2, 7, 11, 14) For the following circuit with one AND gate and one XOR gate, the output function f can be expressed as:



(A) Σ (7, 8, 11)

(B) Σ (2, 7, 8, 11, 14)

(C) Σ (2, 14)

(D) Σ (0, 2, 3, 5, 6, 7, 8, 11, 14, 15)

Answer: (A)

Q.No. 31 Consider the following snapshot of a system running *n* concurrent processes. Process *i* is holding *Xi* instances of a resource R, $1 \le i \le n$. Assume that all instances of R are currently in use. Further, for all *i*, process *i* can place a request for at most *Yi* additional instances of R while holding the *Xi* instances it already has. Of the *n* processes, there are exactly two processes *p* and *q* such that $Yp = Yq = 0$. Which one of the following conditions guarantees that no other process apart from *p* and *q* can complete execution?

(A) $Xp + Xq < \text{Min } \{Yk \mid 1 \le k \le n , k \ne p, k \ne q\}$

(B) $Xp + Xq < \text{Max } \{Yk \mid 1 \le k \le n , k \ne p, k \ne q\}$

(C) Min (Xp , Xq) ≥ Min {Yk | $1 \leq k \leq n$, k ≠p, k≠q}

(D) Min (Xp, Xq) ≤ Max {Yk | $1 \leq k \leq n$, k ≠p, k≠q}

Answer: (A)

Q.No. 32 Consider the functions I. e^{-x} II. x^2 - sin x III. $\sqrt{x^3+1}$ Which of the above functions is/are increasing everywhere in [0, 1]?

(A) III only

(B) II only

(C) II and III only

(D) I and III only

Answer: (A)

Q.No. 33 Consider a database that has the relation schemas EMP(EmpId, EmpName, Deptld), and DEPT(DeptName, Deptld). Note that the Deptld can be permitted to be NULL in the relation EMP. Consider the following queries on the database expressed in tuple relational calculus. (I)
$\{t|\exists u \in \text{EMP}(\text{t}[\text{ EmpName }] = \text{u}[\text{ EmpName }] \wedge \backslash \text{for}all \text{v} \in \text{DEPT}(\text{t}[\text{ DeptId }] \neq \text{v}[\text{ DeptId }]))\}$ (II)
$\{t|\exists u \in \text{EMP}(\text{t}[\text{ EmpName }] = \text{u}[\text{ EmpName }] \wedge \exists \text{v} \in \text{DEPT}(\text{t}[\text{ DeptId }] \neq \text{v}[\text{ DeptId }]))\}$ (III)
$\{t|\exists u \in EMP(t[\text{ EmpName }] = u[\text{ EmpName }] \wedge \exists v \in DEPT(t[\text{ DeptId }] = v[\text{ DeptId }]))\}$

(A) (I) and (II) only

(B) (I) and (III) only

(C) (II) and (III) only

(D) (I), (II) and (III)

Answer: (D)

Q.No. 34 Consider a process executing on an operating system that uses demand paging. The average time for a memory access in the system is M units if the corresponding memory page is available in memory, and D units if the memory access causes a page fault. It has been experimentally measured that the average time taken for a memory access in the process is X units. Which one of the following is the correct expression for the page fault rate experienced by the process?

(A) (D – M) / (X – M)

(B) (X – M) / (D – M)

(C) (D – X) / (D – M)

(D) (X – M) / (D – X)

Answer: (B)

Q.No. 35 Consider the following two tables and four queries in SQL.

Book (isbn, bname), Stock (isbn, copies)

Query 1:
```
SELECT B.isbn, S.copies
FROM Book B INNER JOIN Stock S
ON B.isbn = S.isbn;
```

Query 2:
```
SELECT B.isbn, S.copies
FROM Book B LEFT OUTER JOIN Stock S
ON B.isbn = S.isbn;
```

Query 3:
```
SELECT B.isbn, S.copies
 FROM Book B RIGHT OUTER JOIN Stock S
 ON B.isbn = S.isbn;
```

Query 4:
```
SELECT B.isbn, S.copies
FROM Book B FULL OUTER JOIN Stock S
ON B.isbn = S.isbn;
```

Which one of the queries above is certain to have an output that is a superset of the outputs of the other three queries?

(A) Query 1

(B) Query 2

(C) Query 3

(D) Query 4

Answer: (D)

Q.No. 36 Consider the following intermediate program in three address code: p=a-b q=p*c p=u*v q=p+q Which one of the following corresponds to a static single assignment form of the above code?

(A)
$$p_1 = a - b$$
$$q_1 = p_1 * c$$
$$p_1 = u * v$$
$$q_1 = p_1 + q_1$$

(B)
$$\mathrm{P}_3 = \mathrm{a} - \mathrm{b}$$
$$q_4 = p_3 * \mathrm{c}$$
$$\mathrm{P}_4 = \mathrm{u} * \mathrm{v}$$
$$q_5 = p_4 + q_4$$

(C)
$$p_1 = a - b$$
$$q_1 = p_2 * c$$
$$p_3 = u * v$$
$$\mathrm{q2} = \mathrm{p4} + \mathrm{q}_3$$

(D)
$$p_1 = a - b$$
$$q_1 = p * c$$
$$\mathrm{P}_2 = \mathrm{u} * \mathrm{v}$$
$$q_2 = p + q$$

Answer: (B)

Q.No. 37 Threads of a process share

(A) global variables but not heap.

(B) heap but not global variables.

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(C) neither global variables nor heap.

(D) both heap and global variables,

Answer: (D)

Q.No. 38 Consider the first-order logic sentence $\varphi \equiv \exists s \exists t \exists u \forall v \forall w \forall x \forall y\ \psi(s, t, u, v, w, x, y)$ where $\psi(s, t, u, v, w, x, y)$ is a quantifier-free first-order logic formula using only predicate symbols, and possibly equality, but no function symbols. Suppose φ has a model with a universe containing 7 elements. Which one of the following statements is necessarily true?

(A) There exists at least one model of φ with universe of size less than or equal to 3.

(B) There exists no model of φ with universe of size less than or equal to 3.

(C) There exists no model of φ with universe of size greater than 7.

(D) Every model of φ has a universe of size equal to 7.

Answer: (A)

Q.No. 39 Let u and v be two vectors in R2 whose Euclidean norms satisfy $\|u\|=2\|v\|$. What is the value of $\propto$ such that $w=u+\propto v$ bisects the angle between u and v?

(A) 2

(B) ½

(C) 1

(D) -½

Answer: (A)

Q.No. 40 The value of $\lim_{x \to 1} \frac{x^7-2x^5+1}{x^3-3x^2+2}$

(A) is 0

(B) is -1

(C) is 1

(D) does not exist.

Answer: (C)

Q.No. 41 Let $U = \{1,2, \ldots, n\}$. Let $A = \{(x, X) | x \in X, X \subseteq U\}$. Consider the following two statements on $|A|$. I. $|A| = n2^{n-1}$ II. $|A| = \sum k(n)\ nk=1$ Which of the above statements is/are TRUE?

(A) Only I

(B) Only II

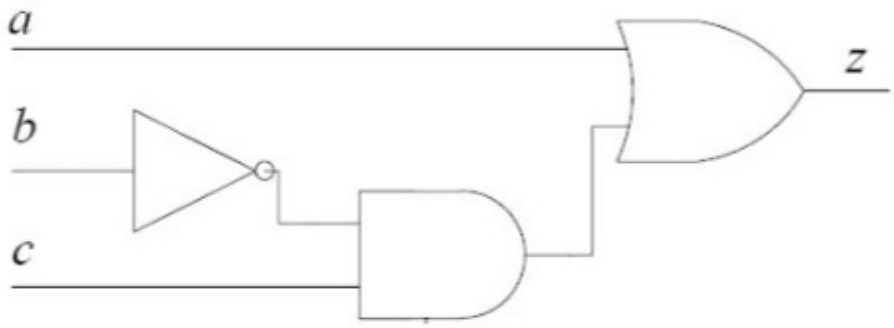
(C) Both I and II

(D) Neither I nor II

Answer: (C)

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Q.No. 42 Consider the Boolean function z(a, b, c).



Which one of the following minterm lists represents the circuit given above?

(A) $z = \sum(0, 1, 3, 7)$

(B) $z = \sum(1, 4, 5, 6, 7)$

(C) $z = \sum(2, 4, 5, 6, 7)$

(D) $z = \sum(2, 3, 5)$

Answer: (B)

Q.No. 43 Consider the unsigned 8-bit fixed point binary number representation below, $\mathbf{b}_7$ b_ bs $\mathbf{b}_4\mathbf{b}_3, \mathbf{b}_2, \mathbf{b}_1\mathbf{b}_0$ where the position of the binary point is between b_3 and b_2. Assume b_7 is the most significant bit. Some of the decimal numbers listed below cannot be represented exactly in the above representation: (i) 31.500 (ii) 0.875 (iii) 12.100 (iv) 3.001 Which one of the following statements is true?

(A) None of (i), (ii), (iii), (iv) can be exactly represented

(B) Only (ii) cannot be exactly represented

(C) Only (iii) and (iv) cannot be exactly represented

(D) Only (i) and (ii) cannot be exactly represented

Answer: (C)

Q.No. 44 Which of the following protocol pairs can be used to send and retrieve e-mails (in that order)?

(A) IMAP, POP3

(B) SMTP, POP3

(C) SMTP, MIME

(D) IMAP, SMTP

Answer: (B)

Q.No. 45 Let A and B be two n x n matrices over real numbers. Let rank(M) and det(M) denote the rank and determinant of a matrix M, respectively. Consider the following statements. I. rank(AB) = rank(A) rank(B) II. det(AB) = det(A) det(B) III. rank(A + B) ≤ rank(A) + rank(B) IV. det(A + B) ≤ det(A) + det(B) Which of the above statements are TRUE?

(A) I and II only

(B) I and IV only

(C) II and Ill only

(D) Ill and IV only

Answer: (C)

Q.No. 46 Consider the following sets: S1. Set of all recursively enumerable languages over the alphabet {0,1} S2. Set of all syntactically valid C programs S3. Set of all languages over the alphabet {0,1} S4. Set of all non-regular languages over the alphabet {0,1} Which of the above sets are uncountable?

(A) S1 and S2

(B) S3 and S4

(C) S2 and S3

(D) S1 and S4

Answer: (B)

Q.No. 47 Let G be a simple undirected graph. Let $T_D$be a depth first search tree of G. Let T_B be a breadth first search tree of G. Consider the following statements. (I) No edge of G is a cross edge with respect to T_D. (A cross edge in G is between two nodes neither of which is an ancestor of the other in T_D.) (II) For every edge (u,v) of G, if u is at depth i and v is at depth j in T_B, then $|i - j| = 1$. Which of the statements above must necessarily be true?

(A) I only

(B) II only

(C) Both I and II

(D) Neither I nor II

Answer: (A)

Q.No. 48 What is the worst case time complexity of inserting n^2 elements into an AVL-tree with n elements initially ?

(A) $\theta(n^4)$

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

(C) $\theta(n^2 \log n)$

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

Answer: (C)

Q.No. 49 Consider a relational table R that is in 3NF, but not in BCNF. Which one of the following statements is TRUE?

(A) R has a nontrivial functional dependency X → A, where X is not a superkey and A is a prime attribute.

(B) R has a nontrivial functional dependency X → A, where X is not a superkey and A is a non-prime attribute and X is not a proper subset of any key.

(C) R has a nontrivial functional dependency X → A, where X is not a superkey and A is a non-prime attribute and X is a proper subset of some key.

(D) A cell in R holds a set instead of an atomic value.

Answer: (A)

Q.No. 50 Consider the following C function. void convert(int n){ if(n<0) printf("%d",n); else { convert(n/2); printf("%d",n%2); } } Which one of the following will happen when the function convert is called with any positive integer n as argument?

(A) It will print the binary representation of n and terminate

(B) It will print the binary representation of n in the reverse order and terminate

(C) It will print the binary representation of n but will not terminate

(D) It will not print anything and will not terminate

Answer: (D)

Q.No. 51 Consider the following languages: I. $\{a^m b^n c^p d^q \mid m + p = n + q$, where $m, n, p, q \geq 0\}$ II. $\{a^m b^n c^p d^q \mid m = n$ and $p = q$, where $m, n, p, q \geq 0\}$ III. $\{a^m b^n c^p d^q \mid m = n = p$ and $p \neq q$, where $m, n, p, q \geq 0\}$ IV. $\{a^m b^n c^p d^q \mid mn = p + q$, where $m, n, p, q \geq 0\}$ Which of the languages above are context-free?

(A) I and IV only

(B) I and II only

(C) II and III only

(D) II and IV only

Answer: (B)

Q.No. 52 Recall that Belady's anomaly is that the page-fault rate may increase as the number of allocated frames increase. Now. consider the following statements: S1: Random page replacement algorithm (where a page chosen at random is replaced) suffers from Belady's anomaly S2: LRU page replacement algorithm suffers from Belady's anomaly Which of the following is CORRECT?

(A) S1 is true, S2 is true

(B) S1 is true, S2 is false

(C) S1 is false, S2 is true

(D) S1 is false, S2 is false

Answer: (B)

Q.No. 53 Consider the following context-free grammar over the alphabet Σ= {a, b, c} with S as the start symbol: S —> abScT I abcT Which one of the following represents the language generated by the above grammar?

(A) {(ab)n (cb)n|n>=1}

(B) $\{\{(ab)^n cb^{m_1} cb^{m_2} \dots cb^{m_n} | n, m_1, m_2, \dots, m_n \geq 1\}\}$

(C) $\{\{(ab)^n (cb^m)^n | m, n \geq 1\}\}$

(D) $\{\{(ab)^n (cb^n)^m | m, n \geq 1\}\}$

Answer: (B)

Q.No. 54 Suppose that in an IP-over-Ethernet network, a machine X wishes to find the MAC address of another machine Y in its subnet. Which one of the following techniques can be used for this?

(A) X sends an ARP request packet to the local gateway's IP address which then finds the MAC address of Y and sends to X

(B) X sends an ARP request packet to the local gateway's MAC address which then finds the MAC address of Y and sends to X

(C) X sends an ARP request packet with broadcast MAC address in its local subnet

(D) X sends an ARP request packet with broadcast IP address in its local subnet

Answer: (C)

Q.No. 55 Which one of the following statements is FALSE?

(A) Context-free grammar can be used to specify both lexical and syntax rules.

(B) Type checking is done before parsing.

(C) High-level language programs can be translated to different Intermediate Representations.

(D) Arguments to a function can be passed using the program stack.

Answer: (B)

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