COMPUTER SCIENCE ENGINEERING

Q. No. 1 – 25 Carry One Mark Each

1. Let X be a Gaussian random variable mean 0 and variance σ^2 .Let Y=max(X, 0) where max (a,b) is the maximum of a and b. The median of Y is _____.

Answer: (0) **Click here to watch video explanation**

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2. Consider the Karnaugh map given below, where x represents "don't care" and blank represents 0.

dc \ ba	00	01	11	10
00		x	x	
01	1			x
11	1			1
10		x	x	

Assume for all inputs (a,b, c, d) the respective complements $\left(\bar{a},\bar{b},\bar{c},\bar{d}\right)$ are also available. The above logic is implemented 2-input NOR gates only. The minimum number of gates required is _____.

Answer: (1) **Click here to watch video explanation**

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3. The statement $(\neg p)\Rightarrow(\neg q)$ is logically equivalent to which of the statements below?

I. $p \Rightarrow q$
II. $q \Rightarrow p$
III. $(\neg q)\vee p$
IV. $(\neg p)\vee q$

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

Answer: (D) **Click here to watch video explanation**

4. Consider the following table:

Algorithms		Design Paradigms	
P.	Kruskal	i.	Divide and Conquer
Q.	Quicksort	ii.	Greedy
R.	Floyd-Warshall	iii.	Dynamic Programming

Match the algorithms to the design paradigms they are based on.

(A) P-(ii), Q-(iii),R-(i) (B) P-(iii), Q-(i), R-(ii)

(C) P-(ii), Q-(i), R-(iii) (D) P-(i), Q-(ii), R-(iii)

Answer: (C) **Click here to watch video explanation**

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5. 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.

III. 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) **Click here to watch video explanation**

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6. Consider the following grammar.

$P \rightarrow$ xQRS

$Q \rightarrow$ yz|z

$R \rightarrow$ w|$\in$

$S \rightarrow$ y

What is FOLLOW (Q) ?

(A) {R} (B) {w} (C) {w, y} (D) {w, $}

Answer: (C) **Click here to watch video explanation**

7. Consider the language L given by the regular expression $(a+b)^* b(a+b)$ over the alphabet {a,b}. The smallest number of states needed in a deterministic finite-state automation (DFA) accepting L is _____ .

Answer: (4) **Click here to watch video explanation**

8. Consider a two-level cache hierarchy with L1 and L2 caches. An application incurs 1.4 memory accesses per instruction on average. For this application, the miss rate of L1 cache 0.1, the L2 cache experiences, on average, 7 misses per 1000 instructions. The miss rate of L2expressed correct to two decimal places is _____.

Answer: (0.05) **Click here to watch video explanation**

9. Consider the following CPU processes with arrival times (in milliseconds) and length of CPU burst (in milliseconds) as given below:

Process	Arrival time	Burst time
P1	0	7
P2	3	3
P3	5	5
P4	6	2

If the pre-emptive shortest remaining time first scheduling algorithm is used to schedule the processes, then the average waiting time across all processes is _____ milliseconds.

Answer: (3) **Click here to watch video explanation**

10. Threads of a process share

(A) global variable but not heap
(B) heap but not global variables.
(C) neither global variables nor heap
(D) Both heap and global variables.

Answer: (D) **Click here to watch video explanation**

11. Let $c_1.....c_n$ be scalars, not all zero, such that $\sum_{i=1}^{n} c_i a_i = 0$ where a_i are column vectors in R^n. Consider the set of linear equations $Ax = b$

where $A = [a_1.....a_n]$ and $b = \sum_{i=1}^{n} a_i$ .The set of equations has

(A) a unique solution at $x = J_n$ where J_n denotes a n-dimensional vector of all 1

(B) no solution

(C) infinitely many solutions

(D) finitely many solutions

Answer: (C) **Click here to watch video explanation**

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12. Consider the C code fragment given below.

```
typedef struct node
{
int data;
node* next ;
} node;
void join (node* m, node* n)   {
node* p=n ;
while (p->next ! =NULL){
p = p ->next ;
}
p-> next = m;
}
```

Assuming that m and n point to valid NULL- terminated linked lists, invocation of join will

(A) append list m to the end of list n for all inputs.

(B) either cause a null pointer dereference or append list m to the end of list n.

(C) cause a null pointer dereference for all inputs.

(D) append list n to the end of list m for all inputs..

Answer: (B) **Click here to watch video explanation**

13. The n-bit fixed-point representation of an unsigned real number real 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 2^{i} (B) 2^{-f} to $\left(2^{i}-2^{-f}\right)$

(C) 0 to 2^{i} (D) 0 to $\left(2^{i}-2^{-f}\right)$

Answer: (D) **Click here to watch video explanation**

14. 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)
```
p1=a-b
q1=p1*c
p1=u*v
q1=p1+q1
```

(B)
```
p3=a-b
q4=p3*c
p4=u*v
q5=p4+q4
```

(C)
```
p1=a-b
q1=p2*c
p3=u*v
q2=p4+q3
```

(D)
```
p1=a-b
q1=p*c
p2=u*v
q2=p+q
```

Answer: (B) **Click here to watch video explanation**

15. Consider the C struct defined below:

```
struct data {
    int marks [100] ;
    char grade;
    int cnumber;
};
struct data student;
```

The base address of student is available in register R1. The field student.grade can be accessed efficiently using

(A) Post-increment addressing mode. (R1)+

(B) Pre-decrement addressing mode, -(R1)

(C) Register direct addressing mode, R1

(D) Index addressing mode, X(R1), where X is an offset represented in 2's complement 16-bit representation.

Answer: (D) **Click here to watch video explanation**

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16. Consider a TCP client and a TCP server running on two different machines. After completing data transfer, the TCP client calls **close** to terminate the connectional and a FIN segment is sent to the TCP server. Server-side TCP responds by sending an ACK which is received by the client-side TCP. As per the TCP connections state diagram (RFC 793), in which state does the client-side TCP connection wait for the FIN from the sever-side TCP?

(A) LAST-ACK (B) TIME-WAIT (C) FIN-WAIT-1 (D) FIN-WAIT-2

Answer: (D) **Click here to watch video explanation**

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17. Consider the following context-free grammar over the alphabet $\sum = \{a, b, c\}$ with S as the start symbol.

$S \rightarrow abScT \mid abcT$

$T \rightarrow bT \mid b$

Which one of the following represents the language generated by the above grammar ?

(A) $\{(ab)^n (cb)^n \mid n \geq 1\}$

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

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

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

Answer: (B) **Click here to watch video explanation**

18. Consider the first-order logic sentence $F:\forall z(\exists y R(x,y))$. Assuming non-empty logical domains, which of the sentences below are *implied* by F?

I. $\exists y(\exists x R(x,y))$ **II.** $\exists y(\forall x R(x,y))$

III. $\forall y(\exists x R(x,y))$ **IV.** $\neg\exists x(\forall y \neg R(x,y))$

(A) IV only (B) I and IV only

(C) II only (D) II and III only

Answer: (B) **Click here to watch video explanation**

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19. When two 8-bit numbers $A_7....A_0$ and $B_7.....B_0$ in 2's complement representation (with A_0 and B_0 as the least significant bits) are added using a **ripple-carry adder**, the sum bits obtained are $S_7....S_0$ and the carry bits are $C_7....C_0$. An overflow is said to have occurred if

(A) the carry bit C_7 is 1 (B) all the carry bits ($C_7....C_0$) are 1

(C) $(A_7 B_7.\overline{S_7} + \overline{A_7}.\overline{B_7}.S_7)$ is 1 (D) $(A_0.B_0.\overline{S_0} + \overline{A_0}.\overline{B_0}.S_0)$ is 1

Answer: (C) **Click here to watch video explanation**

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20. Consider a database that has the relation schema EMP (EmpId, EmpName, and DeptName). An instance of the schema EMP and a SQL query on it are given below:

EMP		
EmpId	**EmpName**	**DeptName**
1.	XYA	AA
2.	XYB	AA
3.	XYC	AA
4.	XYD	AA
5.	XYE	AB
6.	XYF	AB
7.	XYG	AB
8.	XYH	AC
9.	XYI	AC
10	XYJ	AC
11.	XYK	AD
12.	XYL	AD
13.	XYM	AE

```
SELECT AVG(EC.Num)
FROM EC
WHERE(DeptName, Num)IN
      (SELECT DeptName, COUNT(EmpId)AS
                        EC(DeptName, Num)
      FROM EMP
      GROUP BY DeptName)
```

The output of executing the SQL query is _____.

Answer: (2.6) **Click here to watch video explanation**

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21. The following functional dependencies hold true for the relational schema R{V,W,X,Y,Z}:

$V \rightarrow W$
$VW \rightarrow X$
$Y \rightarrow VX$
$Y \rightarrow Z$

Which of the following is irreducible equivalent for this set of functional dependencies ?

(A) $V \rightarrow W$, $V \rightarrow X$, $Y \rightarrow V$, $Y \rightarrow Z$

(B) $V \rightarrow W$, $W \rightarrow X$, $Y \rightarrow V$, $Y \rightarrow Z$

(C) $V \rightarrow W$, $V \rightarrow X$, $Y \rightarrow V$, $Y \rightarrow X$, $Y \rightarrow Z$

(D) $V \rightarrow W$, $W \rightarrow X$, $Y \rightarrow V$, $Y \rightarrow X$, $Y \rightarrow Z$

Answer: (A) **Click here to watch video explanation**

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22. Consider the following functions from positive integers to real numbers:

$$10, \sqrt{n}, n, \log_2 n, \frac{100}{n}$$

The CORRECT arrangement of the above functions in increasing order of asymptotic complexity is:

(A) $\log_2 n, \frac{100}{n}, 10, \sqrt{n}, n$

(B) $\frac{100}{n}, 10, \log_2 n, \sqrt{n}, n$

(C) $10, \frac{100}{n}, \sqrt{n}, \log_2 n, n$

(D) $\frac{100}{n}, \log_2 n, 10, \sqrt{n}, n$

Answer: (B) **Click here to watch video explanation**

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23. Let T be a tree with 10 vertices. The sum of the degrees of all the vertices in T is _____.

Answer: (18) **Click here to watch video explanation**

24. 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) **Click here to watch video explanation**

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25. Consider the following C code:

```
# include <stdio.h>
int * assignval (int *x, int val)  {
     *x = val;
     return x;
}
void main ( ){
     int  * x= malloc (sizeof (int));
     if (NULL = = x) return;
     x = assignval (x,0);
     if(x)   {
     x=(int*) malloc (sizeof (int));
     if (NULL = = x) return;
     x = assignval (x, 10);
}
printf("%d\n", *x);
free (x);   }
```

The code suffers from which one of the following problems:

(A) compiler error as the return of malloc is not typecast appropriately.

(B) compiler error because the comparison should be made as x==NULL and not as shown.

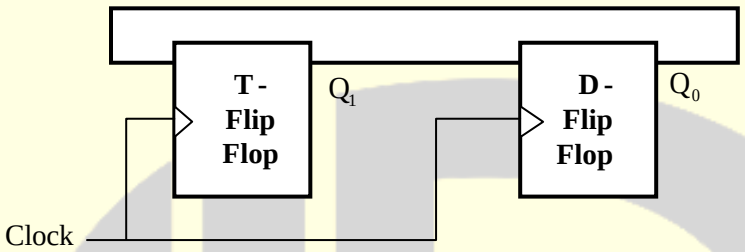
(C) compiles successfully but execution may result in dangling pointer.

(D) compiles successfully but execution may result in memory leak.

Answer: (D) **Click here to watch video explanation**

Q. No. 26 – 55 Carry Two Marks Each

26. 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 Q_0 and Q_1 are set to 1 (before the 1st clock cycle). The outputs

(A) Q_1Q_0 after the 3rd cycle are 11 and after the 4th cycle are 00 respectively

(B) Q_1Q_0 after the 3rd cycle are 11 and after the 4th cycle are 01 respectively

(C) Q_1Q_0 after the 3rd cycle are 00 and after the 4th cycle are 11 respectively

(D) Q_1Q_0 after the 3rd cycle are 01 and after the 4th cycle are 01 respectively

Answer: (B) **Click here to watch video explanation**

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27. The number of integers between 1 and 500 (both inclusive) that are divisible by 3 or 5 or 7 is _____.

Answer: (271) **Click here to watch video explanation**

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28. Consider a RISC machine where each instruction is exactly 4 bytes long. Conditional and unconditional branch instructions use PC- relative addressing mode with Offset specified in bytes to the target location of the branch instruction. Further the Offset is always with respect to the address of the next instruction in the program sequence. Consider the following instruction sequence.

Instruction No.	Instruction
i:	add R2, R3, R4
i +1:	sub R5, R6, R7
i + 2:	cmp R1, R9, R10
i + 3	beq R1, Offset

If the target of the branch instruction is i, then the decimal value of the Offset is _____.

Answer: (–16) **Click here to watch video explanation**

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29. Consider the C functions foo and bar given below:

```
int foo (int val ) {
     int x = 0;
     while (val> 0)  {
     x = x + foo ( val --);
}
     return val ;
}
int bar (int val )  {
int x = 0;
while (val> 0) {
     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.

(C) Abnormal termination and infinite loop respectively.

(D) Both terminating abnormally

Answer: (C) **Click here to watch video explanation**

30. In a RSA cryptosystem a participant A uses two prime numbers p = 13 and q =17 to generate her public and private keys. If the public key of A is 35. Then the private key of A is _____.

Answer: (11) **Click here to watch video explanation**

31. Let A be an array of 31 numbers consisting of sequence of 0's followed by a sequence of 1's. The problem is to find the smallest index *i* that A[*i*] is 1 by probing the minimum numbers of locations in A. The *worst case* number of probes performed by an *optimal* algorithm is _____.

Answer: (5) **Click here to watch video explanation**

32. If G is grammar with productions

$S \rightarrow SaS|aSb|bSa|SS|\hat{I}$

where S is the start variable, then which one of the following is not generated by G?

(A) abab (B) aaab (C) abbaa (D) babba

Answer: (D) **Click here to watch video explanation**

33. 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) **Click here to watch video explanation**

34. Instructions execution in a processor is divided into 5 stages. Instruction Fetch (IF), Instruction Decode (ID), Operand Fetch (OF), Execute (EX), and Write Back (WB), These stages take **5,4,20, 10 and 3 nanoseconds (ns)** respectively. A pipelined implementation of the processor requires buffering between each pair of consecutive stages with a delay of 2ns. Two pipelined implementations of the processor are contemplated.

(i) a naïve pipeline implementation (NP) with 5 stages and

(ii) an efficient pipeline (EP) where the OF stage id divided into stages OF1 and OF2 with execution times of 12 ns and 8 ns respectively.

The speedup (correct to two decimals places) achieved by EP over NP in executing 20 independent instructions with no hazards is _____.

Answer: (1.508) **Click here to watch video explanation**

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35. Consider a database that has the relation schemas EMP(EmpId, EmpName, DepId). And DEPT(DeptName, DeptId). Note that the DeptId can be permitted to be NULL in the relation EMP. Consider the following queries on the database expressed in tuple relational calculus.

(I) $\{t \mid \exists u \in EMP(t[EmpName] = u[EmpName] \wedge \forall v \in DEPT(t[DeptId] \neq v[DeptId]))\}$

(II) $\{t \mid \exists u \in EMP(t[EmpName] = u[EmpName] \wedge \exists v \in DEPT(t[DeptId] \neq v[DeptId]))\}$

(III) $\{t \mid \exists u \in EMP(t[EmpName] = u[EmpName] \wedge \exists v \in DEPT(t[DeptId] \neq v[DeptId]))\}$

Which of the above queries are safe?

(A) (I) and (II) only (B) (I) and (III) only

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

Answer: (D) **Click here to watch video explanation**

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36. Recall that Belady's anomaly is that the pages-fault rate may increase as the number of allocated frames increases. Now consider the following statements:

S_1: *Random page replacement* algorithm (where a page chosen at random is replaced) suffers from Belady's anomaly

S_2: *LRU page replacement* algorithm suffers from Belady's anomaly

Which of the following is CORRECT ?

(A) S_1 is true, S_2 is true (B) S_1 is true, S_2 is false

(C) S_1 is false , S_2 is true (D) S_1 is false, S_2 is false

Answer: (B) **Click here to watch video explanation**

37. The output of executing the following C program is _____.

```
# include <stdio.h>
int total (int v) {
while (v)  {
        count + = v & 1;
        v>> = 1;
}
        return count;
}
void main ( ) {
static int x = 0;
inti = 5;
for (; i> 0; i--)  {
        x=x + total (i) ;
}
printf ("%d\n", x)  ;
}
```

Answer: (B) **Click here to watch video explanation**

38. Consider the following C program.

```
#include <stdio.h>
#include<string.h>
void printlength (char *s, char *t) {
     unsigned int c = 0;
     int len = ((strlen(s) - strlen (t)) > c) ?strlen(s): strlen(t);
     printf ("%d\n", len);
}
void main (  ) {
     char *x = "abc";
     char *y ="defgh";
     printlength (x,y);
```

Recall that strlen is defined in string.h as returning a value of type size_t, which is an unsigned int. The output of the program is _____.

Answer: (3) **Click here to watch video explanation**

39. Consider the following languages over the alphabet $\sum = \{a, b, c\}$

Let $L_1 = \{a^n b^n c^m \mid m, n \geq 0\}$ and $L_2 = \{a^m b^n c^n \mid m, n \geq 0\}$

Which of the following are context-free languages ?

I. $L_1 \cup L_2$

II. $L_1 \cap L_2$

(A) I only (B) II only (C) I and II (D) Neither I nor II

Answer: (A) **Click here to watch video explanation**

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40. Consider a 2-way set associative cache with 256 blocks and uses LRU replacement, Initially the cache is empty. Conflict misses are those misses which occur due the contention of multiple blocks for the same cache set. Compulsory misses occur due to first time access to the block. The following sequence of accesses to memory blocks.

(0,128,256,128,0,128,256,128,1,129,257,129,1,129,257,129)

is repeated 10 times. The number of *conflict misses* experienced by the cache is _____.

Answer: (76) **Click here to watch video explanation**

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41. Let u and v be two vectors in $\mathbf{R}^2$ whose Euclidean norms satisfy $\|u\| = 2\|v\|$. What is the value of α such that $w = u + \alpha v$ bisects the angle between u and v ?

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

Answer: (A) **Click here to watch video explanation**

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42. Consider the following grammar:

```
stmt → if expr then else expr; stmt | 0
expr → term relop term | term
term → id | number
if → a | b | c
number → [0-9]
```

Where **relop** is a relational operate (e.g<,>,….) ---O refers to the empty statement, and **if** , **then, else** are terminals.

Consider a program P following the above grammar containing ten **if** terminals. The number of control flows paths in P is _____. For example the program

if e_1 **then** e_2 **else** e_3

has 2 controls flow paths $e_1 \to e_2$ and $e_1 \to e_3$

Answer: (1024) **Click here to watch video explanation**

43. In a database system, unique time stamps are assigned to each transaction using Lamport's logical clock . Let $TS(T_1)$ and $TS(T_2)$ be the timestamps of transactions T_1 and T_2 respectively. Besides, T_1 holds a lock on the resource R, and T_2 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
   T1 is killed
else T2 waits.
```

Assume any transactions 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) **Click here to watch video explanation**

44. Let A and B be infinite alphabets and let # be a symbol outside both A and B. Let *f* be a total functional from A^* to B^*. We say *f* is *computable* if there exists a Turning machine M which given an input x in A^*, always halts with *f(x)* on its tape. Let L_f denote the language $\left\{x\#f(x)\middle| x \in A^*\right\}$ .Which of the following statements is true:

(A) f if computable if and only if L_f is recursive.

(B) f is computable if and only L_f recursively enumerable.

(C) If f is computable then L_f is recursive, but not conversely.

(D) If f is computable then L_f is recursively enumerable, but not conversely.3

Answer: (A) **Click here to watch video explanation**

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45. Consider the expression $(a-1)^*(((b+c)/3)+d))$. Let X be the minimum number of registers required by an optimal code generation (without any register spill) algorithm for a load/store architecture in which

(i) only loads and store instructions can have memory operands and

(ii) arithmetic instructions can have only register or immediate operands.

The value of X is _____.

Answer: (2) **Click here to watch video explanation**

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46. 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:

I. 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) **Click here to watch video explanation**

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47. A multithreaded program P executes with x number of threads and uses y number of locks for ensuring mutual exclusion while operating on shared memory locations. All locks in the program are *non-reentrant*, i.e., if a thread holds a lock *l*, then it cannot re-acquire lock *l* without releasing it. If a thread is unable to acquire a lock, it blocks until the lock becomes available. The *minimum* value of x and the *minimum* value of y together for which execution of P can result in a deadlock are:

(A) x = 1, y = 2 (B) x =2, y=1 (C) x = 2,y=2 (D) x = 1, y = 1

Answer: (D) **Click here to watch video explanation**

48. The values of parameters for the Stop-and – Wait ARQ protocol are as given below:

Bit rate of the transmission channel = 1Mbps

Propagation delay from sender to receiver = 0.75 ms

Time to process a frame = 0.25ms

Number of bytes in the information frame =1980

Number of bytes in the acknowledge frame = 20

Number of overhead bytes in the information frame = 20

Assume that there are no transmission errors. Then the transmission efficiency (expressed in percentage) of the Stop-and – Wait ARQ protocol for the above parameters is _____(correct to 2 decimal places)

Answer: (89.33) **Click here to watch video explanation**

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49. A computer network uses polynomials over *GF(2)* for error checking with 8 bits as information bits and uses $x^3 + x + 1$ as the generator polynomial to generate the check bits. In this network, the message 01011011 is transmitted as

(A) 01011011010 (B) 01011011011

(C) 01011011101 (D) 01011011100

Answer: (C) **Click here to watch video explanation**

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50. Let p, q, and r be propositions and the expression $(p \to q) \to r$ be a contradiction. Then, the expression $(r \to p) \to q$ is

(A) a tautology (B) a contradiction

(C) always TRUE when p is FALSE (D) always TRUE when q is TRUE

Answer: (D) **Click here to watch video explanation**

51. A cache memory unit with capacity of N words and block size of B words is to be designed. If it is designed as a direct mapped cache, the length of the TAG field is 10 bits. If the cache unit is now designed as a 16-way set-associative cache, the length of the TAG field is _____bits.

Answer: (14) **Click here to watch video explanation**

52. Consider the following two functions.

```
void fun1 (int  n)
{
    if (n = =0 ) return;
    printf ("%d" , n);
    fun2 (n - 2);
    printf ("%d" , n);
}
```

```
void fun2 (int  n)
    {
    if (n = = 0) return ;
    printf ("%d" , n);
    fun1(++n) ;
    printf ("%d" , n);
    }
```

The output printed when fun1 (5) is called is

(A) 53423122233445

(B) 53423120112233

(C) 53423122132435

(D) 53423120213243

Answer: (A) **Click here to watch video explanation**

53. Consider a database that has the relation schema CR (StudentName, CourseName). An instance of the schema CR is as given below.

CR	
Student Name	**Course Name**
SA	CA
SA	CB
SA	CC
SB	CB
SB	CC
SC	CA
SC	CB
SC	CC
SD	CA
SD	CB
SD	CC

SD	CD
SE	CD
SE	CA
SE	CB
SF	CA
SF	CB
SF	CC

The following query is made on the database.

$T1 \leftarrow \pi_{CourseName}\left(\sigma_{StudentName='SA'}(CR)\right)$

$T2 \leftarrow CR \div T1$

The number of rows in T2 is _____.

Answer: (4) **Click here to watch video explanation**

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54. Let A be $n \times n$ real valued square symmetric matrix of rank 2 with $\sum_{i=1}^{n}\sum_{j=1}^{n} A_{ij}^2 = 50$. Consider the following statements.

(I) One eigen value must be in [-5, 5]

(II) The eigen value with the largest magnitude must be strictly greater than 5.

Which of the above statements about eigen values of A is/are necessarily CORRECT?

(A) Both (I) and (II) (B) (I) only

(C) (II) only (D) Neither (I) nor (II)

Answer: (B) **Click here to watch video explanation**

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55. Consider the context-free grammars over the alphabet {a,b,c} given below. S and T are non-terminals

$G_1 : S \rightarrow aSb \mid T, T \rightarrow cT \mid \in$

$G_2 : S \rightarrow bSa \mid T, T \rightarrow cT \mid \in$

The language $L(G_1) \cap L(G_2)$ is

(A) Finite. (B) Not finite but regular.

(C) Context-free but not regular. (D) Recursive but not context-free.

Answer: (B) **Click here to watch video explanation**