*Res

CS: COMPUTER SCIENCE AND INFORMATION TECHNOLOGY

EE25BTECH11041 - Naman Kumar

1. 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

   (GATE CS 2017)

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

   I $\exists y(\exists x R(x, y))$

   II $\exists v(\forall x R(x, y))$

   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

   (GATE CS 2017)

3. 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 11-dimensional vector of all 1
   (b) no solution
   (c) infinitely many solutions
   (d) finitely many solutions

   (GATE CS 2017)

4. 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) $\frac{100}{n}, \log_2 n, 10, \sqrt{n}, n$

   (GATE CS 2017)

5. 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)

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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

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7. 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 2^i
(b) 2^{-f} to $(2^i - 2^{-f})$
(c) 0 to 2^i
(d) 0 to $(2^i - 2^{-i})$

(GATE CS 2017)

8. Consider the C code fragment given below.

```
typedef struct node {
    int data;
    struct 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.

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9. When two 8-bit numbers $A_7 \cdots A_0$ and $B_7 \cdots B_0$ 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 $S_7 \cdots S_0$ and the carry bits are $C_7 \cdots C_0$. An overflow is said to have occurred if

(a) the carry bit C_7 is 1
(b) all the carry bits $(C_7, \cdots, C_0)$ are 1
(c) $(A_7 \cdot B_7 \cdot \overline{S_7} + \overline{A_7} \cdot \overline{B_7} \cdot S_7)$ is 1
(d) $(A_0 \cdot B_0 \cdot \overline{S_0} + \overline{A_0} \cdot \overline{B_0} \cdot S_0)$ is 1

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10. Consider the following context-free grammar over the alphabet $\Sigma = \{a, b, c\}$ with S as the start symbol:
$S \rightarrow abScT | abcT$
$T \rightarrow bT | b$
Which one of the following represents the language generated by the above grammar?

(a) $\{(ab)^n(cb)^n | n \geq 1\}$
(b) $\{(ab)^n cb^{m_1} cb^{m_2} ... cb^{m_n} | n, m_1, m_2, ..., m_n \geq 1\}$
(c) $\{(ab)^n(cb^m)^n | m, n \geq 1\}$
(d) $\{(ab)^n(cb^n)^m | m, n \geq 1\}$

(GATE CS 2017)

11. 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.

(GATE CS 2017)

12. 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) $p_3 = a - b$
$q_4 = p_3 * c$
$p_4 = u * v$
$q_5 = p_4 + q_4$

(c) $p_1 = a - b$
$q_1 = p_2 * c$
$p_3 = u * v$
$q_2 = p_4 + q_3$

(d) $p_1 = a - b$
$q_1 = p * c$
$p_2 = u * v$
$q_2 = p + q$

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13. Consider the following C code:

```
#include <stdio.h>
#include <stdlib.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

(GATE CS 2017)

14. 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 connection 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 connection state diagram (RFC 793), in which state does the client-side TCP connection wait for the FIN from the server-side TCP?

(a) LAST-ACK (b) TIME-WAIT (c) FIN-WAIT-1 (d) FIN-WAIT-2

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15. 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

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16. The following functional dependencies hold true for the relational schema RV, W, X, Y, Z:

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

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

(a) $V \to W$, $V \to X$, $Y \to V$, $Y \to Z$

(b) $V \to W$, $W \to X$, $Y \to V$, $Y \to Z$

(c) $V \to W$, $V \to X$, $Y \to V$, $Y \to X$, $Y \to Z$

(d) $V \to W$, $W \to X$, $Y \to V$, $Y \to X$, $Y \to Z$

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17. Consider the following grammar:
$P \to xQRS$
$Q \to yz|z$
$R \to w|\varepsilon$
$S \to y$
What is FOLLOW(Q)?

(a) $\{R\}$ (b) $\{w\}$ (c) $\{w, y\}$ (d) $\{w, \$\}$

(GATE CS 2017)

18. Threads of a process share

(a) global variables but not heap.
(b) heap but not global variables.
(c) neither global variables nor heap.
(d) both heap and global variables.

(GATE CS 2017)

19. Let X be a Gaussian random variable with 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 __________.

(GATE CS 2017)

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

(GATE CS 2017)

21. 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 $(\vec{a}, \vec{b}, \vec{c}, \vec{d})$ are also available. The above logic is implemented using 2-input NOR gates only. The minimum number of gates required is __________.

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22. 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 automaton (DFA) accepting L is __________.

(GATE CS 2017)

23. Consider a database that has the relation schema EMP (EmpId, EmpName, 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	AC
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 __________.

(GATE CS 2017)

24. Consider the following CPU processes with arrival times (in milliseconds) and length of CPU bursts (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.

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25. 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 is 0.1; the L2 cache experiences, on average, 7 misses per 1000 instructions. The miss rate of L2 expressed correct to two decimal places is __________

(GATE CS 2017)

26. 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

(GATE CS 2017)

27. 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) $x = 1, y = 1$

(GATE CS 2017)

28. 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

(GATE CS 2017)

29. 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.

(GATE CS 2017)

30. Let u and v be two vectors in 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) $-1/2$

(GATE CS 2017)

31. 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 eigenvalue must be in $([) - 5, 5]$
II The eigenvalue with the largest magnitude must be strictly greater than 5

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

(a) Both I and II
(b) I only
(c) II only
(d) Neither I nor II

(GATE CS 2017)

32. 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

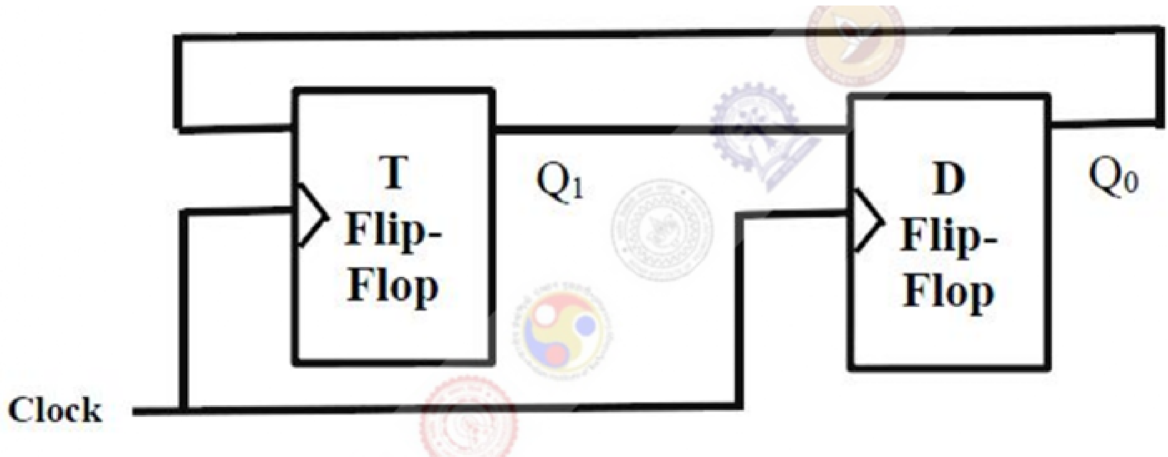
(b) 01011011011

(c) 01011011101

(d) 01011011100

(GATE CS 2017)

33. 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 1^{st} clock cycle). The outputs Q_1Q_0 after the 3^{rd} cycle are 11 and after the 4^{th} cycle are 00 respectively.

(a) Q_1Q_0 after the 3^{rd} cycle are 11 and after the 4^{th} cycle are 00 respectively

(b) Q_1Q_0 after the 3^{rd} cycle are 11 and after the 4^{th} cycle are 01 respectively

(c) Q_1Q_0 after the 3^{rd} cycle are 00 and after the 4^{th} cycle are 11 respectively

(d) Q_1Q_0 after the 3^{rd} cycle are 01 and after the 4^{th} cycle are 01 respectively

(GATE CS 2017)

34. If G is a grammar with productions

$$S \rightarrow SaS|aSb|bSa|SS|\epsilon$$

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

(a) abab (b) aaab (c) abbaa (d) babba

(GATE CS 2017)

35. Consider the following two functions.

void funl (int n) {	void fun2 (int n) {
if (n==0) return;	if (n==0) return;
printf("%d", n);	printf("%d", n);
fun2 (n − 2);	funl (++n);
printf("%d", n);	printf("%d", n);
}	}

The output printed when fun1(5) is called is

(a) 53423122233445

(b) 53423120112233

(c) 53423122132435

(d) 53423120213243

(GATE CS 2017)

36. 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.

(GATE CS 2017)

37. Consider the context-free grammars over the alphabet $\{a, b, c\}$ given below. S and T are non-terminals.
$G_1 : S \to aSb|T, T \to cT|\epsilon$ $G_2 : S \to bSa|T, T \to cT|\epsilon$
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.

(GATE CS 2017)

38. Consider the following languages over the alphabet $\Sigma = \{a, b, c\}$ Let $L_1 = \{a^n b^n c^m | m, n \geq 0\}$ and $L_2 = \{a^m b^n c^n | m, n \geq 0\}$.

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

(GATE CS 2017)

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

    (a) f is computable if and only if L_f is recursive.
    (b) f is computable if and only if L_f is 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.

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40. Recall that Belady's anomaly is that the page-fault rate may increase as the number of allocated frames increases. 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

(GATE CS 2017)

41. Consider a database that has the relation schemas EMP($EmpId$, $EmpName$, $DeptId$), 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 $\{t | \exists u \in EMP(t[EmpName] = u[EmpN]ame \wedge \forall v \in DEPT(t[DeptId] \neq v[DeptId]))$

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

    III $\{t | \exists u \in EMP(t[EmpName] = u[EmpN]ame \wedge \exists v \in DEPT(t[DeptId] = v[DeptId]))$

    Which of the above queries are safe?

    (a) I and II only
    (b) I and III only
    (c) II and III only
    (d) I only

(GATE CS 2017)

42. In a database system, unique timestamps 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 $TS(T_2) < TS(T_1)$ then
    T_1 is killed
    else T_2 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.

(GATE CS 2017)

43. Consider the following grammar:

```
stmt -> \textbf{if} expr \textbf{then} expr \textbf{else} expr stmt | o
expr -> term \textbf{relop} term | term
term -> id | number
id -> a | b | c
number -> [0-9]
```

where relop is a relational operator (e.g.,<, > , ...), ó 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 flow paths in P is __________. For example, the program

$$\textbf{if } e_1 \textbf{ then } e_2 \textbf{ else } e_3$$

has 2 control flow paths, $e_1 \to e_2$ and $e_1 \to e_3$

(GATE CS 2017)

44. 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 __________

(GATE CS 2017)

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

Bit rate of the transmission channel = 1 Mbps.
Propagation delay from sender to receiver = 0.75 ms
Time to process a frame = 0.25 ms.
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).

(GATE CS 2017)

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

EMP	
StudentName	CourseName
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.

$$T1 \leftarrow \pi_{CourseName}(\sigma_{SudentName='SA'}(CR))$$
$$T2 \leftarrow CR \div T1$$

The number of rows in T2 is __________

(GATE CS 2017)

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

(GATE CS 2017)

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

(GATE CS 2017)

49. 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

Instr. 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 __________

(GATE CS 2017)

50. Instruction 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 2 ns. Two pipelined implementations of the processor are contemplated:

    I a naive pipeline implementation (NP) with 5 stages and

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

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

(GATE CS 2017)

51. 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 to 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 __________

(GATE CS 2017)

52. 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 load and store instructions can have memory operands and (ii) arithmetic instructions can have only register or immediate operands. The value of X is __________

(GATE CS 2017)

53. 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 __________

(GATE CS 2017)

54. 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.

(GATE CS 2017)

55. The output of executing the following C program is ___________

```
#include <stdio.h>

int total (int v) {
    static int count = 0;
    while (v) {
        count += v & 1;
        v >>= 1;
    }
    return count;
}

void main() {
    static int x = 0;
    int i = 5;
    for (; i > 0; i--) {
        x = x + total(i);
    }
    printf("%d\n", x);
}
```

(GATE CS 2017)

56. After Rajendra Chola returned from his voyage to Indonesia, he ___________ to visit the temple in Thanjavur.

(a) was wishing (b) is wishing (c) wished (d) had wished

(GATE CS 2017)

57. Research in the workplace reveals that people work for many reasons ___________ money.

(a) money beside (b) beside money (c) money besides (d) besides money

(GATE CS 2017)

58. Rahul, Murali, Srinivas and Arul are seated around a square table. Rahul is sitting to the left of Murali. Srinivas is sitting to the right of Arul. Which of the following pairs are seated opposite each other?

(a) Rahul and Murali
(b) Srinivas and Arul
(c) Srinivas and Murali
(d) Srinivas and Rahul

(GATE CS 2017)

59. Find the smallest number y such that $y \times 162$ is a perfect cube.

(a) 24 (b) 27 (c) 32 (d) 36

(GATE CS 2017)

60. The probability that a k-digit number does NOT contain the digits 0, 5, or 9 is

(a) 0.3^k (b) 0.6^k (c) 0.7^k (d) 0.9^k

(GATE CS 2017)

61. ”The hold of the nationalist imagination on our colonial past is such that anything inadequately or improperly nationalist is just not history.”

Which of the following statements best reflects the author’s opinion?

(a) Nationalists are highly imaginative.

(b) History is viewed through the filter of nationalism.

(c) Our colonial past never happened.

(d) Nationalism has to be both adequately and properly imagined.

(GATE CS 2017)

62. Six people are seated around a circular table. There are at least two men and two women. There are at least three right-handed persons. Every woman has a left-handed person to her immediate right. None of the women are right-handed. The number of women at the table is

(a) 2 (b) 3 (c) 4 (d) Cannot be determined

(GATE CS 2017)

63. The expression $\frac{(x+y)-|x-y|}{2}$ is equal to

(a) the maximum of x and y

(b) the minimum of x and y

(c) 1

(d) none of the above

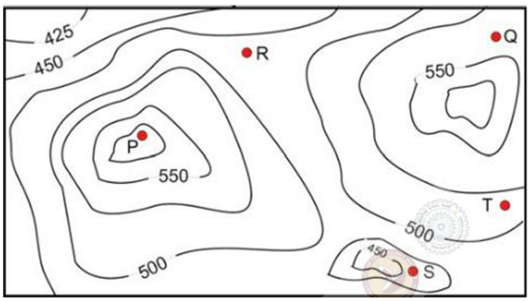
(GATE CS 2017)

64. Arun, Gulab, Neel and Shweta must choose one shirt each from a pile of four shirts coloured red, pink, blue and white respectively. Arun dislikes the colour red and Shweta dislikes the colour white. Gulab and Neel like all the colours. In how many different ways can they choose the shirts so that no one has a shirt with a colour he or she dislikes?

(a) 21 (b) 18 (c) 16 (d) 14

(GATE CS 2017)

65. A contour line joins locations having the same height above the mean sea level. The following is a contour plot of a geographical region. Contour lines are shown at 25 m intervals in this plot. If in a flood, the water level rises to 525 m, which of the villages P, Q, R, S, T get submerged?



(a) P, Q (b) P, Q, T (c) R, S, T (d) Q, R, S

(GATE CS 2017)