GATE

Subject : CS 2016_Set-2 - SOLUTIONS

TECHNICAL SECTION (Q. NO. 1 – 25) 1 MARKS

1. A statement 'A' is said to be logically implied by 'B', then $B \rightarrow A$ is always true i.e. a tautology

(i) false

$= P \wedge (P \rightarrow Q) \rightarrow$ false

$= P \wedge (P + Q) \rightarrow$ false

$= P \wedge (\overline{P} + Q) \rightarrow$ false

$= \neg P \vee \neg Q \vee$ false which is not always true.

$\therefore$ Not logically implied

(ii) Q

$P \wedge (P \rightarrow Q) \rightarrow Q$

According to 'moduls ponens' rule of inference, the above statement is always true i.e. logically implied

$\therefore P \wedge (P \rightarrow Q) \rightarrow Q$

$= P \wedge (\neg P \vee \neg Q) \rightarrow Q$

$= P \wedge Q \rightarrow Q$

$= \neg P \vee \neg Q \vee Q$

True

$\therefore$ Logically implied

(iii) true

$P \wedge (P \rightarrow Q) \rightarrow$ true

$= P \wedge Q \rightarrow$ true

$= \neg P \vee \neg Q \vee$ true

= True

$\therefore$ Logically implied

(iv) $\neg Q \vee \neg P$

$P \wedge (P \rightarrow Q) \rightarrow (\neg Q \vee P)$

$= P \wedge Q \rightarrow \neg Q \vee P$

$= \neg Q \vee \neg P \vee \neg Q \vee P$

= True

$\therefore$ Logically implied

(v) $P \vee Q$

$= P \wedge (P \rightarrow Q) \rightarrow (P \vee Q)$

$= \neg P \vee \neg Q \vee P \vee Q$

= true

$\therefore$ Logically implied

$\therefore$ 4 statements are logically implied

2. $f(x)$ is a polynomial of degree 10

let $f(x) = x^{10}$

and $f(x) = f'(x) = 10x^3$

$f(x) + f(-x) = x^{10} + x^{10} = 2x^{10}$

$g(x) = 10x^9$

$g(-x) = -10x^9$

$g(x) - g(-x) = 10x^9 - (-10x^9)$

$= 20x^9$

$\therefore$ Degree of $g(x) - g(x) - g(-x) = 9$

3. A planar graph is 4-colorable or 4-partite.

i.e. any planar graph can be colored using atmost 4 colours.

A graph is said to be planar if it can be drawn on a plane with no two edges crossing each other.

Consider a 4 vertex complete graph. It requires 4 colors so that no two adjacent vertices have the same color.

$\therefore$ Answer is 4.

4. To solve the linear equation in 'n' variables we need atleast 'n' equations.

$\therefore$ I is false

If no. of equations are more than no. of variables, even then solutions will exist

$\therefore$ II is false

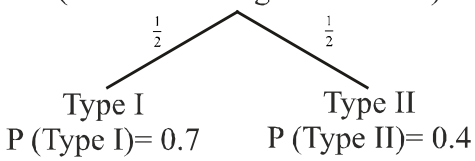
If no. of equation = no. of variables, then there will exist a system which has solution.

The solution will be unique.

$\therefore$ III is true

(C) is correct choice

5. P (led Bulb lasting > 100 hours)



Required probability $= \frac{1}{2} \times 0.7 + \frac{1}{2} \times 0.4$

$= 0.55$

6. Eigen values of a matrix A = 1, 2, 4

$\left|\left(A^{-1}\right)^T\right| = \left|\left(A^T\right)^{-1}\right| = \left|\left(A^T\right)\right|^{-1}$

We know that $|A| = |A^T|$

Also |A| = product of its eigen values = $1 \times 2 \times 4 = 8$

$\therefore \left|\left(A^{-1}\right)^T\right| = (8)^{-1} = \frac{1}{8} = 0.125$

7. Here, we have to find a number B such that the adder takes maximum delay to add A and B

decimal value A = 0000 0001

Maximum latency will occur when carry bit will be generated out of the MSB

Thus, addition of 2 K-bit numbers produces (K + 1) bits when there is a carry out of the MSB.

Consider – 1

In 2'S complement 8–bit representation,

$$\begin{array}{rl} -1 = & 11\ 11\ 11\ 10 \\ + & \qquad\qquad\ 1 \\ \hline \therefore B = & 11\ 11\ 11\ 11 \end{array}$$

Now if we add A and B

$$\begin{array}{rl} & 11\ 11\ 11\ 11 \\ A & 00\ 00\ 00\ 01 \\ + B & 11\ 11\ 11\ 11 \\ \hline & \boxed{1}00\ 00\ 00\ 00 \end{array}$$

Carry bit generated

$\therefore$ 1 gate delay extra

So, answer is –1

8. $x_1 \oplus x_2 \oplus x_3 \oplus x_4 = 0$

$\oplus$ is XOR operation.

Construct truth table for 4 variables

x_1	x_2	x_3	x_4	$y = x_1 \oplus x_2 \oplus x_3 \oplus x_4$
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	0
0	1	1	0	0
0	1	1	1	1
1	0	0	0	1
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

(A) is false for input 1111

(B) is false for input 1111

(D) is also false for input 1111

(C) is true for all cases where O/P is 0

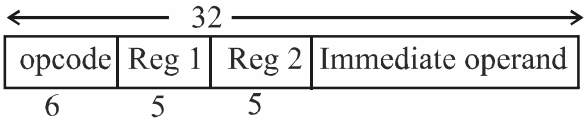
Hence (C) is the correct choice.

9. $\therefore$ X = -2^{16-1} to $(+2^{16-1} - 1)$

Y = $(-2^{16-1} - 1)$ to + $(2^{16-1} - 1)$

$\therefore$ X – Y = 1 (as in signed magnitude there are two representations of 0 whereas in 2's complement from, there is only one representation of 0)

10.



opcode = $\lceil \log_2 (40) \rceil$ = 6

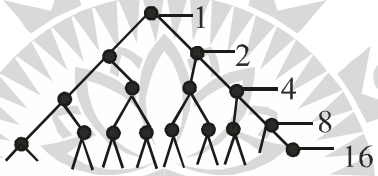
For registers R_1 and R_2 we require $\lceil \log_2 (24) \rceil$ = 5

$\therefore$ Immediate operand has = 32 – (6 + 5 + 5)

= 16 bits

16 is the answer

11. Since there is a vertex 't' at a distance of 4, the height of the tree must be 4 and at height 4, the maximum value of nth value of n^{th} vertex will be the right most vertex



$\therefore$ n = 16 + 8 + 4 + 2 + 1 = $2^5 - 1$ = 31

12. i = 5 j= 10

```
f (& i, j)                    void f(int * P, int m)
{
m = m + 5 // m = 15
*P = *P + m // *P = 5 + 15 = 20
     ∴ i = 20 (i.e. value of i is changed from 5 to 20)
}
```

Print (i + j) = 20 + 10 = 30

Hence 30 is the correct answer

13. If the input is already sorted in ascending order.

(i) Quick sort takes $O(n^2)$ time (It becomes worst case of quick sort)

(ii) Bubble sort runs in O(n) time (Best case)

(iii) Merge sort runs in O(n logn) time (Merge sort is not adaptable to the input)

(iv) Insertion sort runs in O(n) time (Best case)

$\therefore$ of the given options only I and IV are correct

$\therefore$ (D) is the correct option

14. The floyd-warshall algorithm for all pair shortest path algorithm is based on dynamic programming paradigm

15. delete operation takes O(1) time

insert will take O(N) time in the worst case

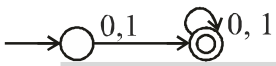
find will take O(N) time in the worst case. decrease key will take O(1) as pointer is provided to the key on which operation is to be performed but we will need to sort the list again once decrease key is performed which will take O(N) in worst case.

Operation	No. of operation	Total time
delete	N	O(N)
insert	Log N	O(N logN)
find	Log N	O(N logN)
decrease key	(N)	$O(N^2)$

$\therefore$ (C) is the correct answer.

16. R.E. = (0 + 1)* (0 + 1) (0 + 1)*

Minimum DFA for above expression is



$\therefore$ 2 states

17. L_1 (G) : $S_1 \rightarrow a\ S_1\ b \mid \varepsilon$

L (S_1) : {ε, ab, aa bb, aaa bbb ....}

$\therefore$ L (S_1) = {a^n, b^n |n $\geq$ 0}

It is a DCFL

L_2 (G) : $S_2 \rightarrow abS_2 \mid \varepsilon$

L (S_2) = {ε, ab, abab, ababab ....}

$\therefore$ L(S_2) = (a b)*

It is a regular lang.

$\therefore$ P is false and Q is true

(C) is the correct choice

18. (i) L′3 U L4 is REL

L3 is recursive

$\therefore$ L′3 is also recursive

and L4 is REL

$\therefore$ L′3 U L4 is REL is true

(ii) L2 is CFL and L3 is recursive

$\therefore$ L2 U L3 is recursive is true

(iii) L1 is regular

L1* is regular

L1* U L2 is CFL is true ($\because$ L2 is CFL)

(iv) L1 is regular and L2 is CFL

$L'2$ is not CFL as CFLs are not closed under complementation

$\therefore$ L1 U L2 $\neq$ CFL $\therefore$ IV is false

$\therefore$ (D) is the correct choice

19. Lexical analysis – Regular expression

Top down passing – leftmost derivation

Semantic analysis – Type checking

Runtime environments – Activation records

$\therefore$ (B) is the correct choice

20. In FIFO page replacement algorithm for some reference strings, it is possible for the page fault rate to increase even when the no. of allocated frames increases.

This is known as Belady's anomaly and occures only in FIFO.

$\therefore$ (D) is the correct choice.

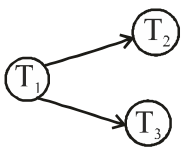
21. In both B+ trees and B-trees, it is a property that the lengths of the paths from root to leaves (all leaf nodes) are equal.

In these trees, we insert and delete elements in such a way that the depth of every leaf node is same from the root.

$\therefore$ (A) is the correct option.

22. If a database schedule is serializable, then the topological sort of the precedence graph is guaranteed to yield a serial schedule.

Cosider the following precedence graph



$< T_1\ T_2\ T_3 >$ and $< T_1\ T_3\ T_2 >$ both yield serializable schedules.

$\therefore$ (A) is the correct option.

23. If the receiver wants to verify the digital signature sent by the sender, the receiver requires the sender's public key for verification of the signature.

(A) is the correct choice.

24. Ethernet is a networking, technology used for data transmission in wired LANS

(A) Is false because a station can continue to sense the channel even if it starts tranmitting a frame.

(B) Jamming signal is used to inform neighbouring devices aboout a collision. Once collision occurs, the station stops transmitting the data and it transmits a jam signal. So (B) is false

(C) Is false as the station stops transmitting the data once collision occurs. When a collison is detected in the time. $(0, 2P_t)$ or exactly $2P_t$, a jam signal is transmitted

(D) Is the correct option. If we increase the number of retransmissions, it reduces the probability of collision using exponential backoff algorithm.

However, the number of retransmissions should not be greater than 10 as the maximum delay is 1023 slot times i.e. $(0 \text{ to } 2^{10} - 1)$

25. When your browser requests a webpage from a server, the first thing it does is the DNS query.

Suppose you request for www.vijayshekharacademy.com

It will translate the human friendly host name to IP address

Now TCP connection needs to be established once a DNS server is located. The TCP protocol establishes connection by sending SYN packets. HTTP data resides above the TCP protocol, which guarantees reliability of delivery.

HTTP requests for a webpage using its GET method.

Thus, the correct sequence is

DNS Query, TCP SYN, HTTP GET

(C) is the correct option.

TECHNICAL SECTION (Q. NO. 26 – 55) 2 MARKS

26. (a, b) R (c, d) if a < = c or b < = d

consider (a, b) R (a, b)

a < = a true or b < = b true

$\therefore$ R is refiexive $\forall x \in R$

Statement P is true

To test transitivity, consider a set S = {1, 2, 3}

and R = {(2, 2), (3, 1), (1, 1)}

(2, 2) R (3, 1) 2 < = 3 $\therefore$ True

(3, 1) R (1, 1) 1 < = 1 (b < = d) $\therefore$ True

So,

(2, 2) R (1, 1) should also be true

But (2, 2) R (1, 1) does not satisfy

as 2 > 1 and 2 > 1 i.e

a > c and b > d

$\therefore$ Transitivity fails

(B) is the correct option

27. Consider

P(x) – It is raining on a day

Q(x) – Schools are closed on a day

(A) is valid

There exists a day when it is not raining or schools are closed

(B) is also valid

(C) is also valid

If there exists a day that it is raining and schools are closed then it implies there exists some day it is raining and there exists some day that schools are closed.

(D) is clearly false

For all days, it is ranining or schools are closed implies a false statement

i.e. for all days it is raining or for all days schools are closed which is obviously false.

28. This is a question of graph theory

$U = \{C_1, C_2, C_3 \ldots\ldots C_{23}\}$ n (U) = 23

Let $S = \{C_1, C_2, C_3 \ldots\ldots C_9\}$ n (S) = 9

$\therefore$ U\S is the compounds in μ but not in S

$\therefore$ $U\backslash S = \{C_{10}, C_{11}, C_{12}, \ldots\ldots C_{23}\}$ n (U\S) = 14

Keep these points in mind

(i) For a simple undirected graph

$\sum$ deg (vertices) = 2 edges

(ii) The number of vertices of odd degree is even in number

It is given that each compounds in S

reacts with exactly 3 compounds in U

Since S has 9 compounds. So, degree of each compounds in S is 3 i.e. odd vertices of odd degree.

And the graph is simple undirected graph.

It will not have self loops ($\because$ the compound doesnt react with itself), no paallel edges according to the question.

Therefore, there must be atleast one compound in U\S such that it reacts with an odd number of compounds to make the overall sum of degrees even.

$\therefore$ only statement II makes sense.

(B) is the answer

29. $\frac{13^{99}}{17}$

$\frac{13^4}{17}$ gives remainder as 1

$\therefore \frac{[13^4]^{24} \cdot 13^3}{17}$

$= \frac{(1)^{24} \cdot 13^3}{17} = \frac{4}{17}$

$\therefore$ Remainder is 4

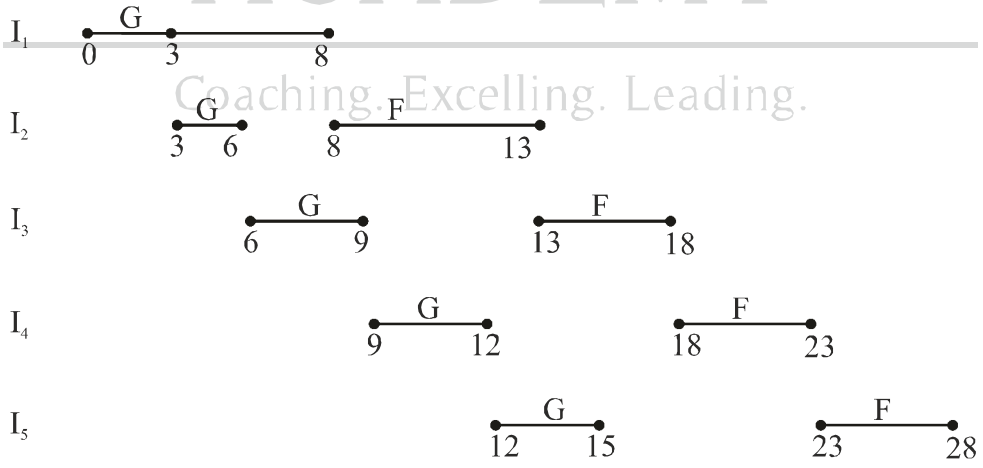
30. F(G (Xi)) for 1 < = *i* < = 10

F takes 5 ns

and G takes 3 ns

since there are two functional units μ_F and μ_G each of F and G, each unit can perform 5 instances each

We use pipelining to solve this problem in which multiple instances execution can be overlapped.



$\therefore$ Both functional units will complete their execution at 28 time units

28 is the answer

31.

opcode	Src Reg 1	Src Reg 2	Dest reg	Immediate value
4	6	6	6	12

64 registers $\lceil \log_2 64 \rceil$ = 6 bits for each register

Instruction size = 12

$\therefore$ opcode $\lceil \log_2 12 \rceil$ = 4 bits

Instruction format has = 4 + 6 + 6 + 6 + 12

= 34 bits

$= \frac{34}{8}$

= 4.25 bytes

But since memory is stored in a byte aligned fashion, so we will require 5 bytes for one instruction.

$\therefore$ for 100 instructions, we require

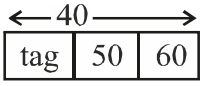
100 × 5 = 500 bytes

500 is the correct answer

32. P. A. = 40 bits

512 KB 8 way set associative cache

set associate memory format is



Let B.S be 2^x B

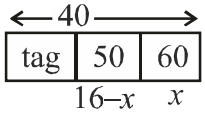
lines of cache = $\frac{512\,\text{kB}}{2^x\text{B}} = \frac{2^9 \cdot 2^{10}\text{B}}{2^x\text{B}}$

$= 2^{19-x}$

sets = $\frac{\#\text{lines}}{\text{n}-\text{way}}$

$= \frac{2^{19-x}}{8}$

$\therefore$ # sets = $2^{19-x-3} = 2^{16-x}$



$\therefore$ # tag bits = 40 – (16 – x + x)

= 24

24 is the correct answer.

33. Frequency = 3GHz

$\therefore$ cycle time = $\frac{1}{3\times10^9}$ sec = 0.33 nsec

T1 = $\frac{3T_2}{4}$ = 2T3

Let $T_3 = x$

$\therefore$ $T_1 = 2x$

$\therefore$ $T_2 = \frac{2x\times4}{3} = \frac{8x}{3}$

T_1	T_2	T_3
$2x$	$\frac{8x}{3}$	x

$\therefore$ T_2 is the longest pipeline stage.

For pipeline P,

T_1	T_2	T_3
$2x$	$\frac{8x}{3}$	x
	$\frac{4x}{3}$ $\quad$ $\frac{4x}{3}$	

max stage delay (t_p) = $\frac{8}{3}x$

for pipeline P1

max stage delay (tp^1) = 2x

Given CT of P_1 = $\frac{1}{3}\times10^{-9}$ n sec

$\frac{8}{3}x = \frac{1}{3}\times10^{-9}$ n sec

$\therefore$ CT of $P^1 = 2x = 2 \times \frac{1}{8} \times 10^{-9}$ n sec

$= 0.25$ n sec

$\therefore$ Frequency of $P^1 = \frac{1}{\text{cycle time}}$

$= \frac{1}{0.25 \times 10^{-9} \text{ sec}}$

$= 4 \times 10^9$ Hz $= 4$ GHz

4 is the answer

34. A property of min heap is that

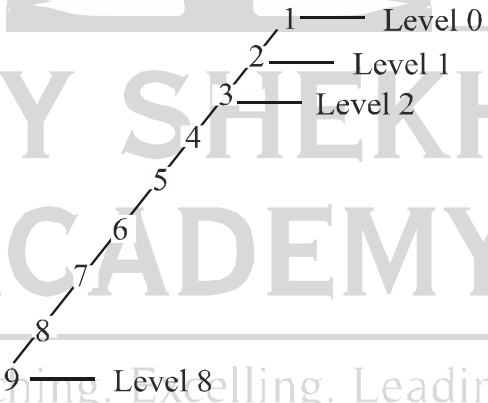
Every parent $\leq$ children

Similarly for max heap

Every parent $\geq$ children

For [1, 1023] we are constructing min heap

Take 1 as root



$\therefore$ 9 can be found at level 8 maximum

$\therefore$ 8 is the answer

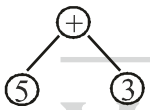
35.

Let x = 4	y = 3	
res = 1	b! = 0 true	b! = 0 True
a = 4	∴ b%2 = 2%2 = 0	b%2 = 1%2 = 1
b = 3	a = a × a	res = res × a
b%2 = 3%2 = 1	a = 4 × 4 = 16	= 4 × 16
∴ res = res × 4	a = 16	res = 64
= 1 × 4	b = b/2 = 2/2	b = b – 1
res = 4	∴ b = 1	b = 0
b = b – 1		b = 0 ∴ stop
b = 2	res = 4	
x^y = res × a^b	x^y = res × a^b	x^y = res × a^b
$4^3 = 4 \times 4^2$	$4^3 = 4 \times 16^1$	$4^3 = 64 \times 4^0$
True	True	True

∴ (C) is the answer

363. Consider the expression 5 + 3

Tree would be



using new order, + 35

Infix notation : 5 + 3

Prefix notation : +53

Postfix notation : 53+

If we observe closely, the new order is the reverse of postfix notation (i.e. reverse polish notation)

∴ New order of the given expression is the reverse of given expression which is

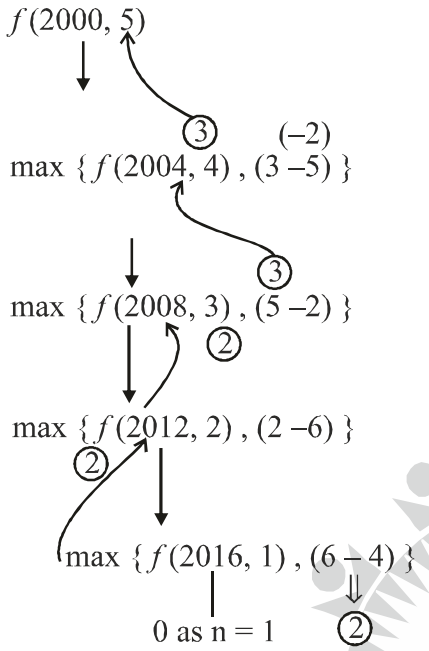
– + 1 × 76 ^ 2 – 5 × 4 3

∴ (C) is the answer

37. a [ ] =

0	1	2	3	4
3	5	2	6	4
2000	2004	2008	2012	2016

as integer takes 4 bytes



$\therefore$ 3 is the answer

38.

Matrices	dimension
A_1	10 × 5
A_2	5 × 20
A_3	20 × 10
A_4	10 × 5

M [i, j] = 0 ; if i = j

= min {M [i, k] + M [k + 1, j] + $P_{i-1} P_k P_j$}

$i \le k < j$

Time complexity = O (n^3)

Space complexity = O(n^2)

If we multiply two matrices $(M_1)_{P \times q}$ and $(M_2)_{q \times r}$

their cost is pqr

order of parenthesizing affects the cost

we have foll. ways in which it can be done

$((A_1 A_2) A_3) A_4$	$A_1 (A_2 (A_3 A_4)$
$(A_1 (A_2 A_3)) A_4$	$A_1 ((A_2 A_3) A_4)$
$(A_1 A_2) (A_3 A_4)$	$A_1 ((A_2 A_3) A_4)$

Out of which $A_1 ((A_2 A_3) A_4)$ will give minimum cost

$(A_2\ A_3)_{5 \times 10} = 5 \times 20 \times 10 = 1000$

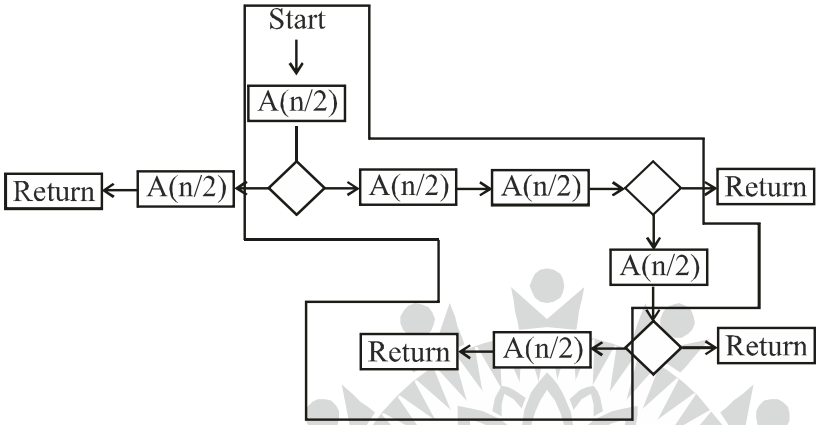
$((A_2\ A_3)\ A_4)_{5 \times 5} = 5 \times 10 \times 5 = 250$

$[A_1\ ((A_2\ A_3)\ A_4)]_{10 \times 5} = 5 \times 10 \times 5 = 250$

$\therefore$ Total cost = 1000 + 250 + 250

1500 is the answer

39.



For worst case T,C, we follow the above path,

$\therefore$ A(n) = 5A(n/2) + C

Using Master's Theorem

a = 5, b = 2, K = 0, P = 0

$b^k = 2^\circ = 1$

$\therefore$ $\boxed{a > b^k}$

$\therefore$ $T(n) = \theta\left(n^{\log_{b^a}}\right)$

$= \theta\left(n^{\log_{2^5}}\right)$

$= \theta(n^{2.32})$

$\therefore$ $\boxed{\propto = 2.32}$

40. To get height = 6, root should be either of 1 or 7

$\therefore$ 2 choices. Suppose we select 1

Now to get height = 5, root will again have 2 choices for that subtree

Repeat the above procedure until height = 1

$\therefore$ No. of trees = 2.2.2.2.2.2 = 2^6 = 64

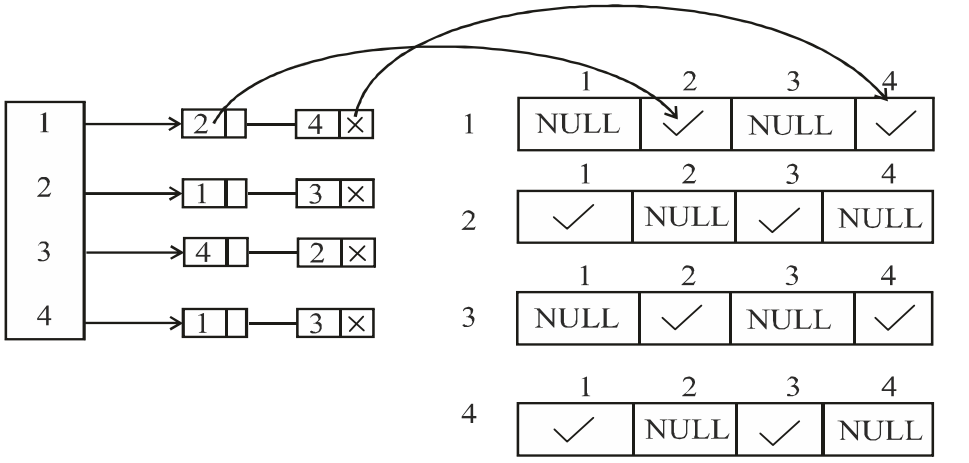
Recurrence relation can be thought of as

$T(n) = 2 \times T(n-1)$ $\quad n > 1$

$= 1$ $\quad n = 1$

n is no. of nodes forming the BST.

41.



Data structure for adjacent vertices

Adjacency List

We can run DFS and find out all twin pointers in O(E + V)

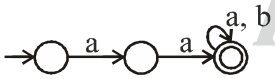
|E| = m and |V| = n

∴ T.C. = O(m + n)

∴ Option (B) is correct.

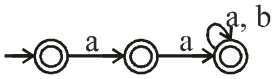
42. I is false

Consider the NFA



It accepts string starting with aa over $\sum = \{a, b\}$

If we make all states as final states



∴ L(NFA) {ε, a, aa, aaa, aab .....}

which is not (a + b)*

∴ I is false

Cosider statement II :

Let A be a language such that L(A) = {ε}

∴ A is regular

Let B be any language. If B contains ε, then L(A ∩ B) = ε which is regular

Also if B doesn't contain ε then, $L(A \cap B) = \phi$ which is also regular

$\therefore$ II is true

(B) is the correct choice

43. $L_1 = \{a^n b^m c^{n+m}; m, n \geq 1\}$

It is a CFL, as there is a relation between any two of a, b and c

$\therefore$ only one stack is required.

$L_2 = \{a^n b^n c^{2n}; n \geq 1\}$

It is a CSL as there is a relation between all 3 a, b and c

$\therefore$ Two stacks are required

(B) is the correct choice

44. L_1 and L_2 are recursive as they accept only those string which takes atleast and exactly 2016 steps on some input

whereas for L_3, it accept ε but we don't know if it halts or loops for other strings

$\therefore$ L_3 is not recursive but recursively enumerable

(C) is the correct choice

45. (A) has left recursion because of the production $A \rightarrow Aa$

(B) does not have any kind of left recursion

(C) has indirect left recursion

$S \rightarrow Aa$

$A \rightarrow Sc$

$\therefore S \rightarrow Sca$

(D) also has indirect left recursion due to the productions

$A \rightarrow Bd$

$B \rightarrow Ae$

$\therefore A \rightarrow Aed$

$\therefore$ (B) is the correct option

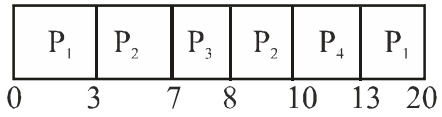
46. Both grammars G1 and G2 generate the given declaration int a[10] [3];

Using G1	Using G2
$D \rightarrow$ int L;	$D \rightarrow$ int L;
$\rightarrow$ int id [E;	$\rightarrow$ int id E;
$\rightarrow$ int id [num] [E;	$\rightarrow$ int id E [num];
$\rightarrow$ int id [num] [num];	$\rightarrow$ int id [num] [num];

$\therefore$ (A) is the correct option

47.

Process	A.T	B.T	C.T	TAT	WT
P1	0	10	20	20	10
P2	3	6	10	7	1
P3	7	1	8	1	0
P4	8	3	13	5	2
				33	13



Use TAT = CT – AT

WT = TAT – BT

$\therefore$ Avg WT = $\frac{13}{4}$ = 3.25 msec

Avg TAT = $\frac{33}{4}$ = 8.25 msec

$\therefore$ 8.25 is the correct answer

48. turn = 0

$\therefore$ P0 in CS, P1 stuck in while loop

P0 out of CS and turn = 1

$\therefore$ P1 in CS

$\therefore$ Mutual exclusion is satisfied

$\therefore$ B is false

To check progress, check if a process can enter a critical section immediately after it is out of critical section i.e.check possibility of entering in a critical section once again immediately.

$\therefore$ for turn = 1, P1 in CS

After excuting CS, P1 out of CS and turn = 0

$\therefore$ For turn = 0, P1 cannot enter CS again it is P0 who enters CS now

$\therefore$ Progress is not satisfied

Hence (C) is the correct option

49. Let initial value of the semaphore be 'X'

After 20 P(S) and 12 V(S) operations,

semaphore value is = X – 20 + 12

= X – 8

∴ After 8 V(S) operations, the eight processes which are blocked will be released.

∴ We want 1 process to be in blocked state

∴ X – 8 = –1

∴ X = 7

7 is the correct answer.

50. We want average read Latency to be < 6 msec

for cache size = 20 MB

avg read = 0.4(1) + 0.6(10) = 0.4 + 6

= 6.4 msec > 6 msec

For cache size = 30 MB

avg read = 0.4(10) + 0.6(1)

= 4 + 0.6 = 4.6 < 6 msec

For cache size = 40 MB

avg read = 0.65(1) + 0.35(10) = 0.65 + 3.5

= 4.15 msec < 6 msec

∴ Smallest cache size = 30 MB

30 is the correct answer

51.

T_1	T_2
	R(x)
R(x)	
	R(y)
W(x)	
R(y)	
	w(x)
a_1	
	a_2

No WR sequence

∴ Recoverable

Also no cascading aborts as both are aborted

∴ (c) is the correct option

52.

district-name	sum (capacity)
Ajmer	20 > = 25 ×
Bikaner	40 > = 25 ✓
Churu	30 > = 25 ✓
Dungargarh	10 > = 25 ×

$$\text{Avg capacity} = \frac{\text{Total capacity}}{\text{No. of districts}} = \frac{100}{4} = 25$$

Total. capacity > = Total avg. capacity

> = 25

∴ Bikaner and churu only 2 types will be returned by the SQL query

∴ 2 is the answer

53. BW = 20×10^6 bps

P_t = 40 μsec

For CSMA /CD,

$T_t \geq 2\ P_t$

$$\frac{L}{BW} \geq 2P_t$$

∴ $L \geq 2.P_t.\ BW$

$L \geq 2 \times 40 \times 10^{-6}$sec . 20×10^6 b psec

$L \geq 1600$ bits

∴ min frame size = $\frac{1600}{8}$ bytes = 200 bytes

54. I is true as three non overlapping channels are available for transmissions (channels 1, 6 and 11 which are 22 - 25 MHz)

II is false as RTS and CTS are used so that collisions do not happen and not for its detection

III is true. IEEE 802.11 WLAN uses half duplex communication.

∴ Unicast frames are ACKED

Option (B) is correct

55. BW = 128×10^3 bps

Pt = 150 msec

L = 1 kB

$$\% \text{ L(u)} = \frac{WS \times Tt}{Tt + 2Pt} \times 100$$

when L(u) = 100%

$$WS = \frac{Tt \times 2Pt}{Tt}$$

$$Tt = \frac{L}{BW} = \frac{1kB}{128 \times 10^3 bps} = \frac{8 \times 10^3 b}{128 \times 10^3 bps} = 62.5 \text{ msec}$$

$$\therefore \text{ WS} = \frac{62.5 \text{ msec}}{(62.5 + 300) \text{ msec}}$$

$$= \frac{62.5}{362.5}$$

$$\text{WS} = \frac{362.5}{62.5} = 5.8$$

$\therefore$ WS = 6

For selective repeat, WS = 2^{n-1}

$\therefore$ $2^{n-1} = 6$

$$\frac{2^n}{2} = 6$$

$\therefore$ $2^n = 12$

$\therefore$ $n = \log_2 \lceil 2.WS \rceil = \log_2 \lceil 12 \rceil = 4$

$\therefore$ 4 is the correct answer

GENRAL APTITUDE SECTION

1. (b) is the correct answer.

Security guard is a general term whereas university is specific here. Hence The university.

2. Put up with – cope up with

$\therefore$ only (A) is correct

3. mock, deride and jeer mean the same thing i.e. to laugh at, to shout at. praise is the opposite of all of these

   $\therefore$ (c) is the correct option

4. C A D B E J H K I L X V Y W Z

   3 1 4 2 5 3 1 4 2 5 3 1 4 2 5

   O N P M Q

   3 2 4 1 5 ($\therefore$ odd man out)

   (d) is the correct answer.

5. $\alpha \cdot \beta = 4$

   $\therefore \beta = \dfrac{4}{\alpha}$

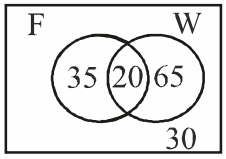
   $$= \frac{\alpha^n + \beta^n}{\frac{1}{\alpha^n} + \frac{1}{\beta^n}} = \frac{\alpha^n + \left(\frac{4}{\alpha}\right)^n}{\frac{1}{\alpha^n} + \left(\frac{4}{\alpha}\right)^n}$$

   $$= \frac{\alpha^n + \frac{4^n}{\alpha^n}}{\frac{1}{\alpha^n} + \frac{\alpha^n}{4^n}}$$

   $$= \frac{\left(\alpha^{2n} + 4^n\right)}{\alpha^n} \div \frac{\left(4^n + \alpha^{2n}\right)}{4^n \cdot \alpha^n}$$

   $$= \frac{\left(\alpha^{2n} + 4^n\right)}{\alpha^n} \times \frac{\alpha^n \cdot 4^n}{\left(4^n + \alpha^{2n}\right)} = 4^n$$

   $\therefore$ B is correct answer

6. 

   $\therefore$ n ($F \cup M$) = 150 – 30 = 120

   n(F) = 55

   n(w) = 85

   n ($F \cup W$) = n(F) + n (W) – n ($F \cap W$)

   120 = 55 + 85 – n($F \cap W$)

   $\therefore$ n ($F \cap W$) = 20

   $\therefore$ n(F) only = n(F) – n ($F \cap W$)

= 55 – 20

= 35

∴ (A) is the answer

7. (i) is not implied by the given paragraph

(ii) is also not implied

as the author says 'many believe that internet is an uninted consequence of original invention'

∴ (D) is the correct

8. $\left.\begin{array}{l}\text{All hill stations have a lake}\\ \text{ooty has 2 lakes}\end{array}\right]$ given

(i) ooty is not a hill station

Hill stations $\rightarrow$ lake

$\neg$ Hill station V lake

∴ Ooty may or may not be a hill station

(i) is not implied

(ii) No hill stations has more than one lake Hill stations may have more than one lake. Exactly one lake is not a complusion for a hill station.

∴ (D) is true.

9. There are 3 horizontal and 5 vertical lines.

To build a rectangle, we need 2 vertical and 2 horizontal lines

∴ No. of rectangles = $3C_2 \cdot 5C_2$

= 3 × 10

= 30

∴ (C) is the correct option

10. at $x = -1$, $f(x) = 0$

and at x = 0 , $f(x) = 1$

∴ $f(x) = 2 - |x - 1|$ Satisfies the above equations

∴ (C) is the correct option