

PRE-GATE-2020

Computer Science Engineering

(Questions with Detailed Solutions)

The GA section consists of 10 questions. Questions 1 to 5 are of 1 mark each, and Questions 6 to 10 are of 2 marks each.

- 01. Fill in the blank with an appropriate phrase
 - Jobs are hard to _____ these days
 - (A) Come by (B) Come down
 - (C) Come of (D) Come from
- 01. Ans: (A)
- Sol: 'Come by' means to manage to get something.
- 02. The question below consists of a pair of related words followed by four pairs of words. Select the pair that best expresses the relation in the original pair.

MONKEY : TROOP:

- (A) sheep : hard
- (B) elephant : Parliament
- (C) bacteria : Colony
- (D) wolves : School

02. Ans: (C)

- **Sol:** Troop consists of monkeys just as a colony consists of bacteria.
- 03. Choose the most appropriate word from the options given below to complete the following sentence:

If you had gone to see him, he ______delighted.

- (A) Would have been
- (B) Will have been
- (C) Had been
- (D) Would be
- 03. Ans: (A)
- Ans: 'A" conditional tense type 3 grammatical code is
 - If +had+V3, would +have+V3

04. Which of the following options is closest in meaning to the underlined word? European intellectuals have long debated

1995 the consequences of the <u>hegemony</u> of American popular culture around the world.

- (A) regimen
- (B) vastness
- (C) dominance
- (D) popularity
- 04. Ans: (C)
- **Sol:** Dominance means influence or control over another country, a group of people etc.

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- 05. How many one-rupee coins, 50 paise coins, 25 paise coins in total of which the numbers are proportional to 5, 7 and 12 are together work ₹115?
 - (A) 50, 70, 120
 - (B) 60, 70, 110
 - (C) 70, 80, 90
 - (D) None of these
- 05. Ans: (A)
- **Sol:** $(5 \times 1 + 7 \times 0.5 + 12 \times 0.25) = 115$
 - (5+3.5+3)x = 115
 - 11.5x = 115
 - x = 10
 - ... Number of one rupee coins

 $= 5x = 5 \times 10 = 50$

Number of 5-paise coins

 $= 7x = 7 \times 10 = 70$

Number of 25-paise coins

 $= 12x = 12 \times 10 = 120$

06. Critical reading is a demanding process. To read critically, you must slow down your reading and with pencil in hand, perform specific operations on the text, mark up the text with your reactions, conclusions, and questions, then you read, become an active participant.

This passage best supports the statement that

- (A) Critical reading is a slow, dull but essential process.
- (B) The best critical reading happens at critical times in a person's life.
- (C) Readers should get in the habit of questioning the truth of what they read.
- (D) Critical reading requires thoughtful and careful attention.

06. Ans: (D)

Sol: Choice (A) is incorrect because the author never says that reading is dull.

Choice (B) and (C) are not supported by the paragraph.

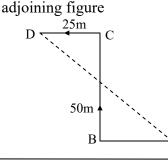
Choice (D) is correct as it is implied in the entire passage.

07. Anil's house faces east from the back-side of the house, he walks straight 50 metres, then turns to the right and walks 50m again finally, he turns towards left and stops after walking 25m. Now Anil is in which direction from the starting point?

(A) South-east	(B) South-west
(C) North-east	(D) North-west

07. Ans: (D)





:3:

He starts walking from back of his house (i.e) towards west now, the final position is D, which is to the north west of his starting point A.

08. A and B enter into a partnership, A puts in ₹50 and B puts in ₹45. At the end of 4 months, A withdraws half his capital and at the end of 5 months B withdraws $\frac{1}{2}$ of his, C then enters with a capital of ₹70 at the end of 12 months, the profit of concern is ₹254, how can the profit be divided among A, B and C? (A) ₹76, ₹80 and ₹98 (B) ₹80, ₹76 and ₹98 (C) ₹76, ₹98 and ₹80 Since (D) None of these 08. Ans: (B) B's share : C's share Sol: A's share: (50×4+25×8): (45×5+22.5×7) : (70×7) 400 : 382.5 : 490 800: 765 :980 160 : 153 : 196 Total profit = ₹254 Profit of A

 $=\frac{160}{160+153+196} \times 254 = \frac{160}{509} \times 254 = ₹80$

Profit of
$$B = \frac{153}{509} \times 254 = ₹76$$

Profit of $C = \frac{196}{509} \times 254 = ₹98$
 \therefore Hence option 'B' is correct.
09. A sum of ₹25400 was lent out in two parts,
one of 12% and the other at $12\frac{1}{2}$ % of the
total annual income is ₹3124.2, the money
lent at 12% is _____.
(A) ₹15240 (B) ₹25400
(C) ₹10160 (D) ₹31242
09. Ans: (C)
Sol: Overall rate of interest
 $\frac{3124.2}{25400} \times 100 = 12.3\%$
 1^{st} part 2^{st} part
 $12\frac{1}{2}\frac{1}{2}\%$
 $12\frac{1}{2}\frac{1}{2}\%$
 \therefore The sum will be divided in the ratio
 $0.2:0.3$ (or) 2:3
 \therefore The sum lent at $12\% = 25400 \times \frac{2}{5}$

=₹10160.



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10. The following question is to be answered on the basis of the table given below.

Category of personnel	Number of staff in the year-1990	Number of staff in the year-1995	
Data preparation	18	25	
Data control	5	8	
Operators	18	32	7
Programmers	21	36	
Analysts	15	31	
Managers	3	3, GIN	E
Total	80	135	

What is the increase in the sector angle for operators in the year 1995 over the sector angle for operators in the year 1990?

(A) 4° (B) 3° (C) 2° (D) 1°

10. Ans: (A)

- Sol: Sector angle for operators in the year 1990
 - $=\frac{18}{80} \times 360^\circ = 81^\circ$

Sector angle for operator in the year 1995

$$=\frac{32}{135}\times 360^\circ = 85.33 \simeq 85\%$$

- \therefore Required difference = $85^{\circ} 81^{\circ} = 4^{\circ}$
- 11. Which is the correct SQL command to display the loan numbers of the customers in ascending order of their loan amounts. Primary key is underlined in the schema. loan(loan_number, branch_name, amount)

- (A) SELECT loan_number FROM loan GROUP BY amount;
- (B) SELECT loan_number FROM loan SORT BY amount;
- (C) SELECT loan_number FROM loan ORDER BY amount ASCENDING;
- (D) SELECT loan_number FROM loan ORDER BY amount;
- 11. Ans: (D)
- Sol: The ORDER BY clause is used to sort list items in ascending order by default. We also use DSC or ASC to sort the values in descending or ascending order respectively.

Options (A) and (B) are incorrect since option (B) generates the error message, SQL command not properly ended since SORT BY is not valid for this.

Option (A) also generates error message, not a GROUP BY expression.

So options (A), (B) and (C) are incorrect.

12. Let L_1 , L_2 , L_3 be three languages $L_1 = \{a^n b^n c^m | m, n \ge 1\}$ $L_2 = \{a^n b^m c^m | m, n \ge 1\}$ $L_3 = \{a^n b^n c^n | n \ge 1\}$

Choose the correct answer

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12.	Ans: (D)	14.	Ans: (D)
Sol:	$L_1 = \{a^n b^n c^m \mid m, n \ge 1\}$	Sol:	$FIRST(S) = \{a, b\}$
	= {abc, abcc, aabbc,}		$FOLLOW(B) = \{b\}$
	$L_2 = \{a^n b^m c^m \mid m, n \ge 1\}$		$FOLLOW(S) = \{\$, b\}$
	= {abc, aabc, abbcc,}		
	$L_3 = \{a^n b^n c^n \mid n \ge 1\}$		$FOLLOW(A) = \{a\}$
	= {abc, aabbcc,}		
	$L_3 \subseteq L_1$ and $L_3 \subseteq L_2$	15.	In a system using simple segmentation, the
	No relation exist between L_1 and L_2		address space has 256 segments. Each
	INE	RING	segment is offsetted by 12 bits. The size of
13.	In Go-Back-N protocol, if the maximum		logical address in bits is
	window size is 256. What is the range of		(A) 20 bits (B) 8 bits
	sequence number?		(C) 18 bits (D) 28 bits
	(A) 0 to 257 (B) 1 to 257	15.	Ans: (A)
	(C) 0 to 256 (D) 1 to 256	Sol:	Each Segment is addressed by 8 bits.
13.	Ans:(C)		Segment Offset is 12 bits. Hence adding
Sol:	In GB-N, if maximum window size is N		them together the size of LA is 20 bits
	then we need N+1 sequence number i.e., 0		
	to N(0 to 256).		Which of the following is false in the case
	Sind	:e 1995	of a spanning Tree of a graph G?
14.	Consider the following Context-Free		(A) It is tree that spans G
	Grammar G = {{S,A,B},S,{a,b},P}		(B) It includes every vertex of the G
	where P is		(C) It is a subgraph of G
	$S \to AaBb$ $S \to Bb$		(D) It can be either cyclic (or) acyclic
	$S \rightarrow Bb$ $A \rightarrow \varepsilon \mid Sb$	16.	Ans: (D)
	$B \rightarrow \varepsilon$	Sol:	Each spanning Tree of a graph is subgraph
	Which of the following set does not		of the graph and it includes every vertex of
	contain 'b'?		graph. Spanning Tree is always acyclic
	(A) FIRST(S) (B) FOLLOW(B)		
	(C) FOLLOW(S) (D) FOLLOW(A)		

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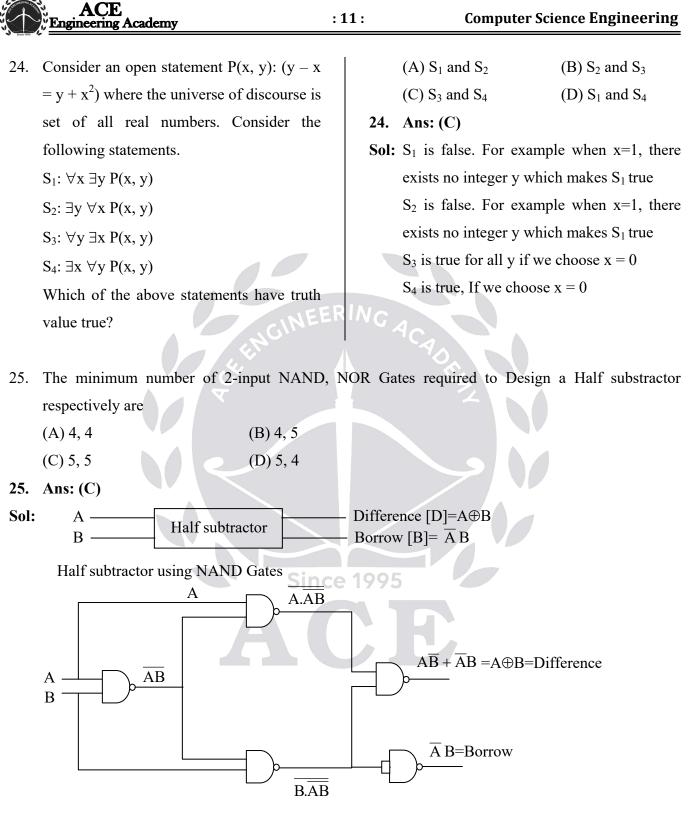
17. If
$$A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$$
 then
Which of the following is not true?
Sy: A has 3 distinct eigen values
Sy: A has 3 Linearly independent eigen
vectors
(A) S₁ is true and S₂ is false
(B) S₁ is false and S₂ is false
(C) Both S₁ and S₂ are true
(D) Neither S₁ nor S₂ is true
(C) Both S₁ and S₂ are true
(D) Neither S₁ nor S₂ is true
17. Ans: (B)
Sol: The characteristic equation is $|A-\lambda 1| = 0$
 $\Rightarrow \begin{vmatrix} 2-\lambda & 1 & 1 \\ 0 & 1-\lambda & 0 \\ 1 & 1 & 2-\lambda \end{vmatrix} = 0$
 $\Rightarrow \lambda = 1, 1, 3$
 \therefore S₁ is not true
For $\lambda = 1$, the eigen vectors are given by
 $(A - 1) X = 0$
 $\Rightarrow x + y + z = 8$
 \Rightarrow For $\lambda - 1$, we have two Linearly
independent eigen vectors
For $\lambda = 2$ there exists only index eigen
vector, because 2 is a distinct eigen value.
 \therefore S₂ is true
18. The simplified expression of
f(A, B) = [A \oplus B] © [A+B] represents

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19. Ans: (B)	21. Match List-I (types of cache misses) with
Sol: $\int_{0}^{\pi} \theta \sin^{4} \theta \cos^{4} \theta d\theta$	List-II (solution to reduce miss of specific
	type)
π	List-I List-II
$=\frac{\pi}{2}\int_{0}^{\pi}\sin^{4}\theta\cos^{4}\theta \ d\theta$	p. Conflict miss 1. Increase cache size
	q. Capacity miss 2. Increase block size
$\therefore \int_0^a x f(x) dx = \frac{a}{2} \int_0^a f(x) dx$	r. Compulsory miss 3. Increase associativity
	Codes
$=\pi\int_{0}^{\pi/2}\sin^{4}\theta\cos^{4}\theta d\theta$	p q r
	(A) 1 2 3
$\left[\because \int_0^{2a} f(x) dx = 2 \int_0^a f(x) dx \text{ if } f(2a-x) = f(x) \right]$	ING (B) 2 3 1
$\left[\int_{0}^{\infty} \int (x) dx - 2 \int_{0}^{\infty} \int (x) dx dy \int (2d - x) - \int (x) dx dy \right]$	(C) $3 - 2 = 1$
44	(D) 3 1 2
$=\pi \frac{(3.1)(3.1)}{8.6.4.2} \frac{\pi}{2}$ By Reduction formula	21. Ans: (D)
$3\pi^2$	22. 127.0.127.195 is a
$=\frac{3\pi^2}{256}$	(A) Limited Broadcast Address
	(B) Direct Broadcast Address
20. Choose the wrong statement	(C) Multicast Address
(A) the class of all formal languages is	(D) Loop Back Address
	22. Ans: (D)
	Sol: Any IP Address which have 1 st octet value
(B) the set of all primes is countably	as 127 is called as Loop Back Address.
infinite	
(C) the class of all DCFLs is countably	23. Which of the following is NOT a
infinite	necessary condition for deadlock in a
(D) the class of all regular languages is	multi-programmed O.S?
countably infinite	(A) Circular wait (B) Bounded wait
20. Ans: (A)	(C) Preemption (D) Both (B) and (C)
Sol: "Set of all formal languages" is	23. Ans: (D)
uncountable	Sol: Non-Preemption is a necessary condition
	Whereas Bounded Waiting is a
	requirement of CS Problem

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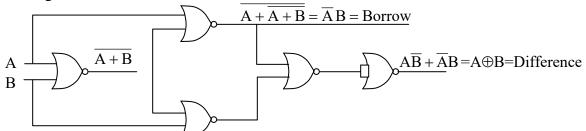
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Hence 5 NAND Gates are required



Using NOR:



Hence 5 NOR Gates are required

Conclusions

	Min Number of		
	NAND	NOR	
Half Adder	5	5	
Half Subtractor	.5	5	
Full Adder	v 9	9	
Full Subtractor	9	9	

- 26. Which of the following is **True** about Topological sort?
 - (A) Topological sort starts from a node which has maximum degree
 - (B) Topological sort starts from a node CO which has minimum degree
 - (C) Topological sort starts from a node which has any degree
 - (D) Topological sort starts from a node which has zero degree

26. Ans: (D)

- **Sol:** Topological sort start from a node which has zero degree. If we have multiple nodes with zero degree then we can start from any node whose degree is zero.
- 27. Consider the following schemas: employee (empid, deptid, empname, salary, address, phone no, date of joining) department (deptid, deptname, location, manager) Consider the following query on the above relation: SELECT empname, deptname FROM employee, department WHERE salary>10000 and location='Kolkata'; The optimized relational algebra for the given query will be which of the following? (A) $\Pi_{\text{empname,deptname}}(\sigma_{\text{location}='Kolkata' \land salary > 10000})$ (employee⊠department)) (B) $\Pi_{\text{empname,deptname}}((\sigma_{\text{salary}>10000}(\text{employee})) \bowtie$ department) (C) $\Pi_{\text{empname,deptname}}((\sigma_{\text{location='Kolkata}}(\Pi_{\text{empname,salary,}})))$ $_{deptid}(employee))) \bowtie (\sigma_{salary>10000}(\Pi_{deptname,dept}))$ id,location(department)))) (D) $\Pi_{\text{empname,deptname}}((\sigma_{\text{salary}>10000}(\Pi_{\text{empname,salary,dept}}))$ $_{id}(employee))) \bowtie (\sigma_{location='Kolkata'}(\Pi_{deptname,dep}))$

tid,location(department))))



27. Ans: (D)

- Sol: If we perform employee \bowtie department, then we obtain a relation with non-required attributes. Performing selection and projection early reduces size of relation to be joined. So, the attributes empname, salary, deptid from relation employee and attributes deptname, deptid, location from relation department are taken by projection operation first. Then the tuples from employee are selected using select operation where salary>10000. Similarly, tuples from relation department having location='Kolkata' are selected. Now join is performed between these reduced datasets and finally empname and deptname attributes are obtained by project operation. Hence option (D) is the correct option that follows the said process of optimization.
- 28. Consider the following statements.
 - S1: There exists a simple graph with 8 vertices with degree sequence {1, 1, 1, 2, 3, 4, 5, 7}

S₂: There are 15 people at a party and each person shook hands with exactly 3 others.Which of the above statements are true?

- (A) S_1 is true and S_2 is false
- (B) S_1 is false and S_2 is true
- (C) Both S_1 and S_2 are true
- (D) Both S_1 and S_2 are false

28. Ans: (D)

- Sol: S_1 : Let us denote the vertices by a, b, c, d,
 - e, f, g, h so that
 - deg(a) =1, deg(b) =1, deg(c)=1, deg(d)= 2, deg(e) = 3, deg(f)=4, deg(g)= 5, deg(h) = 7 Since deg(h)=7, h is adjacent to all of other vertices.

 \therefore Vertex g cannot be adjacent to only of the vertices a, b and c.

 $\therefore deg(g)$ cannot be 5

 \therefore S₁ is false

 S_2 : Let each person represent a vertex in a graph. If two persons shake hands then we draw an edge between the corresponding vertices. Now, there would be a graph with 15vertices and degree of each vertex 3.

By sum of degree theorem, such a graph does not exist.

 \therefore S₂ is false.

- 29. The 7's and 8's complement of [3 0 5 7 0 0]₈ respectively are
 (A) 472077, 472101
 (B) 472000, 472100
 (C) 472077, 472100
 (D) 472077, 472000
- 29. Ans: (C)
- **Sol:** Given number \Rightarrow N = [3 0 5 7 0 0]₈

Here radix = r = 8

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For 7's [r–1] complement subtract each bit	Step1: Assume that Base address of arra
of a given number from 7[r–1]	is 100 and integer occupies '2' bytes
77777	Array name always holds base address of
$N = 3 \ 0 \ 5 \ 7 \ 0 \ 0$	array
7's complement of N = 472077	Step2: $P = a+5$ means
For 8's [r] complement, write zero bits as	$P = 100 + (5 \times 2)$
it is then subtract 1 st Non zero LSB bit	P = 110
from 8[r] and remaining bits from 7[r-1]	Now 'P' is pointing to the address 110
7778	Step3: Now P[-2] value is 40
$N = 3 \ 0 \ 5 \ 7 \ 0 \ 0$	and 3[a] value is 40
NORME	so the result of $P[-2] + 3[a]$
as it is 8's complement of N = 472100	=40+40=80
	3
0. void main()	31. Let $S = Set$ of all +ve integers. The
s	smallest positive integer m such that an
int $a[10] = \{10, 20, 30, 40, 50, 60, 70,$	subset of S with m elements contain atleas
$\{10, 20, 30, 40, 50, 00, 70, 80, 90, 100\}$	3 elements x, y and z which leaves sam
int *P;	remainder upon division by 1
P = a+5;	is .
r = a + 3, printf("%d", P[-2]+3[a]); Sin	ce 131.5Ans: 21
$p_{1}m_{1}(700, 1[-2]+5[a]),$	Sol: Let us apply pigeonhole principle. If w
} The output of the should program	divide only +ve integer with 10 th
The output of the above program	possible remainders are $\{0, 1, 2, \dots, 9\}$
	Number of pigeonholes = 10 (= n say)
0. Ans: 80	The minimum number of pigeons require
Sol:	to ensure that atleast k+1 pigeons belong t
0 1 2 3 4 5 6 7 8	9 same pigeonhole = kn+1 where k+1 =
a 1 2 3 4 5 6 7 8 9 1	$\begin{array}{c} 0 \\ \hline \end{array} \\ and n = 10 \end{array}$
100 102 104 106 108 110 112 114 116	
	m = 21









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- 32. Assume that for a certain processor a read request takes 16 nanoseconds as average memory access time. A read request which causes cache hit, takes 10nsec and a read request which causes cache miss, takes 50nsec. The cache miss ratio (in percentage) is _____.
- 32. Ans: 15
- Sol: Assume hit ratio is h

Hence
$$16 = h*10+(1-h)*50$$

h = 0.85

miss ratio = $(1-h) = 1-0.85 = 0.15 \implies 15\%$

- 33. In the expansion of $(v + w + x + y + z)^{16}$. The coefficient of wxy¹³z is_____.
- 33. Ans: 3360
- Sol: Multinomial theorem:

For positive integers n and t, the coefficient of $x_1^{n_1}.x_l^{n_2}....x_t^{n_t}$ in the expansion of

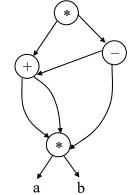
$$(x_1 + x_2 + \dots + x_t)^n$$
 is $\frac{n!}{n_1! \cdot n_2! \cdot n_t!}$

where each n_i is an integer with $0 \le n_i \le n$ for all $1 \le i \le t$ and $n_1 + n_2 + \dots + n_t = n$ By multinomial theorem, the coefficient of

$$v^{0} w^{1} x^{1} y^{13} z^{1} = \frac{\angle 16}{\angle 0. \angle 1. \angle 1. \angle 13. \angle 1}$$

= (14).(15).(16)=3360

34. Consider the following DAG



The minimum number of variables required in equivalent 3-Address code for the above DAG is _____.

34. Ans: 2

$$b = a + a$$
$$a = b - a$$
$$a = b * a$$

Minimum 2 variables are required to represent 3AC for given DAG.

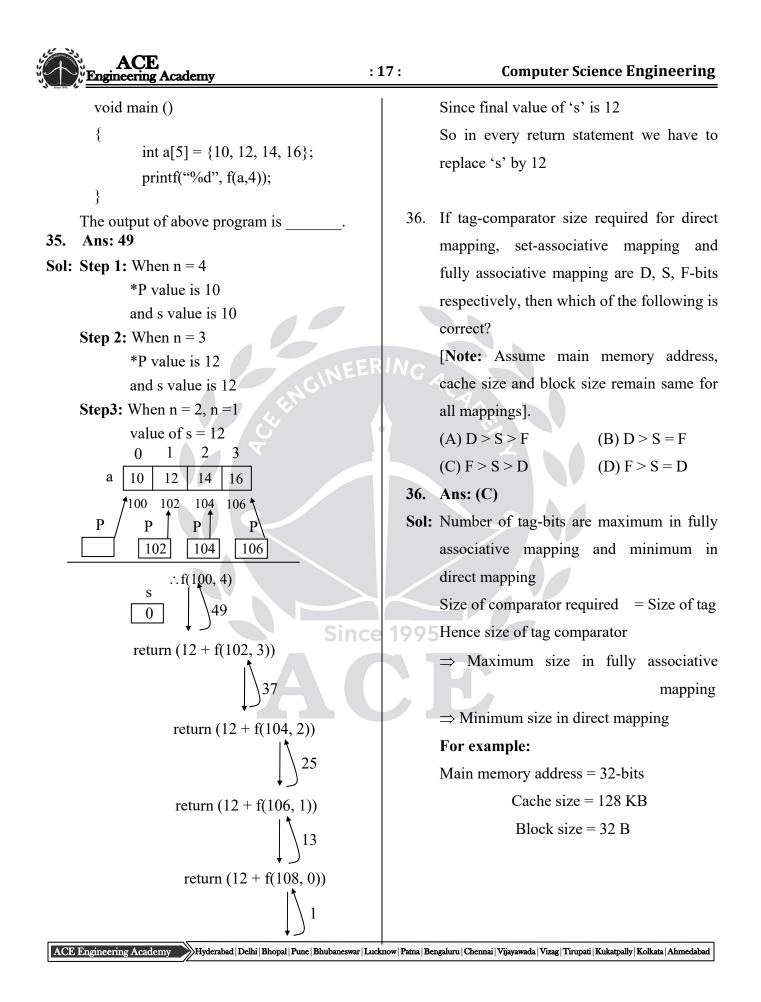
if (n < = 0)

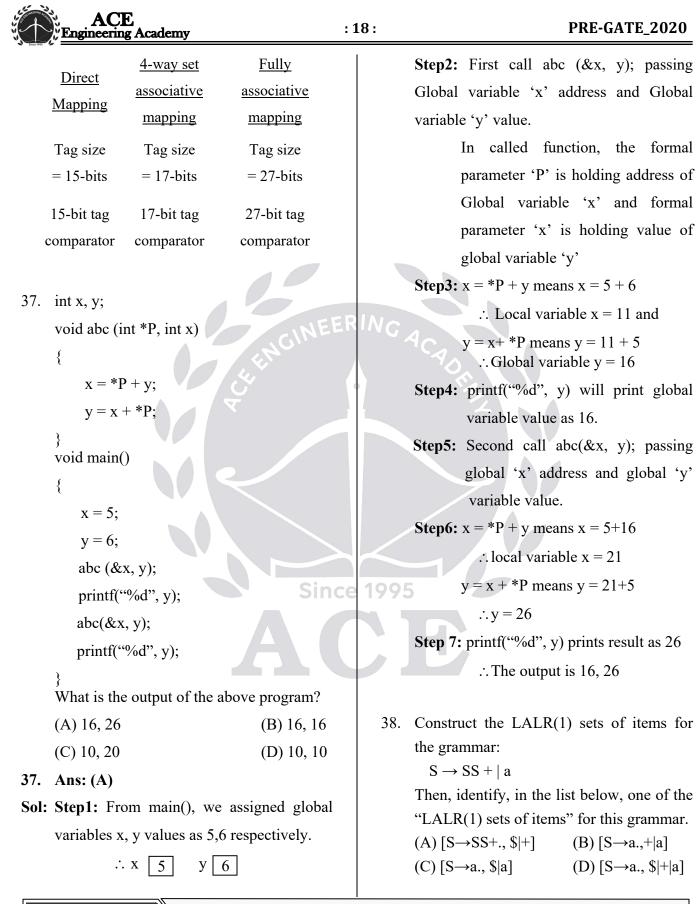
return 1;

if
$$(n \ge 3)$$

{
 $s = *P;$

return(s + f(P+1, n-1));





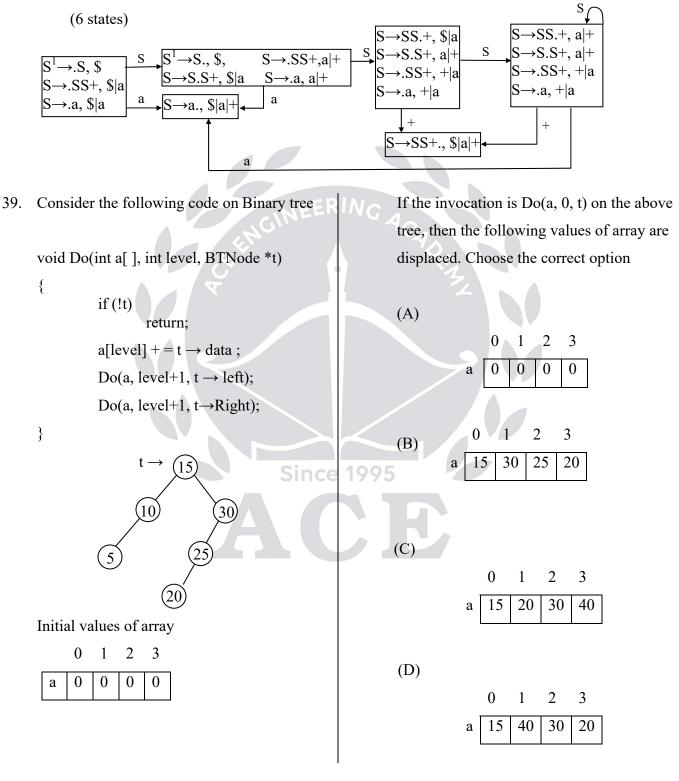
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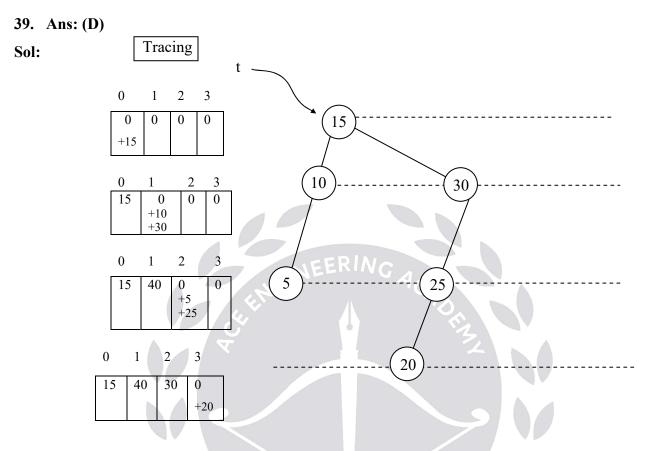


38. Ans: (D)

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Sol: Total 6 LALR(1) sets of items are present





- 40. Two computers A & B are configured as follows A has IP Address 200.197.17.157 and net mask 255.255.128.0. B has IP address 200.192.192.201 and Net mask 255.255.192.0. Which one of the following statement is True?
 - (A) A and B both assume they are on same network.
 - (B) B assume A is on same network but A assume B is on different network.
 - (C) A assume B is on same network, B assume A is on different network.
 - (D) A and B both assume they are on different network

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40. Ans: (D)

Sol:

Sol:	В
IP _A : 200.197.17.157	IP _B : 200.192.192.201
SM _A : 255.255.128.0	SM _B : 255.255.192.0
IP_A : 200.197.17.157	IP _B : 200.192.192.201
AND AND	AND AND
\underline{SM}_{A} : 255.255.128. 0	\underline{SM}_{B} : 255.255.192.0
$NID_{AA} = 200.197.0.0$	$NID_{BB} = 200.192.192.0$
IP _B : 200.192.192.201	IP_A : 200.197.17.157
AND AND SINE T	RIN AND AND
\underline{SM}_{A} : <u>255.255.128.0</u>	<u>SM</u> _B : <u>255.255.192.0</u>
$NID_{BA} = 200.192.128.0$	$NID_{AB} = 200.192.0.0$
$\mathrm{NID}_{\mathrm{AA}} eq \mathrm{NID}_{\mathrm{BA}}$	$NID_{BB} \neq NID_{AB}$
A assumes B is on the different	B assumes A is on the different
network	network
41. int f(int n)	(C) $f\left(\frac{n}{2}\right) + 1$ (D) $f(n-1) + n$
if(n = = 0)	41. Ans: (D)
return 1; Since	Sol: Let $f(n) = maximum$ number of pieces of
else	cake made by 'n' straight cuts.
return ();	In order to get maximum number of pieces
	of cake, the n^{th} straight cut must intersect
f f the return value is maximum number of	remaining $(n-1)$ straight cuts at $(n-1)$ distinct points, so that the n th straight cut
pieces of cake made by 'n' straight cuts	will add extra 'n' pieces to the number of
then which of the following is suitable	pieces obtained upto $(n - 1)$ cuts.
statement in the blank provided in the	$\therefore \mathbf{f}(\mathbf{n}) = \mathbf{f}(\mathbf{n}-1) + \mathbf{n}$
above program?	Ex: $n = 1$ $n = 2$ $n = 3$
(A) $f(n-1)+1$ (B) $f\left(\frac{n}{2}\right)+n$	$\square \square $
(1) (2)	f(n) = 2 $f(n) = 4$ $f(n) = 7$
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Exam Date : 23rd February 2020

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Duration : 90 Min.

No. of Questions: **50** (1M:25, 2M:25)

Marks : **75**

Streams : EC | EE | ME | CE | CSIT | IN | PI

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Engg. Mathematics : 20 Q

Numerical Ability : 20 Q

Verbal Ability : 10 Q

Syllabus for 3rd/4th Year & Passed-out Students - Technical Paper									
EEE		ECE / IN CS		CS & IT	& IT CE			ME / PI	
Subject	No. of Questions	Subject	No. of Questions	Subject	No. of Questions	Subject	No. of Questions	Subject	No. of Questions
Networks	5 Q	Networks	6 Q	DS,PL& Algorithm	10 Q	SOM	5 Q	SOM	6 Q
Control System	5 Q	Control System	6 Q	DBMS	5 Q	FM & HM	5 Q	FM & HM	5 Q
Analog Electronics	4 Q	Analog Electronics	5 Q	Computer Networks	5 Q	Geo Technical Engg.	7 Q	ТОМ	6 Q
Digital Electronics	5 Q	Digital Electronics	5 Q	Operating System	6 Q	Environmental	7 Q	Machine Design	4 Q
Electrical Machines	8 Q	Signal & Systems	5 Q	Computer Organization	4 Q	Transportation	4 Q	Thermal	7 Q
Power System	7 Q	EDC & VLSI	5 Q	Theory of Computation	6 Q	RCC& STEEL	6 Q	Heat Mass Transfer	4 Q
Power Electronics	6 Q	Communications	8 Q	Digital Electronics	4 Q	Surveying	6 Q	Production	8 Q
Engg. Maths	5 Q	Engg. Maths	5 Q	Engg. Maths	5 Q	Engg. Maths	5 Q	Engg. Maths	5 Q
Numerical / Verbal Ability	5 Q	Numerical / Verbal Ability	5 Q	Numerical / Verbal Ability	5 Q	Numerical / Verbal Ability	5 Q	Numerical / Verbal Ability	5 Q

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42. The probability that a process spends its time in performing I/O operations is 'P'. In a multi programmed O.S environment, if there are 'n' processes in memory at once, then the probability that all processes are waiting for I/O & the systems utilization is respectively

(B) P^{n} , 1– P^{n}

(D) $1/P^n$, $1-P^n$

- (A) $1/P, P^n$
- (C) P, P^n
- 42. Ans: (B)
- Sol: The probability that all processes goes for I/O is P*P*..*P for n processes i.e Pⁿ
 Hence the Probability of CPU Utilization will be 1–Pⁿ
- 43. Consider the following schedule R1(A), W1(A), R2(A), W2(A), R1(B), W1(B), C1, R2(B), W2(B), C2
 (i) Schedule is conflict serializable
 (ii) Schedule is recoverable
 (iii) Schedule is Cascade less
 (A) (i) only
 (B) (i) and (ii) only
 - (C) (ii) and (iii) only
 - (D) (i), (ii), and (iii)

43. Ans: (B)

Sol: The precedence graph for the schedule do not have cycles and the schedule is conflict serializable.

T2 reads the value written by T1 and is committing after T1 then the schedule is recoverable and also cascading rollbacks possible, if T1 fails just before it commits need to rollback both T1 and T2.

- 44. Match the following:
 - **OSI** Layer
 - 1. Network Layer
 - 2. Transport Layer
 - 3. Data Link layer
 - 4. Session Layer
 - 5. Physical Layer

Responsibility

- P. Transmission mode Q. Feed back Message
- R. Segmentation & Reassembly
- S. Dialog Control
- T. Access Control

Cod	les				
	1	2	3	4	5
(A)	Q	Р	Т	S	R
(B)	Q	R	Т	S	Р
(C)	Q	R	Т	Р	S
(D)	Q	R	Р	Т	S

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44. Ans:(B)

- Sol: 1. Network Layer is responsible for feedback message
 - 2. Transport Layer is responsible for segmentation & reassembly
 - 3. Data Link Layer is responsible for access control
 - 4. Session Layer is responsible for dialog control
 - Physical layer is responsible for transmission mode i.e. Simplex, Half duplex or Full duplex.

```
45. int x = 2;
```

void f(int y)

```
static int a = 5:
```

```
int b = 6;
```

x = a + b + b

a = a + x;

printf("%d%d", x, a);

}___

void main ()

```
{
```

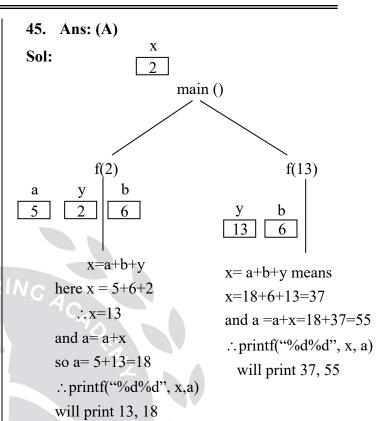
f(x);

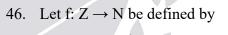
f(x);

}

What is the output of the above program?

(A) 13, 18, 37, 55	(B) 13, 18, 24, 29
(C) 13, 18, 13, 18	(D) 13, 18





$$F(\mathbf{x}) = \begin{cases} 2\mathbf{x} - 1, & \text{if } \mathbf{x} > 0\\ -2\mathbf{x}, & \text{for } \mathbf{x} \le 0 \end{cases}$$

Which of the following is true?
(A) f is 1–1 but not on-to
(B) f is on-to but not 1–1
(C) f is a bijection

(D) f is neither 1–1 nor on-to

46. Ans: (C)

Sol: Let $x_1, x_2 \in Z$ and $f(x_1) = f(x_2)$. Then with $f(x_1)$ and $f(x_2)$ are both even or both odd.

Case1: If both are even

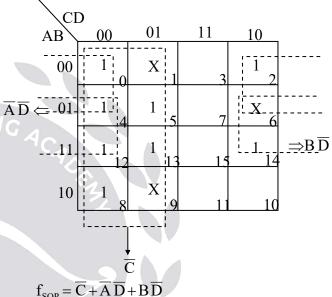
then $f(x_1) = f(x_2)$ $\Rightarrow -2x_1 = -2x_2$ $\Rightarrow x_1 = x_2$

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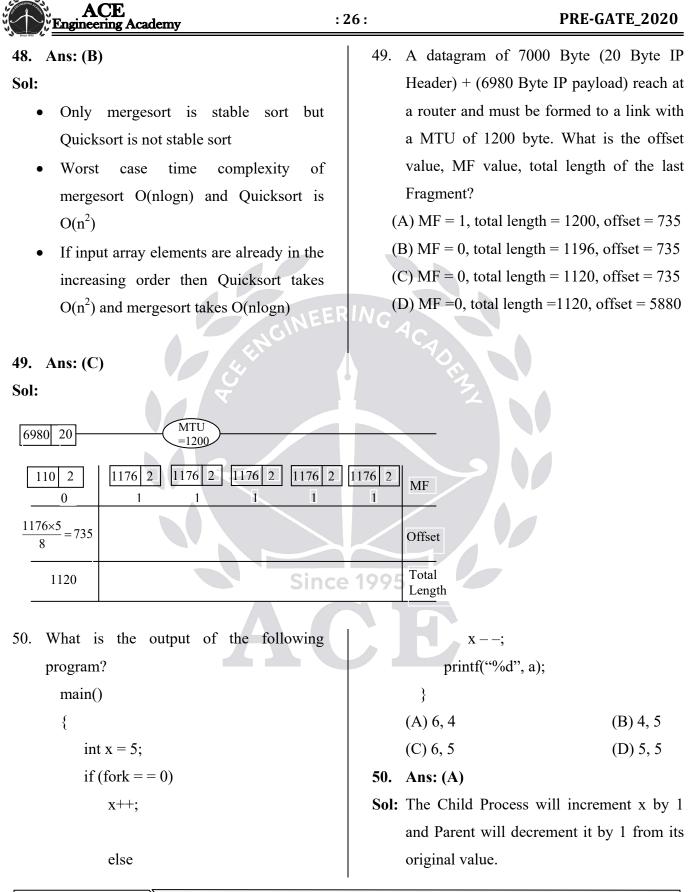
Case2: If both are odd then $f(x_1) = f(x_2)$ $\Rightarrow 2x_1 - 1 = 2x_2 - 1$ $\Rightarrow x_1 = x_2$ \therefore f is 1–1 To prove f is on-to function Let $n \in N$ **Case1:** If n is even, then $\frac{-n}{2} \in \mathbb{Z}$ and $\left(\frac{-n}{2}\right) < 0$ and $f\left(\frac{-n}{2}\right) = -2\left(\frac{-n}{2}\right) = n$ **Case 2:** If n is odd then $\frac{n+1}{2} \in \mathbb{Z}$ and $\left(\frac{n+1}{2}\right) > 0$ and $f\left(\frac{n+1}{2}\right) = 2\left(\frac{n+1}{2}\right) - 1 = n$ \therefore f is on-to. Since 47. Consider the following Boolean function $f(A,B,C,D) = \prod M [3,7,10,11,15] + d$ [1,6,9] Here M = Max terms; d = don't cares The simplified expression of "f " in SOP form is (A) $\overline{C} + \overline{A}\overline{D} + \overline{B}\overline{D}$ (B) $\overline{C} + \overline{A}\overline{D} + \overline{B}\overline{D}$ (C) $\overline{C} + A\overline{D} + B\overline{D}$ (D) $\overline{C} + \overline{A}D + \overline{B}\overline{D}$ 47. Ans. (B)

Sol: Given $f_{SPOS}(A,B,C,D) =$ $\prod M [3,7,10,11,15] + d [1,6,9]$ $f_{SSOP}(A,B,C,D) =$ $\sum m [0,2,4,5,8,12,13,14] + d [1,6,9]$

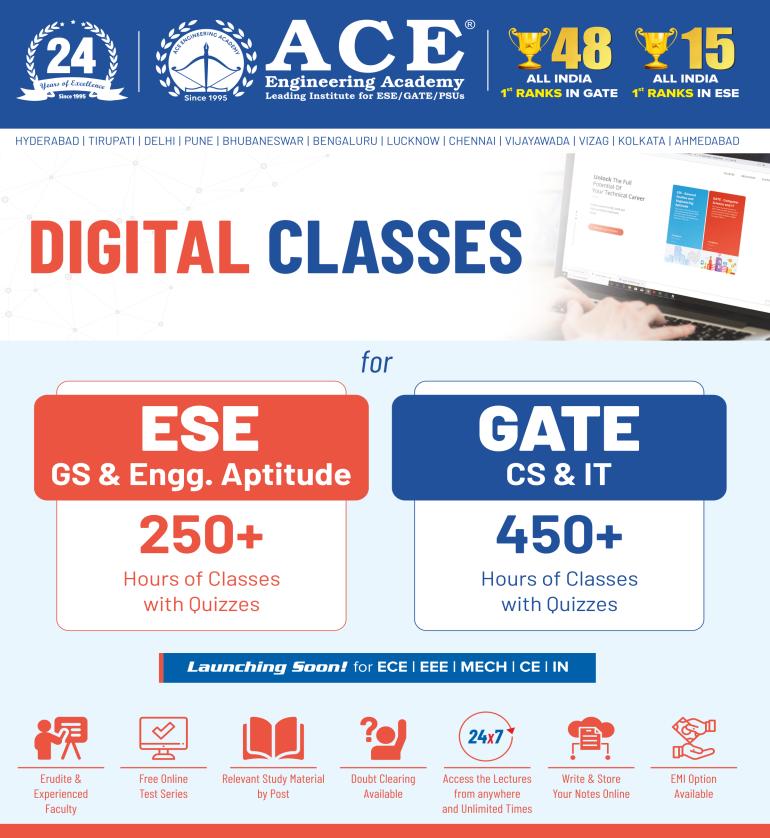


- Which of the following is True about 48. sorting algorithms ?
- 1995I. Merge sort, Quick sort are stable sorting algorithms
 - II. Worst case Time complexity of mergesort is O(nlogn) and Quicksort has worst case time complexity $O(n^2)$
 - III. If the input array elements are already in the increasing order then Mergesort takes O(nlogn) and Quicksort takes $O(n^2)$ time for sorting that array elements
 - (A) only I, II (B) only II, III (C) only I, III (D) I, II and III

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 - 51. Consider the following sequence of actions:

r1(A); r2(B); w1(C); w3(B); r3(C); w2(B); w3(A);

Assume that the read and writetimestamps of A, B, and C are each 0 prior to execution of these actions. For which initial timestamps of the transactions T1, T2 and T3 will no transaction abort, using time stamping protocol with Thomas write rule?

(A) T S(T1) =100; T S(T2) = 300; T S(T3) = 200
(B) T S(T1) =300; T S(T2) = 200; T S(T3) = 100
(C) T S(T1) =100; T S(T2) = 200; T S(T3) = 300
(D) None of the above

51. Ans: (C)

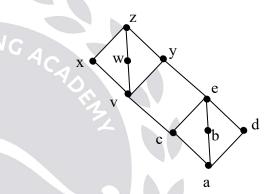
Sol: Thomas Write Rule does not enforce *Conflict Serializablity* but rejects fewer Write Operations by modifying the check Operations for W_item(X)

1. If $\mathbf{R}_T \mathbf{S}(\mathbf{X}) > \mathbf{TS}(\mathbf{T})$, then abort and rollback T and reject the operation.

2. If $W_TS(X) > TS(T)$, then don't execute the Write Operation and continue processing.

This is a case of *Outdated or Obsolete Writes*. Remember, outdated writes are ignored in Thomas Write Rule but a Transaction following Basic TO protocol will abort such a Transaction. 3. If neither the condition in 1 or 2 occurs,then and only then execute the W_item(X)operation of T and set W_TS(X) toTS(T)

52. For A = {a, b, c, d, e, v, w, x, y, z}, consider the poset [A;R] Whose hasse diagram is shown below



Which of the following is not true?

- (A) Complement of b = x
- (B) Complement of d = x
- (C) Complement of c = y

(D) Complement of b = w

52. Ans: (C)

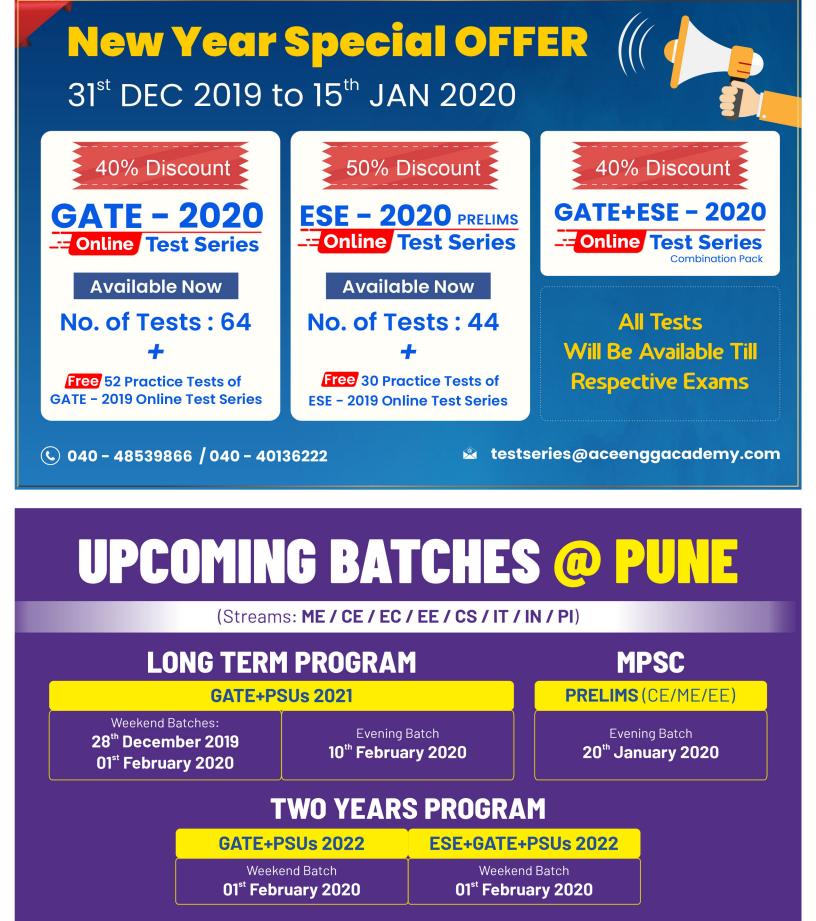
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Sol: The given poset is a lattice, with upper bound z and lower bound a.
(A) lub of b and x = z
glb of b and x = a

 \therefore complement of b = x

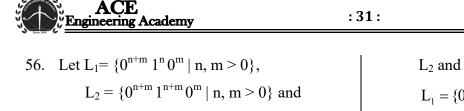
(B) lub of d and x = zglb of d and x = a \therefore complement of d = x

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(C) c is related to y	(C) S→SaS b
\Rightarrow lub of c and y = y (not z)	(D) S→SS ε
\therefore y is not a complement of c	54. Ans: (C)
(D) lub of b and $w = z$	Sol: Operator grammar "should not have any
glb of b and $w = a$	production which contain 2 consecutiv
\therefore complement of b = w	non terminals" and also "should not hav
	null productions in it".
53. Consider $f(n) = 3^{\sqrt{n} \log_3 n}$, $g(n) = 2n^{\sqrt{n}}$	S→SaS b is operator grammar
h(n) = n!	
which of the following is True?	EER 55. Consider the languages
(A) $h(n) = O(f(n))$ (B) $h(n) = O(g(n))$	(n)) (i) $\{a^{n^2} \mid n \le 20\}$
(C) $f(n)$ is not $O(g(n))$ (D) $f(n) = O(g(n))$	n)) (ii) $\{a^{n^2} \mid n \ge 20\}$
53. Ans: (D)	(iii) $\{a^n n \text{ is prime} \le 2^{10}\}$
Sol: If $\lim_{n \to \infty} \frac{f(n)}{g(n)} \le c \ [\exists a \text{ finite } c > 0] \text{ then}$	(iv) {w $\in (0+1)^* n_{10}(w) = n_{01}(w)$ }
	Which of the above languages are not
$\mathbf{f}(\mathbf{n}) = \mathbf{O}(\mathbf{g}(\mathbf{n}))$	regular?
Now we have $f(n) = 3^{\sqrt{n} \log_3 n}$	(A) Only (i)
$=3^{\log_3 n^{\sqrt{n}}}$	(B) (ii) & (iv)
$= n^{\sqrt{n}} \qquad [\because a^{\log^{b}}_{a} \cong b] \qquad $	ince 1995 ^(C) (iii) & (iv)
	(D) Only (ii)
Now $\lim_{n \to \infty} \frac{f(n)}{g(n)} = \lim_{n \to \infty} \frac{n^{\sqrt{n}}}{2n^{\sqrt{n}}} = \frac{1}{2} \le c$ for so	ome 55. Ans: (D)
finite $c > 0$	Sol: (i) $\{a^{n^2} n \le 20\}$ is finite language, so
$\therefore f(n) = O(g(n))$	regular
Since $f(n) = g(n) \le h(n)$	(ii) $\{a^{n^2} n \ge 20\}$ is infinite language and
So we have $f(n) = O(g(n))$, $g(n) = O(f(n))$	
and $f(n) = O(h(n)); g(n) = O(h(n))$	(iii) $\{a^n \mid n \text{ is prime } \leq 2^{10}\}$ is finit
54. Identify operator grammar.	language
(A) S→SS a	(iv) {w \in (0+1)* n_{01} (w) = n_{10} (w)} i
(A) $S \rightarrow SaS a$ (B) $S \rightarrow SaS a$	$(1v) \{w \in (0+1) \mid n_{01}(w) - n_{10}(w)\} $ regular language
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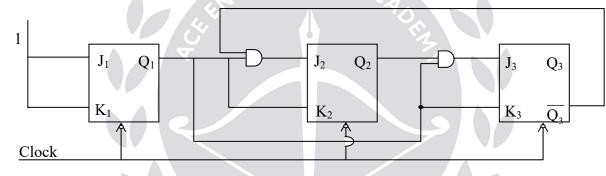
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 $L_3 = \{0^{n+m} \, 1^{n+m} \, 0^{n+m} \mid n, \, m \geq 0\}$ Which of these languages are NOT context free?

- $(A) L_1, L_2 \text{ only } (B) L_1, L_3 \text{ only }$
- $(C) L_2, L_3 only (D) L_3 only$
- 56. Ans: (C)
- Sol: L₁ is CFL
- 57. Consider the following Sequential circuit

L₂ and L₃ are not CFLs L₁ = { $0^{n+m} 1^n 0^m | n, m > 0$ } is DCFL, so CFL. $\downarrow \downarrow \downarrow \downarrow$ Push Pop Pop 0's 0's 0'sL₂ = { $0^{n+m} 1^{n+m} 0^m | n, m > 0$ } = { $0^i 1^i 0^j | i >$ j, i, j>0} is not CFL L₃ = { $0^{n+m} 1^{n+m} 0^{n+m} | n, m > 0$ } = { $0^k 1^k 0^k |$ k>1} is not CFL



Assume initially $Q_1 Q_2 Q_3 = 000$ then Modulus of the above counter is //

Since

57. Ans: 6

Sol: JK Flip-Flop Table

	1	. 1			
	J	K	Q _{n+1}		
	0	0	Qn		
	0	1	0		
	1	0	1		
	1	1	$\overline{Q_n}$		
Fr	om t	he circui	it		1
J_1	=1;	J ₂ =	$Q_1 \overline{Q_3};$	J ₃ =	$= Q_2 Q_1$
K	₁ = 1;	K ₂ =	$= Q_1 ;$	K ₃	$= \mathbf{Q}_1$

Clock	J_1	K ₁	J ₂	K ₂	J_3	K ₃	Q ₁	Q ₂	Q ₃	
0	-	-	-	-	-	-	0	0	0	
1	1	1	0	0	0	0	1	0	0	
2	1	1	1	1	0	1	0	1	0	
3	1	1	0	0	0	0	1	1	0	
4	1	1	1	1	1	1	0	0	1	
5	1	1	0	0	0	0	1	0	1	
										\rightarrow Initial
6	1	1	0	1	0	1	0	0	0	State is
										Repeating
Initial state is repeating after "6" clock										
	pulses. Hence It is a MOD-6 counter							cou	nter	

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58. Consider a system using segmented-paging architecture with a V.A of 23 bits. The segment table has 32 entries and page table of segment is indexed with 9 bits. The size of largest segment is _____KB.

58. Ans: 256

- Sol: The size of VA is 23 bits. There are 32 entries in segment table. Hence the VAS has 32 segments which requires 5 bits to access them. The remaining 23 - 5 = 18bits are used to access the segment. This implies the max segment size is 256KB.
- 59. An urn contains 5 chips numbered 1, 2, 3,
 4 & 5. When 2 chips are drawn (without replacement) from the urn, the random variable X records higher value. Standard deviation of X = _____.

59. Ans: 1

Sol: Let X = higher value of the 2 chips

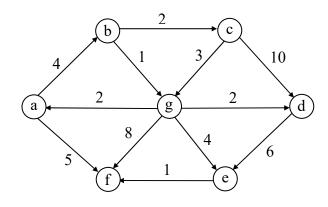
X has the following probability distribution

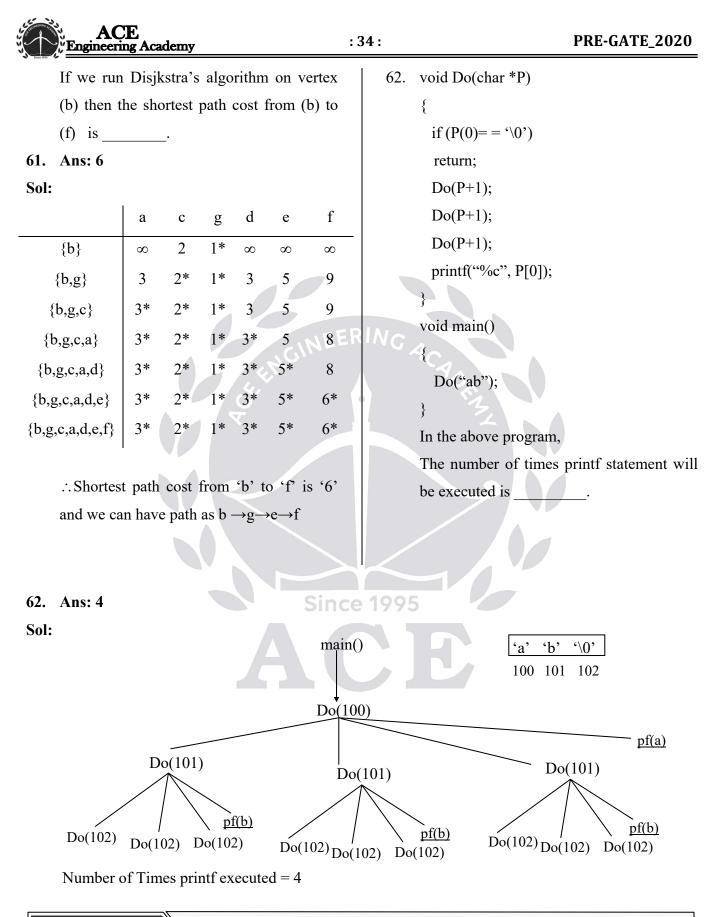
$$\sigma_{x} = \sqrt{E(X^{2}) - E(X)^{2}}$$
$$= \sqrt{17 - 16} = 1$$

- 60. Consider the following relation schema R(A,B,C,D,E,F,G) with FD set {AB→C, AC→B, AD→E, B→D, BC→A, E→G}. The relation R is subdivided into following relations R1(ABC), R2(ABCD), R3(ABCEG). The number of sub relations that are in BCNF is ______
- 60. Ans: 1
- Sol: R1(ABC) contains AB \rightarrow C, AC \rightarrow B, and BC \rightarrow A, as Every LHS is super key R1 is in BCNF. R2(ABCD) contains AB \rightarrow C, AC \rightarrow B, B \rightarrow D, and BC \rightarrow A, Because B is not a super key in B \rightarrow D, R2 is not in BCNF.

R3(ABCEG) contains AB→C, AC→B,
SE→G, and BC→A, Because E is not a super key in E→G, R3 is not in BCNF.

61. Consider the following graph





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63. Number of equivalence classes with respect to the language,

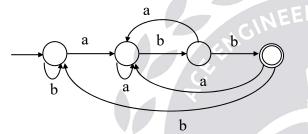
 $L = (a+b)^*abb \text{ over } \Sigma = \{a,b\} \text{ is } _$

63. Ans: 4

Sol: L=(a+b)*abb is regular language.

Every regular language has finite number of equivalence classes.

Number of equivalence classes = Number of states in min DFA



L has 4 states in equivalent min DFA. So, 4 equivalences exist for L.

64. A process has 45 distinct instructions. A 32-bit instruction has an opcode, 3-register operands and a 5-bit immediate operand. Maximum number of registers the CPU can have is _____.

64. Ans: 128

Sol: Number of Instructions = $45 \Rightarrow$ opcode bits = $\lceil \log_2 45 \rceil$ = 6-bits Instruction format: [Assume x-bits required for register reference]

32-bit Instruction

Opcode	Reg.1	Reg.2	Reg.3	Immediate operands
6	Х	Х	X	5

6 + 3x + 5 = 32-bits x = 7 bits

Maximum number of registers= $2^7 = 128$

65. If a_n = The number n-digit quaternary (0, 1, 2, 3) sequences in which there is never a₃
any where to the right of a₀, then a₅ =

65. Ans: 648

Sol: Case1: If the first digit is not 0, then we can choose first digit in 3 ways and the remaining digits in a_{n-1} ways.

 \therefore The number of quaternary sequences in this case is $3a_{n-1}$

Case 2: If the first digit is 0, then each of the remaining digits we can choose in 3 ways.

 \therefore The number of quaternary sequences in this case is 3^{n-1}

 \therefore The recurrence relation for a_n is

 $a_n = 3a_{n-1} + 3^{n-1}$ where $a_1 = 4$ $a_2 = 3a_1 + 3^1 = 15$ $a_3 = 3a_2 + 3^2 = 54$ $a_4 = 3a_4 + 3^3 = 189$ $a_5 = 3a_4 + 3^4 = 648$

Hearty Congratulations to our **ESE-2019 Top Rankers**



Total Selections in Top 10: 33 EE : 9 E&T : 8 ME : 9 CE : 7