



# ACE

## Engineering Academy



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**ACE Pre-GATE 2017**

**Branch: CSIT.**

**Q.1 – Q.5 Carry One Mark Each**

**01. Choose the most appropriate phrase from the options given below to complete the following sentence.**

The bus stopped to \_\_\_\_\_ more passengers.

(A) Take in

(B) Take on

(C) Take up

(D) Take for

**01. Ans: (B)**

**02. Choose the appropriate sentence from the following options.**

(A) She has been discharged since

(B) She has since been discharged.

(C) She has been since discharged

(D) She since has been discharged.

**02. Ans: (B)**

**03. Fill in the blank with an appropriate phrase.**

The jet \_\_\_\_\_ into the air.

(A) Soared.

(B) Soured

(C) Sourced.

(D) Sored.

**03. Ans: (A)**

**04. Choose the most appropriate word from the options given below to complete the following sentence.**

If I had known that you were coming, I \_\_\_\_\_ you at the airport.

(A) Would meet

(B) Would have met

(C) Will have met

(D) Had met

**04. Ans: (B)**



## SHORT TERM BATCHES FOR GATE+PSUs - 2018

### HYDERABAD

29<sup>TH</sup> APRIL 2017

06<sup>TH</sup> MAY 2017

13<sup>TH</sup> MAY 2017

18<sup>TH</sup> MAY 2017

01<sup>ST</sup> JUNE 2017

### NEW BATCHES FOR ESE | GATE | PSUs - 2018

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05. Reaching a place of appointment on Friday. I found that I was two days earlier than the scheduled day. If I had reached on the following Wednesday then how many days late would I have been?
- (A) One                      (B) Two                      (C) Three                      (D) Four

05. Ans: (C)

Sol: Friday → 2 days earlier

Therefore, scheduled day = Friday + 2  
= Sunday

Sunday + 3 = Wednesday

Therefore, I would have been late by 3 days



**Q.6 – Q.10 Carry two marks each**

06. A contractor, who got the contract for building the flyover, failed to construct the flyover in the specified time and was supposed to pay ₹ 50,000 for the first day of extra time. This amount increased by ₹ 4,000 each day. If he completes the flyover after one month of stipulated time, he suffers a loss of 10% in the business. What is the amount he received for making the flyover in crores of rupee? (One month = 30 days)
- (A) 3.1                      (B) 3.24                      (C) 3.46                      (D) 3.68

**06. Ans: (B)**

**Sol:** The sum of money that the contractor was supposed to pay for the period of an month over the stipulated time is

$$= S_n = \frac{n}{2}[2a + (n-1)d]$$

$$a = 50,000, \quad n = 30, \quad d = 4000$$

$$S_{30} = \frac{30}{2}[2 \times 50,000 + (30-1) \times 4000]$$

$$= 15[100,000 + 29 \times 4000]$$

$$₹ 3240000 = ₹ 32.4 \text{ lakhs}$$

Loss in the business = 10%

$$\therefore \text{Amount he received for making the flyover} = \frac{3240000}{0.1} = 32400,000$$

$$= ₹ 3.24 \text{ crores}$$

07. A person has to go from city A to city E. There is no direct way to reach city E from city A. However, there are intermediate cities B, C and D by which A can travel through. The information about the number of routes between any two cities is given in the table below.

A → B	7 routes
A → C	6 routes
A → D	8 routes
B → C	5 routes
B → E	4 routes
C → E	4 routes
D → E	6 routes



For instance, there are 5 ways in which the person can go from city B and city C. Also, the arrow between cities B and C indicates that the person can travel from city B to C but not from city C to B. In how many ways can that person travel from city A to city E?

- (A) 140                                      (B) 240                                      (C) 100                                      (D) 72

**07. Ans: (B)**

**Sol:** The routes that can be used are ABE, ABCE, ACE and ADE.

For ABE, number of ways =  $7 \times 4 = 28$

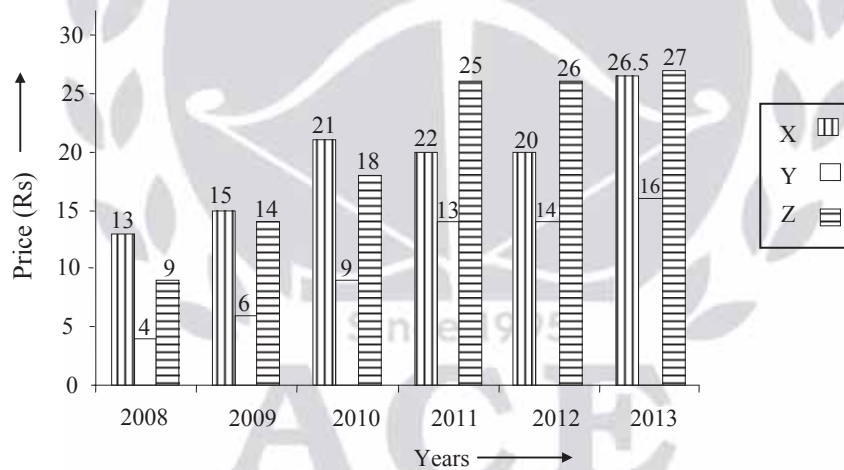
For ABCE, number of ways =  $7 \times 5 \times 4 = 140$

For ACE, number of ways =  $6 \times 4 = 24$

For ADE, number of ways =  $8 \times 6 = 48$

$\therefore$  Total number of ways to travel from city A to city E =  $28 + 140 + 24 + 48 = 240$ .

**08.** The following bar graph shows the price per litre of different fuels X, Y and Z year 2008 to 2013. Study the graph carefully and answer the following question.



The percentage increase in the price of fuel X from 2008 to 2013 is \_\_\_\_% of the percentage increase in the price of fuel Z for the given period?

- (A) 200%                                      (B) 100%                                      (C) 50%                                      (D) 120%

**08. Ans: (C)**

**Sol:** Percentage increase in the price of fuel X =  $\frac{26.5 - 13}{13} \times 100 = 100\%$

Percentage increase in the price of fuel Z =  $\frac{27 - 9}{9} \times 100 = 200\%$

Percent of percentage increase of X to percentage increase of Z =  $\frac{100 - 100}{200} \times 100 = \frac{100}{200} \times 100 = 50\%$



09. Examine the information given below. Who is to the immediate right of P among five persons P, Q, R, S and T, facing north?

Two statements, labeled I and II, are given below. You have to decide whether the data given in the statements are sufficient for answering the question. Using the data given in the statements, you have to choose the correct alternative.

**Statements:**

I. R is third to the left of Q and P is second to the right of R

II. Q is the immediate left of T who is second to the right of P.

(A) I alone is sufficient while II alone is not sufficient to answer the question.

(B) II alone is sufficient while I alone is not sufficient to answer the question

(C) Either I (or) II is sufficient to answer the question

(D) Neither I (nor) II is sufficient to answer the question

**09. Ans: (C)**

**Sol:** From statement I, we have the order: R – P, Q ..... (i)

From statement II, we have the order: P, Q, T ..... (ii)

It is clear from both the equations that Q is to the immediate right of P. So, either of the statements is sufficient to answer the question.

**10. Which of the following can be logically inferred from the given statement.**

“No other studied medicine except Helen”

(A) Helen only studied medicine

(B) Only Helen studied medicine

(C) Helen studied only medicine

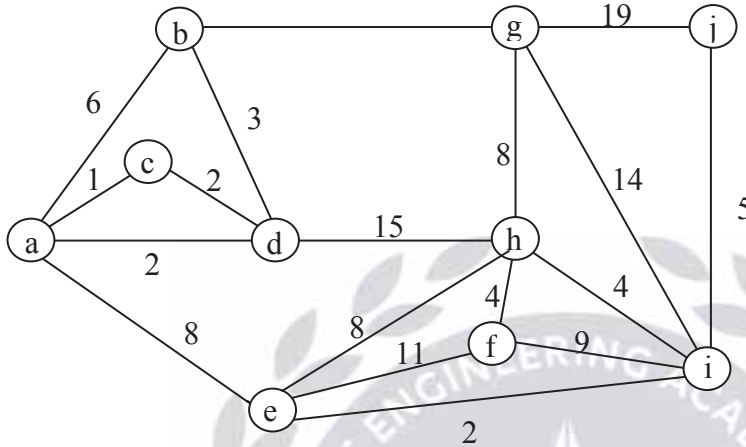
(D) Helen studied medicine only

10. Ans: (B)



Q.11 – Q.35 Carry one mark each.

11.



The possible number of minimum cost spanning tree is \_\_\_\_\_.

11. Ans: 4

Sol: Between  $\langle c, d \rangle$  and  $\langle a, d \rangle$  we choose one edge in  ${}^2C_1$  ways

Between  $\langle a, e \rangle$  and  $\langle g, h \rangle$  we choose 1 edge in  ${}^2C_1$  ways.

Total number of possible ways =  $2 \times 2 = 4$ .

12. `int f(int *p, int n)`

```
{
    if (n <= 1)
        return 0;
    if (*p > 3)
        return *p + f(p + 1, n - 1);
    else
```

```
return *p - f(p + 1, n - 1);
```

```
}
```

```
void main()
```

```
{
```

```
int a[ ] = {3, 8, 1, 6, 12};
```

```
printf("%d", f(a, 5));
```

```
}
```

The output of the above program is \_\_\_\_\_.



12. Ans: 0

Sol:

$$\begin{aligned}
 & f(100, 5) = 0 \\
 & \quad \downarrow \uparrow 0 \\
 & 3 - f(102, 4) \\
 & \quad \downarrow \uparrow 3 \\
 & 8 + f(104, 3) \\
 & \quad \downarrow \uparrow -5 \\
 & 1 - f(106, 2) \\
 & \quad \downarrow \uparrow 6 \\
 & 6 + f(108, 1) \\
 & \quad \downarrow \uparrow 0
 \end{aligned}$$

13. If each element of a second order determinant is either 0 or 1, then the probability that the determinant is positive, is \_\_\_\_\_. (Assume that the individual entries are chosen independently, each value being assumed with probability  $\frac{1}{2}$ )

13. Ans: **0.1875 ( Range: 0.18 to 0.19)**

Sol: Let  $\Delta = \begin{vmatrix} a & b \\ c & d \end{vmatrix}$

Number of determinants possible =  $2^4 = 16$

Consider,  $ad - bc > 0$

$$\Rightarrow ad > bc$$

$$\Rightarrow ad = 1 \text{ and } bc = 0$$

We have 3 cases where  $ad > bc$

I.  $a = 1, d = 1, b = 0$  and  $c = 0$

II.  $a = 1, d = 1, b = 1$  and  $c = 0$

III.  $a = 1, d = 1, b = 0$  and  $c = 1$

$$\therefore \text{Required probability} = \frac{3}{16} = 0.1875$$



14. Let X be a continuous random variable with probability density function 'f' given by

$$f(x) = ax, 0 \leq x \leq 1$$

$$= a, 1 \leq x \leq 2$$

$$= -ax + 3a, 2 \leq x \leq 3$$

$$= 0, \text{ else where}$$

The value of the constant a = \_\_\_\_\_.

**14. Ans: 0.5**

**Sol:**  $\int_{-\infty}^{\infty} f(x) dx = 1$

$$\Rightarrow \int_0^1 ax dx + \int_1^2 a dx + \int_2^3 (-ax + 3a) dx = 1$$

$$\Rightarrow a = \frac{1}{2} = 0.5$$

15. Consider a disk with block size B = 512 bytes. A block pointer is P = 6 bytes long. A record pointer is P<sub>R</sub> = 7 bytes long and key value size = 9 bytes long. Construct a B<sup>+</sup> Tree with 30,000 records. The minimum height of the tree is \_\_\_\_\_. (Assume root node is of level 1).

**15. Ans: 3**

**Sol:** Blocking Factor = 512/16 = 32

Number of index blocks in leaf level = 30000/32 = 938

Blocking Factor = 512/15 = 34

Number of index blocks in 1<sup>st</sup> level = 938/34 = 28

Number of index blocks in 2<sup>nd</sup> level (root) = 28/34 = 1

16. If the TCP Round-Trip Time (RTT) is currently 30 msec and the acknowledgement comes in after 26 msec, the new RTT estimate is \_\_\_\_\_ msec. (Use  $\alpha = 0.9$ )

**16. Ans: 29.6**

**Sol:** RTT = 30 msec

$$\alpha = 0.9$$

NRRT = 26

Basic algorithm =  $\alpha$  (IRTT) + (1 -  $\alpha$ ) (NRRT)

$$= 0.9 \times 30 + (1 - 0.9) (26)$$

$$= 29.6 \text{ msec}$$





17. Suppose that a message has been encrypted using DES in **Cipher text block chaining** mode. One bit of cipher text in block  $C_i$  is accidentally transformed from 0 to 1 during transmission. The number of blocks, the plain text garbled is \_\_\_\_\_.

**17. Ans: 2**

**Sol:** Bit error causes its impact on two blocks only (i, i+1).

18. If the quick sort algorithm in the worst case takes 30 seconds for an input of size 5. Then the maximum input size of a problem that can be solved in 8 minutes is \_\_\_\_\_.

**18. Ans: 20**

**Sol:** Worst case Time for Quick sort for sorting '5' elements takes

$$cn^2 = 30$$

$$\therefore c = \frac{6}{5}$$

So in '8' minutes we can sort

$$cn^2 = 8 \times 60$$

$$n^2 = \frac{8 \times 60 \times 5}{6} = 400$$

$$\therefore n = 20$$

19. The Syntax Directed Translation schema given below :

<u>Production</u>	<u>Semantic rule</u>
$E \rightarrow E1 + E2$	$E.count = E1.count + E2.count$
$E \rightarrow T$	$E.count = T.count$
$T \rightarrow T1 * F$	$T.count = T1.count + F.count$
$T \rightarrow F$	$T.count = F.count$
$T \rightarrow -F$	$T.count = F.count$
$F \rightarrow (E)$	$T.count = E.count$
$F \rightarrow i$	$T.count = 1$

(A) Count the number of binary operators in an expression

(B) Counts the number of operands in an expression

(C) Counts the number of operators in an expression

(D) Evaluates an expression

**19. Ans: (B)**



**Sol:** Counts the number of operands in an expression

**Distractor Logic:**

Option A: As the semantic rule  $F \rightarrow i \quad T.count = 1$  specifies counting the number of operands not the binary operators.

Option B: As the semantic rule  $F \rightarrow i \quad T.count = 1$  specifies counting the number of operands.

Option C: As the semantic rule  $F \rightarrow i \quad T.count = 1$  specifies counting the number of operands not the operators.

Option D: As the semantic rule  $F \rightarrow i \quad T.count = 1$  specifies counting the number of operands not the expression evaluation.

20. If the time-slice used in the round-robin scheduling policy is more than the maximum time required to execute any process, then the policy will

(A) degenerate to Shortest Job First

(B) degenerate to Priority Scheduling

(C) degenerate to First Come First Serve

(D) None of the above

**20. Ans: (C)**

**Sol:** RR executes processes in FCFS manner with a time slice. If this time slice becomes long enough, so that a process finishes within it, it becomes FCFS.

**Distractor Logic:**

Option A: S.J.F does not use time Quantum

Option B: Priority based used only Priority

Option C: Refer to Solution

Option D: None

21. A relation  $R(ABCD)$  is in 3NF but not in BCNF. Which of the following dependency set is suitable for above statement?

(A)  $\{AB \rightarrow CD, A \rightarrow C, D \rightarrow B\}$

(B)  $\{AB \rightarrow CD, C \rightarrow DA\}$

(C)  $\{A \rightarrow BCD, B \rightarrow CD, C \rightarrow D\}$

(D)  $\{AB \rightarrow CD, C \rightarrow A, D \rightarrow B\}$

**21. Ans: (D)**

**Sol:** Only option (D) satisfies 3NF Definition

**Distractor Logic:**

Option A:  $A \rightarrow C$  is partial dependency

Option B:  $C \rightarrow D$  is partial dependency

Option C:  $B \rightarrow CD, C \rightarrow D$  are transitive dependencies

Option D: Refer to Solution



## NEW BATCHES FOR

### ESE – 2017 Stage – II (Mains)

BATCH - 1	BATCH - 2
18 <sup>th</sup> Jan 2017 (E&T, EE, CE & ME)	9 <sup>th</sup> Feb 2017 (E&T & ME)
	15 <sup>th</sup> Feb 2017 (EE & CE)

ESE - 2017 MAINS OFFLINE TEST SERIES  
WILL BE CONDUCTED FROM MARCH 1<sup>ST</sup> WEEK  
DETAILED SCHEDULE WILL BE ANNOUNCED SOON

22. Let  $A$  be a  $2 \times 2$  matrix. If  $A$  has two distinct eigen values, then which of the following is *true*?
- (A) Rank of  $A = 2$
  - (B)  $A$  is non-singular
  - (C)  $AX = 0$  has two linearly independent solutions
  - (D)  $A$  has two linearly independent eigen vectors

22. Ans: (D)

Sol: If  $A$  has 2 distinct eigen values, then for each distinct eigen value there will be only one independent eigen vector.

$\therefore$   $A$  has two linearly independent eigen vectors



**Distractor Logic:**

Option A: If  $A = \begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}$  then eigen values are 1 and 0

But Rank of A = 1

∴ Option (A) need not be true

Option B: The matrix  $A = \begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}$  has two distinct eigen values. But A is singular.

∴ Option (B) need not be true

Option C: If  $A = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$  then, A has two distinct eigen values.

But  $AX = 0$  has no linearly independent solution.

∴ Option (C) need not be true.

Option D: Refer to solution

23. Consider the following SQL query on a relation R(A, B) that has no NULL's:

SELECT r.A, r.B, s.A, s.B FROM R AS r, R AS s WHERE r.A = s.A and r.B = s.B;

Suppose that R has n tuples (not necessarily all distinct). Which of the above conditions are the most restrictive, correct limitation on m, the number of tuples (again not necessarily distinct) in the result?

(A)  $n \leq m \leq n^2$

(B)  $n \leq m \leq 2n$

(C)  $0 \leq m \leq n$

(D)  $m = n$

**23. Ans: (A)**

**Sol:** If R has no duplicates the result is n tuples, if contains duplicates the result is  $n^2$  tuples.

**Distractor Logic:**

Option A: Refer to solution

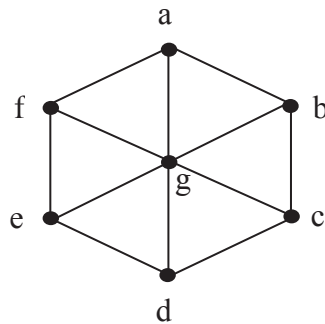
Option B: If R has no duplicates the result is n tuples, if contains only some duplicates the result possible is 2n tuples

Option C: 0 tuples are not possible

Option D: If R has no duplicates the result is n tuples



24. For the graph G shown below



Which of the following is not *true*?

(A) Chromatic number of  $G = 3$

(B) Vertex connectivity = 3

(C) Matching number = 3

(D)  $\bar{G}$  is traversable

24. Ans: (D)

Sol: In  $\bar{G}$ , the degree of  $g$  is 0.

$\Rightarrow \bar{G}$  is not connected

$\Rightarrow \bar{G}$  is not traversable

**Distractor Logic:**

Option A: The given graph  $G$  is the wheel graph  $W_7$ . Chromatic number of wheel graph  $W_n$  is 3, if 'n' is odd

$$\therefore \chi(W_7) = 3$$

$\therefore$  Option (A) is true

Option B: To disconnect wheel graph  $W_7$ , First we have to delete the hub  $g$ . Then by deleting any two non adjacent vertices in the resulting cycle, we can disconnect  $G$ .

$\therefore$  Vertex connectivity of  $G = 3$

Option C: Matching number of  $W_n = \left\lfloor \frac{n}{2} \right\rfloor$

$$\therefore \text{Matching number of } G = \left\lfloor \frac{7}{2} \right\rfloor = 3$$

Option D: Refer to solution



25. If  $f(x) = (x - 1)^2 (x + 1)^3$  then which of the following is not *true*?

- (A)  $f(x)$  has minimum at  $x = -1$
- (B)  $f(x)$  has maximum at  $x = \frac{1}{5}$
- (C)  $f(x)$  has neither maximum nor minimum at  $x = -1$
- (D)  $f(x)$  has a minimum at  $x = 1$

25. Ans: (A)

Sol:  $f(x) = (x - 1)^2 (x + 1)^3$

$$\begin{aligned} f'(x) &= (x - 1)^2 \cdot 3(x + 1)^2 + (x + 1)^3 \cdot 2(x - 1) \\ &= (x - 1)(x + 1)^2 \{3(x - 1) + 2(x + 1)\} \\ &= (x - 1)(x + 1)^2 (5x - 1) \end{aligned}$$

For extremum,  $f'(x) = 0$

$\Rightarrow x = 1, -1, \frac{1}{5}$  are stationary points

At  $x = -1$ ,  $f'(x)$  is positive as  $x$  passes through  $-1$

$\therefore f(x)$  has neither maximum nor minimum at  $-1$

$\therefore$  Option (A) is not true

**Distractor Logic:**

Option A: Refer to solution

Option B:  $f'(x)$  changes sign from positive to negative as  $x$  passes through  $\frac{1}{5}$

$\therefore f(x)$  has maximum at  $x = \frac{1}{5}$

Option C:  $f'(x)$  does not change sign as  $x$  passes through  $-1$

$\therefore f(x)$  has no extremum at  $x = \frac{1}{5}$

Option D:  $f'(x)$  changes sign from negative to positive as  $x$  passes through  $1$

$\therefore f(x)$  has a minimum at  $x = 1$



26.

AB \ CD	00	01	11	10
00		1	1	
01		1		
11		1		1
10		1	1	1

For the given k-map the redundant prime implicant is

(A)  $AC\bar{D}$

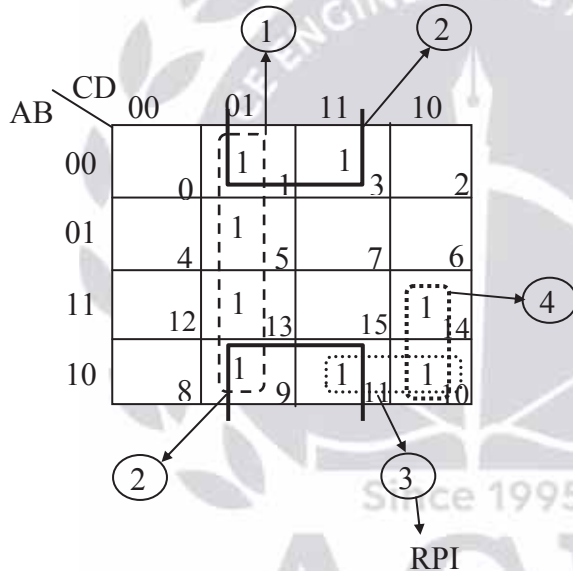
(B)  $\bar{B}D$

(C)  $\bar{C}D$

(D)  $A\bar{B}C$

26. Ans: (D)

Sol:



$$RPI = A\bar{B}C$$

**Distractor Logic:**

Option A:  $AC\bar{D}$  is a Essential Prime Implicant [EPI] but not a Redundant Prime Implicant [RPI].

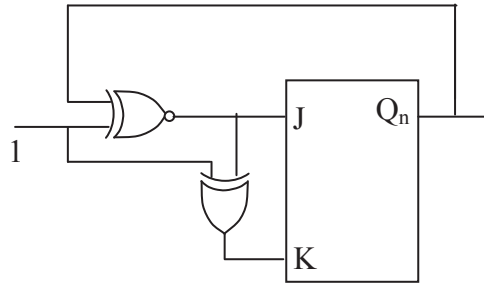
Option B:  $\bar{B}D$  is a EPI but not a RPI

Option C:  $\bar{C}D$  is a EPI but not a RPI

Option D:  $A\bar{B}C$  is a RPI in final minimized expression this term is not included, hence option [D] is correct answer.



27.



For the given Sequential Logic Circuit,  $Q_{n+1}$  is

- (A)  $Q_n$       (B) 0      (C) 1      (D)  $\bar{Q}_n$

27. Ans: (A)

Sol:  $Q_{n+1} = J \bar{Q}_n + \bar{K} Q_n$

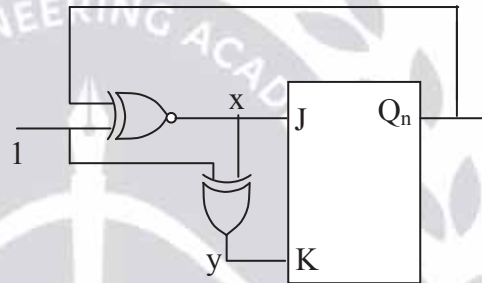
$$= x \bar{Q}_n + \bar{y} Q_n$$

$$= [1 \oplus Q_n] \bar{Q}_n + (\overline{x \oplus 1}) Q_n$$

$$= Q_n \bar{Q}_n + x Q_n$$

$$= 0 + (1 \oplus Q_n) Q_n$$

$$= Q_n \cdot Q_n = Q_n$$



**Distractor Logic:**

Option A: If  $Q_n = 0 \Rightarrow J = 0; K = 1$  then  $Q_{n+1} = 0$

If  $Q_n = 1 \Rightarrow J = 1; K = 0$  then  $Q_{n+1} = 1$

Means present state  $[Q_n]$  and next state  $[Q_{n+1}]$  are same. So  $Q_{n+1} = Q_n$

Hence option(A) is correct

Option B: Here output  $[Q_{n+1}]$  is not zero always irrespective of values of  $Q_n$  [either 0 or 1]

Hence option (B) is wrong

Option C: Here output  $[Q_{n+1}]$  always not equal to one irrespective of values of  $Q_n$  [either 0 or 1]

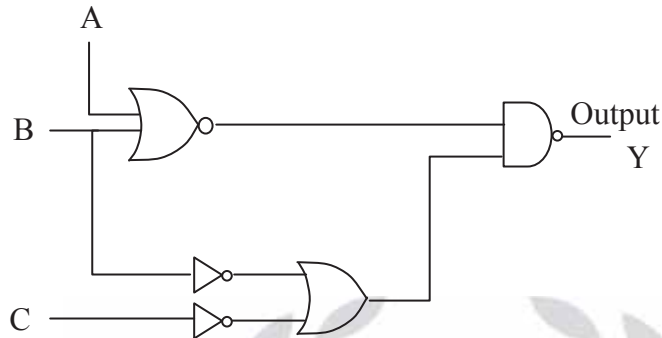
Hence option [C] is wrong

Option D: If present state & next state are complement then  $Q_{n+1} = \bar{Q}_n$ . But here present state & next state are always same. Hence option [D] is wrong.





28. The Digital circuits shown below



If output [Y] is zero then values of A, B and C respectively are

(A) A = 0, B = 0 & C = 1

(B) A = 0, B = 1 & C = 1

(C) A = 1, B = 0 & C = 0

(D) A = 0, B = 1 & C = 0

28. Ans: (A)

Sol: 
$$\begin{aligned} \text{Output}(Y) &= \overline{(\overline{A+B})(\overline{B+C})} \\ &= \overline{\overline{A+B} + \overline{B+C}} \\ &= A+B+BC \\ &= A+B \end{aligned}$$

A	B	C	Y
0	0	X	0
0	1	X	1
1	0	X	1
1	1	X	1

Here 'X' means either 0 or 1

**Distractor Logic:**

Option A: If A = 0; B = 0 & C = 0 (or) 1 then output = 0  
Hence option (A) is correct

Option B: If A = 0; B = 1 ; C = 1, then output = 1 but output should be zero .  
Hence option (B) is wrong

Option C: If A = 1; B = 0 & C = 1, then output = 1  
Hence option (C) is wrong

Option D: If A = 0; B = 1 & C = 0, then output = 1  
Hence option (D) also wrong



29. Consider the following instruction

MOV R<sub>2</sub>, @ R<sub>5</sub>,

Where R<sub>2</sub> and R<sub>5</sub> are the processing Registers. Minimum number of memory references required in the execution cycle of the above instruction cycle (except instruction fetch cycle) is \_\_\_\_\_.

- (A) 0 (B) 1  
(C) 2 (D) 3

29. Ans: (B)

Sol: It is Register indirect addressing mode instruction i.e. content of the R<sub>5</sub> provides Memory Address (Effective Address). For getting the operand from memory; One memory visit is required.

**Distractor Logic:**

Option A: Option 'A' will become correct Answer if the given instruction is MOV R<sub>2</sub>, R<sub>5</sub>

Option B: Refer to solution

Option C: Option 'C' will become correct Answer if R<sub>2</sub> is the Memory Address; then it belongs to Memory indirect Addressing mode. So, it requires 2 memory visits.

Option D: Option 'D' never becomes correct answer

30. Consider the modified binary search algorithms so that it splits the input not into two sets of almost equal sizes but into three sets of sizes approximately one-third. What is the recurrence equation for ternary search?

- (A)  $T(n) = T(n/2) + 1$  (B)  $T(n) = T(n/3) + 2$   
(C)  $T(n) = T(n/2) + n$  (D)  $T(n) = T(n/3) + n$

Ans: (B)

Sol: For ternary search we make two comparisons on elements which partition the list into three sections with roughly  $n/3$  elements and recurse on the appropriate partition.

Thus  $T(n) = T(n/3) + 2$

**Distractor Logic:**

Option A: If student thinks it makes 1 comparison on elements which partition the list.

Option B: Refer to Solution

Option C: If student thinks it makes 'n' comparison on n elements which partition list in two parts

Option D: If student thinks it makes 'n' comparison on n elements which partition list into 3 parts



31. Question Text: If  $T(n) = T\left(\frac{n}{4}\right) + T\left(\frac{3n}{4}\right) + n$  if  $n > 1$   
 $= 1$  if  $n = 1$

Then which of the following is *true*?

- (A)  $T(n) = O(n^2)$  (B)  $T(n) = O(n \log n)$   
 (C)  $T(n) = O(n)$  (D)  $T(n) = O(\log n)$

**31. Ans: (B)**

**Sol:**  $T(n) = T\left(\frac{n}{4}\right) + T\left(\frac{3n}{4}\right) + O(n)$

If  $T(n) = T(\alpha n) + T((1 - \alpha)n) + O(n)$  then

$$T(n) = O\left(n \log_{\frac{1}{1-\alpha}} n\right)$$

here  $\alpha = \frac{1}{4}$

$$\therefore T(n) = O(n \log_{4/3} n) = O(n \log n)$$

**Distractor Logic:**

Option A: If student thinks that worstcase is bounded by  $O(n^2)$

Option B: Refer to Solution

Option C: If student thinks that total time is not exceeded by  $O(n)$

Option D: If student takes only height of tree

32. Prime Factorization of a number means factoring a number into product of prime numbers. The following function for printing prime factors of a number.

```
void PFactors (int num)
{
    int i = 2;
    if (num == 1)
        return;
    while (num % i != 0)
        i ++ ;
    printf("%d", i);
    _____ ;
}
```

Then which of the following function call will place in the blank?

- (A)  $PFactors(num)$ ; (B)  $PFactors(num \% i)$ ;  
 (C)  $PFactors (num/i)$ ; (D)  $PFactors (num/2)$ ;



32. Ans: (C)

Sol: Let num = 84

84 divisible by 2, so 2 is Prime Factor then we have to reduce to find prime factors of  $84/2 = 42$

42 divisible by 2, so 2 is prime factor then we have to reduce to find prime factor of  $42/2 = 21$

We have to continue this process then prime factors of 84 are 2, 2, 3, 7.

**Distractor Logic:**

Option A: If student don't know the definition of prime factor

Option B: If student thinks that remainder of number is required to pass as an argument of function.

Option C: Refer to Solution

Option D: If student thinks that prime factor is divided every time by 2.

33. Let  $\Sigma^*$  be the set of all strings over the alphabet  $\Sigma$  and  $(.)$  dot be the concatenation operator on  $\Sigma^*$ .

Then the  $\Sigma^*$  with respect to operator ' $.$ ' Is

(A) Forms a group

(B) Forms an abelian group

(C) Form a linear space

(D) Forms a Monoid

33. Ans: (D)

Sol:  $\Sigma^*$  satisfies closure, Associative w.r.t concatenation  $(.)$  and also has identity element w.r.t concatenation  $(.)$

**Distractor Logic:**

Option A: String does not have inverse under concatenation, So it is not a group.

Option B:  $(\Sigma^*, .)$  is not a group, hence it is not an abelian.

Option C:  $(\Sigma^*, .)$  is not a field, So can not be a linear space

Option D: Refer to solution

34. Consider the set  $\Sigma^*$  of all strings over an alphabet  $\Sigma$  and the concatenation, union are operators.

Choose the **incorrect** statement from the following?

(A)  $\Sigma^*$  has an Identity element with respect to concatenation

(B)  $\Sigma^*$  has Annihilator with respect to Concatenation

(C)  $\Sigma^*$  has Identity with respect to union

(D)  $\Sigma^*$  has Annihilator with respect to union

34. Ans: (D)

Sol: No annihilator exist w.r.t union  $(+)$ .

**Distractor Logic:**

Option A: Empty string  $\epsilon$  is identity element w.r.t concatenation  $(.)$

Option B:  $\phi$  is the Annihilator w.r.t. concatenation  $(.)$

Option C:  $\phi$  is the identity element w.r.t union  $(+)$

Option D: Refer to Solution



35. Which of the following languages are Accepted by DPDA?

(i)  $L = \{a^n b^{n^2} \mid n \geq 0\}$

(ii)  $L = \{a^n b^m c^{2m} \mid m, n \geq 0\}$

(iii) L = Set of all Palindromes over alphabet  $\Sigma = \{a, b\}$

- (A) Only (i)                      (B) Only (ii)                      (C) (i) and (iii)                      (D) All of the above

35. Ans: (B)

Sol: It is Accepted by DPDA.

Distractor Logic:

Option A: It is CSL not accepted by DPDA

Option B: It is Accepted by DPDA

Option C: (i) is CSL and (iii) is CFL but not DCFL. So both are not Accepted by DPDA.

Option D: Only (ii) is Accepted by DPDA so all of the above is not possible

# OUR ESE 2016 TOP 10 RANKERS IN ALL STREAMS

E&T	EE	CE	ME
1.  Naveen Bhushan	2.  B.Venkatesh	2.  Bhavik Joshi	1.  Mohammad Usaf Ahmed
2.  Amit Rawal	3.  Tanay Kumar Sharma	4.  Adarsh Ravi Srinivas	2.  Govind Atom
3.  Aswathy	4.  Yasho Shukla	6.  Nishit Gang	3.  Chirag Srivastav
4.  T.Naveen	5.  Aishah Varma	8.  Anvith Anand	8.  JGMV Premal
5.  Vishal Ranjani	6.  Mehmed Khan	9.  Adresh Meena	9.  Gaurav Kant
6.  Harshit Jain	8.  Sh. Yashu Kumar Bhatnagar	10.  Himanshu Swati	
7.  Akash Chikara	9.  Anind Biswal		
8.  Vivek Jain	10.  Gaurav Tyagi		
9.  Jhonyanwar			
10.  Prabhakar Saha			
<b>10 IN TOP 10 RANKS</b>	<b>8 IN TOP 10 RANKS</b>	<b>6 IN TOP 10 RANKS</b>	<b>5 IN TOP 10 RANKS</b>

29 RANKS IN TOP 10 IN ESE-2016

# 72%

OF STUDENTS IN TOP 10 ARE FROM ACE and many more...



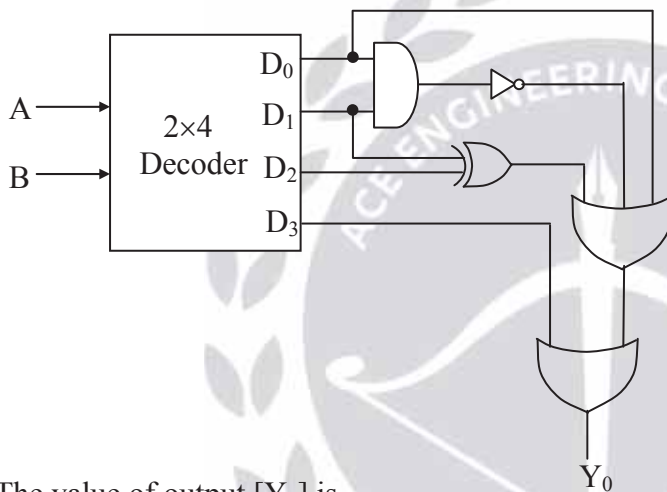
**Q.36 – Q.65 carry two marks each.**

36. Suppose, we have 20 French, 30 Spanish, 25 German, 20 Italian, 50 Russian and 17 English books. The minimum number of books we have to choose randomly, to guarantee that, we get atleast 6 French, or atleast 11 Spanish, or atleast 7 German, or atleast 4 Italian, or atleast 20 Russian, or atleast 1 English book is \_\_\_\_\_.

**36. Ans: 44**

**Sol:** By pigeonhole principle, The minimum number of books  
 $= \{(6 - 1) + (11 - 1) + (7 - 1) + (4 - 1) + (20 - 1) + (1 - 1)\} + 1$   
 $= 44$

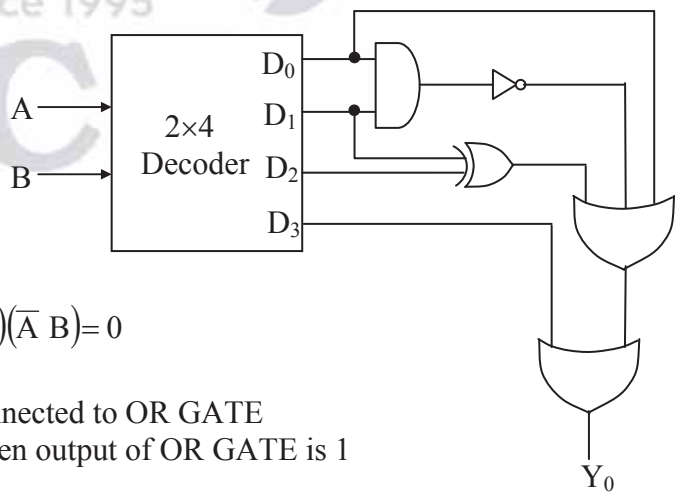
37. Consider the following decoder circuit diagram



The value of output  $[Y_0]$  is \_\_\_\_\_.

**37. Ans: 1**

**Sol:**



In  $2 \times 4$  decoder circuit

$$D_0 = \bar{A} \bar{B} ; \quad D_1 = \bar{A} B$$

$$\rightarrow \text{AND GATE output} = D_0 D_1 = (\bar{A} \bar{B})(\bar{A} B) = 0$$

$$\rightarrow \text{NOT GATE output} = \bar{0} = 1$$

$\rightarrow$  Above NOT GATE output (1) is connected to OR GATE

$\rightarrow$  For OR GATE if one of input is 1 then output of OR GATE is 1

Hence output of OR GATE is 1

$$\rightarrow \text{Output of OR GATE} = Y_0 = D_3 + 1 = 1$$

Hence answer = 1



38. For accessing a word from one disk memory: one Seek time and one average rotational delay are required. Let seek time of a disk be 20 milliseconds and disk is rotated with 50 rotations per second. Each track has '200' words. The access time of a word (in milliseconds) is \_\_\_\_\_.

38. Ans: 30.1

Sol: Word access time = Seek time + Average rotational time + Word reading time

RPS = 50, One rotation time = 20 ms

Average rotational delay = 10 ms

For reading 200 words, 20 ms time is needed

∴ One word Reading time =  $\frac{20 \text{ ms}}{200} = 0.1 \text{ ms}$

Word access time = 20 + 10 + 0.1 ms  
= 30.1 ms

39. `int f(int **a, int *b, int x);`

```
void main( )
```

```
{
```

```
    int i, *p, **q;
```

```
    i = 20;
```

```
    p = &i;
```

```
    q = &p;
```

```
    printf("%d", f(q, p, i));
```

```
}
```

```
int f(int **a, int *b, int x)
```

```
{
```

```
    int y, z;
```

```
    *b = *b + 2;
```

```
    y = *b;
```

```
    **a = **a + 3;
```

```
    z = *b;
```

```
    x = x + 3;
```

```
    return x + y + z;
```

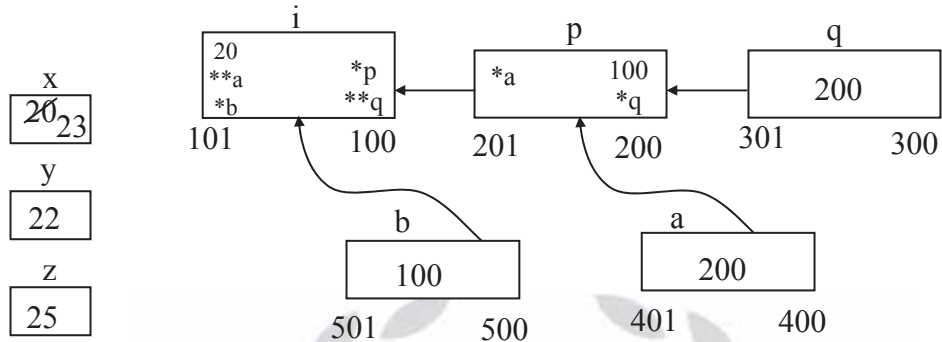
```
}
```

The output of above program is \_\_\_\_\_.



39. Ans: 70

Sol:



40. A recursive algorithm to calculate the combination of objects taken k at a time is

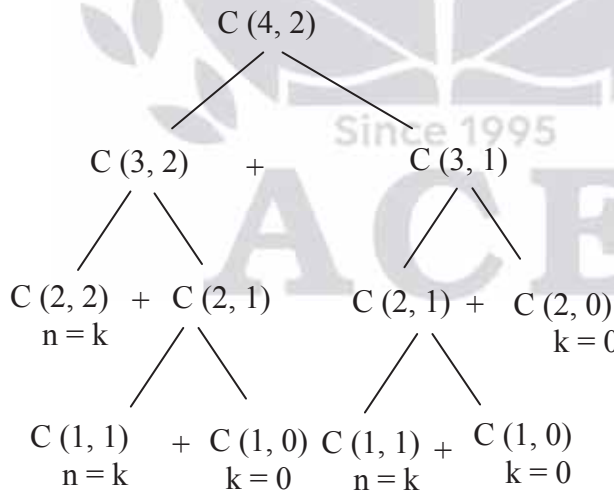
$$C(n, k) = \begin{cases} 1 & \text{if } k=0 \text{ or } n=k \\ C(n, k) = C(n-1, k) + C(n-1, k-1) & \text{if } n > k > 0 \end{cases}$$

The number of invocations

for calculating C(4, 2) by using recursion tree is \_\_\_\_\_.

40. Ans: 11

Sol:



Invocations = Total number of function calls = 11





41. A paging scheme uses a Translation Look-aside Buffer (TLB). A TLB-access takes 10 ns and a main memory access takes 50 ns. The effective access time(in ns) is \_\_\_\_\_.(If the TLB hit ratio is 90% and there is no page-fault)

41. **Ans: 65**

**Sol:** TLB time (c) = 10 ns,

Memory time (m) = 50 ns.

Hit ratio (x) = 90%

E.A.T =  $x(c + m) + (1 - x)(c + 2m)$

E.A.T. =  $((0.90) \times (10 + 50)) + ((1 - 0.9) \times (10 + 2 \times 50))$

E.A.T. =  $(0.90) \times (60) + (0.10 \times 110) = 65$

42. Station (A) needs to send a message of 9 packets where send window = 3. All packets are ready and immediately available for transmission. By using **Selective Repeat(SR)** strategy if every fifth packet gets lost then the number of packets that station (A) will transmit for sending all its message is \_\_\_\_\_.

42. **Ans: 11**

**Sol:** w = 3

Total 9 packets

Every fifth packet lost

				w = 3						w = 3			
Packets	1	2	3	4	5	6	7	5	8	9	-	-	9
Attempts	1	2	3	4	5	6	7	8	9	10	-	-	11

Total 11 attempts

43. RSA algorithm is used by choosing two prime numbers, say p = 7 and q = 17. If the public key is e = 5, then the value of 'd' is \_\_\_\_\_.

43. **Ans: 77**

**Sol:** e = 5, p = 7, q = 17

$z = 6 \times 16 = 96$

$(e \times d) = 1 \pmod{z} = e = 5$

$(e \times d) = \text{multiple of } 96 + 1$

i = 1  $96 \times 1 + 1 = 97 \pmod{96} = 1$

$e \times d = 97; d = 97/5 = \text{fraction}$

i = 2  $96 \times 2 = 192 + 1 = 193$

$e \times d = 193$  fraction

i = 3  $96 \times 3 = 288 + 1 = 289$

$e \times d = 289$  fraction

i = 4  $96 \times 4 = 384 + 1 = 385$

$e \times d = 385 \quad d = \frac{385}{5} = 77$



44. The address of a class B host is to be split into subnets with a 6-bits subnet number. The maximum number of hosts in each subnet is \_\_\_\_\_.

**44. Ans: 1022**

**Sol:** Given 6 bit subnet number.

Maximum number of subnet are  $2^6$ . But 2 subnet numbers are not going to be used.

Therefore maximum number of subnet possible with 6 bits =  $2^6 = 64$

And maximum number of hosts in each subnet =  $2^{16-6} - 2 = 2^{10} - 2 = 1022$

45.  $L_1$  is CFL but not DCFL,  $L_2$  is CSL and  $L_3$  is Recursive enumerable but not Recursive

Define the language L as  $L = L_3 - L_2 - L_1$

Then the compliment of L is

(A) Recursive language

(B) Recursive enumerable but not Recursive

(C) Non recursive enumerable language

(D) None of the above

**45. Ans: (C)**

**Sol:**  $L = L_3 - (L_2 \cap \bar{L}_1)$

$$= L_3 \cap (\overline{L_2 \cap \bar{L}_1})$$

$$= L_3 \cap (\bar{L}_2 \cup L_1)$$

$$= \text{REL} \cap (\text{CSL} \cup \text{CFL})$$

$$= \text{REL}$$

$\therefore \bar{L}$  is NREL

**Distractor Logic:**

Option A: L is REL so need not be recursive

Option B: L is REL but complement of L need not be recursive

Option C: Refer to solution

Option D: None

46. In the following syntax directed schema, what is printed for the input  $\alpha\alpha\alpha\beta\gamma\gamma$

$$S \rightarrow \alpha \alpha W \quad \{\text{"print 1"}\}$$

$$S \rightarrow \beta \quad \{\text{"print 2"}\}$$

$$W \rightarrow S\gamma \quad \{\text{"print 3"}\}$$

(A) 23131

(B) 11233

(C) 11231

(D) 33211

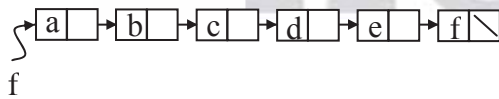
**46. Ans: (A)**

**Sol:** When the parse tree for the input sentence  $\alpha \alpha \alpha \alpha \beta \gamma \gamma$  is traversed in depth first traversal order the translation schema prints 23131



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47.



What would be the output after the following sequence of steps?

- i)  $p = f \rightarrow \text{link} \rightarrow \text{link} \rightarrow \text{link};$
- ii)  $p \rightarrow \text{link} \rightarrow \text{link} \rightarrow \text{link} = f \rightarrow \text{link};$
- iii)  $f \rightarrow \text{link} \rightarrow \text{link} \rightarrow \text{link} = p \rightarrow \text{link} \rightarrow \text{link};$
- iv)  $p \rightarrow \text{link} \rightarrow \text{link} = f;$
- v)  $\text{printf}(\text{"\% c"}, p \rightarrow \text{link} \rightarrow \text{link} \rightarrow \text{link} \rightarrow \text{link} \rightarrow \text{link} \rightarrow \text{link} \rightarrow \text{data});$

- (A) a                      (B) b                      (C) c                      (D) d





49. Processes P1 and P2 use critical flag in the following routine to achieve mutual exclusion. Assume that critical\_flag is initialized to FALSE in the main program.

```
get_exclusive_access ( )  
{  
    if (critical_flag == FALSE)  
        {  
            critical_flag = TRUE ;  
            critical_region () ;  
            critical_flag = FALSE;  
        }  
}
```

Consider the following statements.

- i. It is possible for both P1 and P2 to access critical\_region concurrently.
- ii. This may lead to a deadlock.

Which of the following holds?

- (A) (i) is false and (ii) is true
- (B) Both (i) and (ii) are false
- (C) (i) is true and (ii) is false
- (D) Both (i) and (ii) are true

49. Ans: (C)

**Sol:** Say P1 starts first and executes statement 1, after that system context switches to P2 (before executing statement 2), and it enters inside if statement, since the flag is still false. So now both processes are in critical section!! so (i) is true.. (ii) is false. By no way it happens that flag is true and no process' are inside the if clause, if someone enters the critical section, it will definitely make flag = false. So no deadlock.

**Distractor Logic:**

Option A: This is based on lock variable hence mutual exclusion is not guaranteed

Option B: Never leads to Deadlock

Option C: Refer to Solution

Option D: If is certainly Deadlock free



50. A single processor system has three resource types X, Y and Z, which are shared by three processes. There are 5 units of each resource type. Consider the following scenario, where the column alloc denotes the number of units of each resource type allocated to each process and the column request denotes the number of units of each resource type requested by a process in order to complete execution. Which of these processes will finish LAST?

	alloc			request		
	X	Y	Z	X	Y	Z
P0	1	2	1	1	0	3
P1	2	0	1	0	1	2
P2	2	2	1	1	2	0

- (A) P0                      (B) P1                      (C) P2                      (D) None of the above

**50. Ans: (C)**

**Sol:** Once all resources (5, 4 and 3 instances of X, Y and Z respectively) are allocated, 0, 1 and 2 instances of X, Y and Z are left. Only needs of P1 can be satisfied. So P1 can finish its execution first. Once P1 is done, it releases 2, 1 and 3 units of X, Y and Z respectively. Among P0 and P2, needs of P0 can only be satisfied. So P0 finishes its execution. Finally, P2 finishes its execution.

**Distractor Logic:**

- Option A: P0 request is not satisfied as it asks for one copy of X
- Option B: Look like P1 request is guaranteed but later leads to Problem
- Option C: Refer to Solution
- Option D: None

51. Consider the following table declarations :

```
CREATE TABLE R1 (
a INT PRIMARY KEY,
b INT );
CREATE TABLE R2 (
c INT PRIMARY KEY,
d INT REFERENCES R1(a) );
CREATE TABLE R3 (
e INT PRIMARY KEY,
f INT CHECK(f IN (SELECT a FROM R1)) );
```

Assume R1 contains the tuples (1,10), (2,10) and (3,20), while R2 and R3 are empty. Which of the following sequences of statements would *not* be allowed by SQL?



- (A) INSERT INTO R3 VALUES(5,2);  
DELETE FROM R1 WHERE a = 2;  
INSERT INTO R2 VALUES(1,1);
- (B) INSERT INTO R2 VALUES(1,1);  
DELETE FROM R1 WHERE a = 2;  
INSERT INTO R3 VALUES(6,1);
- (C) INSERT INTO R3 VALUES(6,3);  
UPDATE R1 SET a = 4 WHERE a = 3;  
INSERT INTO R2 VALUES(10,2);
- (D) DELETE FROM R1 WHERE a = 2;  
INSERT INTO R2 VALUES(1,1);  
INSERT INTO R3 VALUES(5,2);

51. Ans: (D)

Sol: Check constraint is violated for INSERT INTO R3 VALUES(5,2);

Distractor Logic:

Option A: DELETE FROM R1 WHERE a = 2; will not violates check constraint.

Option B: INSERT INTO R2 VALUES(1,1); will not violates foreign key constraints

Option C: UPDATE R1 SET a = 4 WHERE a = 3; will not violates check constraint.

Option D: Check constraint is violated for INSERT INTO R3 VALUES(5,2);

52. Which of the following argument is **not** valid?

- (A)  $\{(a \rightarrow b), (a \wedge \sim b)\} \Rightarrow c$
- (B)  $\{(a \rightarrow b), (a \rightarrow c)\} \Rightarrow (a \rightarrow (b \wedge c))$
- (C)  $\{(a \rightarrow b), (b \rightarrow c), (\sim b \vee \sim c)\} \Rightarrow (\sim a \vee \sim b)$
- (D)  $\{a \rightarrow b, b \rightarrow c\} \Rightarrow c$

52. Ans: (D)

Sol: When a is false, b is false and c is false; we can see that both the premises are true and the conclusion is false

$\therefore$  The argument is not valid



**Distractor Logic:**

Option A: In this argument, the premises are inconsistent.

∴ The argument is valid

Option B: The argument is valid by conditional proof (C. P)

1.  $a \rightarrow b$             premise
2.  $a \rightarrow c$             premise
3.  $a$                       new premise to apply C. P
4.  $b$                       (1), (3) modus ponens
5.  $c$                       (2), (3), modus ponens
6.  $b \wedge c$             (4), (5), conjunction
7.  $a \rightarrow (b \wedge c)$    (6)

∴ The argument is valid.

Option C: The argument is a substitution instance of destructive dilemma.

∴ The argument is valid

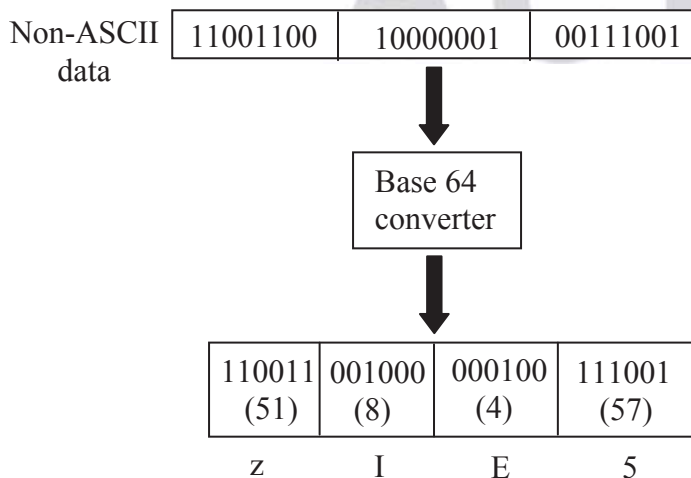
Option D: Refer to Solution

53. You are given the following three bytes: 11001100 10000001 00111001. Which of the following are substrings of the base 64 encoding of the above three bytes?

- (A) z1L5                      (B) zIE5                      (C) ZIF3                      (D) YJF4

**53. Ans: (B)**

Sol:







54. Let  $A = \{1, 7, 49, 343\}$ . For the poset  $[A; \geq]$  which of the following is not *true*?

- (A)  $[A; \geq]$  is a lattice but not a Boolean algebra
- (B)  $[A; \geq]$  is a totally ordered set
- (C)  $[A; \geq]$  is a complemented lattice
- (D)  $[A; \geq]$  is a distributive lattice

**54. Ans: (C)**

**Sol:** In a totally ordered set, complements exist only for upper bound and lower bound. In the given poset, complements do not exist for the elements 7 and 49.

$\therefore [A; \geq]$  is not a complemented lattice

**Distractor Logic:**

Option A: The relation  $\geq$  is a total order on any set of real numbers

$\therefore$  The poset  $[A; \geq]$  is a totally ordered set.

A totally ordered set with 3 or more elements is a lattice but not a Boolean algebra.

Option B: The relation  $\geq$  is a total ordering relation on any set of real numbers

$\therefore$  The poset  $[A; \geq]$  is a totally ordered set

Option C: Refer to Solution

Option D: The given poset is a totally ordered set and every totally ordered set is a distributive lattice.

55. Let  $G = \{a, b\}$  be a group with respect to the binary operation  $*$ . If  $a * b = a$ , then which of the following is not *true*?

- (A)  $b$  is the identity element of the group
- (B) Inverse of  $a = a$
- (C)  $(G, *)$  is a cyclic group
- (D)  $a * a = a$

**55. Ans: (D)**

**Sol:** The composition table is

*	a	b
a	b	a
b	a	b

From, the composition table,

$$a * a = b$$

$\therefore$  Option (D) is false.



**Distractor Logic:**

Option A: In the composition table, the second row of entries is same as top row.

$\therefore$  b is identity element

Option B: From the composition table,

$a * a = b =$  identity element

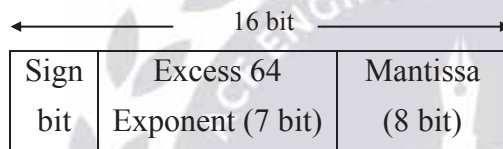
$\Rightarrow$  Inverse of a = a

Option C: Every group of prime order is cyclic.

$\therefore$  (G, \*) is a cyclic group with generator a

Option D: Refer to Solution

56. The given below diagram represents a signed float data with Implicit Normalization



Mantissa is a pure fraction in signed magnitude form. The decimal number  $(-5.75) \times 2^{10}$  has the following Hexa decimal notation with Implicit Normalization is

(A) C C 7 0

(B) 4 C 7 0

(C) C D B 8

(D) 4 D B 8

**56. Ans: (A)**

**Sol:**  $S = 1, 5.75 = 101.11_2$

$$5.75 \times 2^{10} = 101.11 \times 2^{10}$$

After Implicit Normalization  $1.0111 \times 2^{12}$

$M = 0\ 111\ 0000$  (8 bit)

True exponent = 12, Biased exponent = 76 = 1001100

S (1)	E (7)	M (8)
1	100 11 00	0 111 0000

In Hexa decimal form, Result is C C 7 0

**Distractor Logic:**

Option A: Refer to Solution

Option B: 'B' will become correct answer, if data is  $+ 5.75 \times 2^{10}$

Option C: 'C' will become correct answer, if it uses Explicit Normalization

Option D: 'D' will become correct Answer, if it uses Explicit Normalization for  $+ 5.75 \times 2^{10}$  decimal value



57. A 256 word cache and 1024 word main memory are partitioned into 32 word blocks. The tag information for cache memory blocks are shown below.

Block	Tag
0	- 01
1	- 00
2	- 00
3	- 10
4	- 11
5	- 11
6	- 00
7	- 10

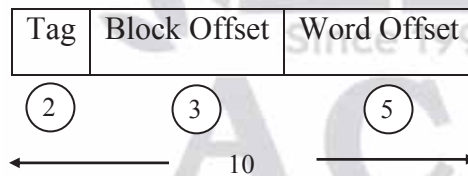
Identify the **correct** statement with respect to the availability of main memory words in the cache memory.

- (A) The words 105 and 896 are available in the cache
- (B) The words 630 and 980 are available in the cache
- (C) The words 256 and 930 are available in the cache
- (D) The words 608 and 250 are available in the cache

**57. Ans: (C)**

**Sol:** Number of words in Main memory = 1024 ( $W_0 - W_{1023}$ )  
 Number of words in cache = 256 ( $W_0 - W_{255}$ )  
 Block size = 32 words  
 Number of Blocks in cache =  $\frac{256}{32} = 8$  ( $C_0$  to  $C_7$ )

**Physical Address format:**



Word addresses in different blocks

Tag	Block	Word	Word Address
01	000	xxxxx	$W_{256}$ to $W_{287}$
00	001	xxxxx	$W_{32}$ to $W_{63}$
00	010	xxxxx	$W_{64}$ to $W_{95}$
10	011	xxxxx	$W_{608}$ to $W_{639}$
11	100	xxxxx	$W_{896}$ to $W_{927}$
11	101	xxxxx	$W_{928}$ to $W_{959}$
00	110	xxxxx	$W_{192}$ to $W_{223}$
10	111	xxxxx	$W_{736}$ to $W_{767}$



The following words are available in cache memory Words 32 to 95, 192 to 223, 256 to 287, 608 to 639, 736 to 767 and 896 to 959 the word 256 is available in cache Block '0' and The word 930 is available in cache Block 5.

**Distractor Logic:**

- Option A: Option 'A' will become correct answer when cache Block 3 tag address is '00'
- Option B: Option 'B' will become correct Answer when cache Block 6 tag address is '11'
- Option C: Refer to Solution
- Option D: Option 'D' will become correct Answer when cache Block 7 tag address is '00'

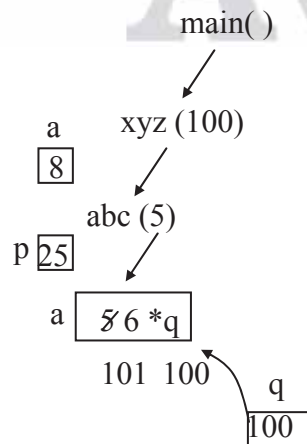
58. What is the output for the following program?

```
int a;
void abc(int p)
{
    p* = a;
    printf("%d", p);
}
void xyz(int *q)
{
    int a = *q + 3;
    abc (*q);
    *q = a - 2;
    printf("%d", a);
}
void main()
{
    a = 5;
    xyz (&a);
    printf("%d", a);
}
```

- (A) 25, 8, 6
- (B) 40, 8, 6
- (C) 25, 8, 5
- (D) 25, 8, 8

58. Ans: (A)

Sol:



Output = 25, 8, 6



**Distractor Logic:**

Option A: Refer to solution

Option B: If student send xyz function variable 'a' value then we get 40, 8, 6

Option C: If student not updated global variable then we get 25, 8, 5

Option D: If student not able to differentiating local and global variable 'a' then we get 25, 8, 8.

59. The following function converts a decimal number to binary number. For any number  $\leq 1023$ .

```
long int binary (int num)
```

```
{
    long a = 1, bin = 0, rem;
    while (num>0)
    {
        rem = rem% 2;
        bin = bin + rem * a;
        num/= 2;
        _____;
    }
    return bin;
}
```

The missing statement is

(A) a += 10

(B) a -= 10

(C) a /= 10

(D) a \*= 10

**59. Ans: (D)**

**Sol:** Suppose decimal number is 29

	Quotient	Remainder	
29/2	14	1	a[0] MSB
14/2	7	0	a[1]
7/2	3	1	a[2]
3/2	1	1	a[3]
1/2	0	1	a[4] LSB

$$(1 \times 1) + (0 \times 10) + (1 \times 100) + (1 \times 1000) + (1 \times 10000) = 11101$$

**Distractor Logic:**

Option A: If student don't know the binary to decimal conversion.

Option B: If student thinks that every time it is required to subtract 10

Option C: If student thinks that every time it is divided by 10

Option D: Refer to solution



60. The following algorithms are sort the input sequence in ascending order of the input array  $V = [6, 5, 4, 3, 2, 1]$  which of the following are **TRUE**?

- I. Selection sort runs in  $\Theta(n^2)$  time
- II. Insertion sort runs in  $\Theta(n^2)$  time
- III. Merge sort runs in  $\Theta(n^2 \log n)$  time
- IV. Quick sort runs in  $\Theta(n^2)$  time

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

**60. Ans: (C)**

**Sol:** If array elements are in the decending order then selection sort, Insertion sort, Quick sort takes worst case Time complexity  $\Theta(n^2)$  time

**Distractor Logic:**

Option A: If student thinks that only selection sort and Insertion sort takes worst case Time  $\Theta(n^2)$ .

Option B: Mergesort algorithm always takes  $\Theta(n \log n)$  for sorting 'n' elements

Option C: Refer to solution

Option D: Merge sort takes always  $\Theta(n \log n)$  for sorting 'n' elements

61. Consider the following variation on merge sort for large values of 'n'. Instead of recurring until 'n' sufficiently small, recurse atleast a constant 'r' times and then use insertion sort to solve the  $2^r$  resulting sub-problems. What is the running time of this variation as a function of 'n'?

- (A)  $O(n \log n)$       (B)  $O(\log \log n)$       (C)  $O(\log n)$       (D)  $O(n^2)$

**61. Ans: (D)**

**Sol:** Each call to merge sort on 'n' elements makes 2 recursive calls of size  $\frac{n}{2}$  so in atleast 'r' recurse it

creates  $2^r$  sub problems of size  $\frac{n}{2}$ , If insertion sort algorithm runs in  $O(n^2)$  so this modified merge

sort will take atleast  $2^r \left(\frac{n}{2^r}\right)^2 = \frac{n^2}{2^r}$  for large instances  $n > 2^r$  number. Since 'r' is constant so

running time is  $O(n^2)$ . Which is asymptotically worse than merge sort.

**Distractor Logic:**

Option A: If student thinks that Time Complexity of merge sort remains unchanged

Option B: If student thinks that length of recursion tree is  $\log \log n$

Option C: If student thinks that length of Recursion tree is  $\log n$ .

Option D: Refer to Solution



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Batches Starting From  
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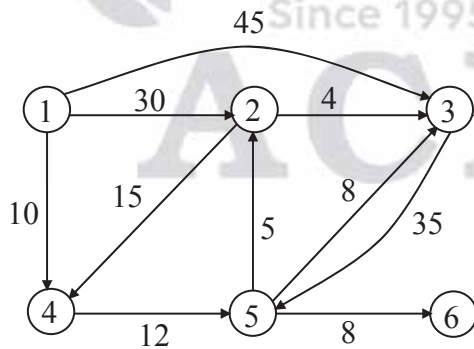
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62.



If we Run Disjkstra algorithm on vertex ① then which of the following are order of visiting nodes in order to compute shortest path distances from vertex ①?

- I. 1, 4, 5, 2, 3, 6
- II. 1, 4, 5, 2, 6, 3
- III. 1, 4, 2, 5, 6, 3

(A) Only I      (B) Only II      (C) Only I & II      (D) Only II & III



62. Ans: (C)

Sol:

Oder of visiting	2	3	4	5	6
S = {1}	30	45	10*	$\infty$	$\infty$
S = {1, 4}	30	45	10*	22*	$\infty$
S = {1, 4, 5,}	27*	30	10*	22*	30
S = {1, 4, 5, 2}	27*	30*	10*	22*	30
S = {1, 4, 5, 2, 3}	27*	30*	10*	22*	30
S = {1, 4, 5, 2, 3, 6}	27*	30*	10*	22*	30*

We can visit the vertex ⑥ before ③ (or) ③ before ⑥ So possible order of visiting is 1, 4, 5, 2, 3, 6 (or) 1, 4, 5, 2, 6, 3

**Distractor Logic:**

Option A: If student thinks only one possible order of visiting nodes then he can choose option A

Option B: If student thinks only one possible order of visiting nodes then he can choose option B

Option C: Refer to Solution

Option D: If student thinks only one possible order of visiting nodes then he can choose option D

63. The recurrence arising for Flyod-Warshell's algorithm in solving problem of all pairs longest path based on principle of optimality, assuming the cost adjacency matrix of the graph in  $C[1..n, 1..n]$ ,  $n$  = number of vertices;  $A_k[i, j]$  = minimum cost path from 'i' to 'j',  $k$  is the intermediate vertex of highest index along the path from 'i' to 'j':

(A)  $A_k(i,j) = A_k(i,k) + A_k(k,j)$

(B)  $A_k(i,j) = \max[A_k(i,k-1)+A_k(k-1,j), A_{k-1}(i,j)]$

(C)  $A_k(i,j) = \max[A_{k-1}(i,k)+A_{k+1}(k-1,j), A_{k-1}(i,j)]$

(D)  $A_k(i,j) = \max[A_{k-1}(i,k) + A_{k-1}(k,j), A_{k-1}(i,j)]$

63. Ans: (D)

Sol: Let  $P = \langle v_i \dots v_j \rangle$  then any vertex except  $v_i$  and  $v_j$  can be intermediate vertex. Divide this at  $K$ .

$$v_i \rightarrow v_k \rightarrow v_j \quad A_k[i,j] = \max \{A_{k-1} [i, j], A_{k-1}[i,k]+A_{k-1}, [k,j]\}$$

**Distractor Logic:**

Option A: It is not based on optimality principle

Option B: 'k' Should be intermediate vertex of highest index

Option C: 'k - 1' is not correct

Option D: Refer to solution





64. If A is a P - Problem and B is NP - Problem  
Then which of the following statement is **False**?
- (A) A may be Recursive language
  - (B) A is decidable
  - (C) B may be Recursive Language
  - (D) B may be Recursive Enumerable language

64. Ans: (D)

Sol: A is already decidable. Because every P-problem is decidable.

**Distractor Logic:**

Option A: Yes A is decidable or Recursive Language.

Option B: Yes A is decidable or Recursive Language.

Option C: B is decidable so it is Recursive

Option D: It can be Accepted by TM and halt. So it can be Recursive, but not REL.

65. Choose the **correct** statement from the following?

- (A) Every property of RE languages is undecidable
- (B) Every property of TM is undecidable
- (C) Every Non-trivial property of RE is undecidable
- (D) None of the above

65. Ans: (C)

Sol: By Rice's theorem, every non-trivial property of REL is undecidable.

**Distractor Logic:**

Option A: Trivial property of REL can be decidable.

Option B: Some properties of TM can be decidable.

Option C: Refer to solution

Option D: None