



Kunal Jha

Course: GATE  
Computer Science Engineering(CS)

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## GATE MOCK TEST 1 (GATE - 2021) - REPORTS

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Q. 1

[▶ Solution Video](#)[Have any Doubt ?](#)

Select the word that is most similar in meaning to the bold word in capital letters.

**STALEMATE****A** Deadly**B** Dastard**C** Dead lock

Correct Option

Solution :

(c)

**D** Dead-drunk

## QUESTION ANALYTICS



Q. 2

[FAQ](#)[▶ Solution Video](#)[Have any Doubt ?](#)

Directions:

I. The sentence is in three separate parts and each one is labeled as (a), (b) and (c). Read the sentence to find out whether there is an error in any part. No sentence has more than one error. When you find an error in any of the part (a), (b) or (c), indicate your response as (a), (b) or (c) option. You may feel that there is no error in a sentence in that case letter (d) will signify a 'No error' response.

II. Error may be in grammar, word usage or idioms. There may be a word missing or there may be a word which should be removed.

No sooner did he see the traffic policeman, he wore seat belt. No error

(a)

(b)

(c)

(d)

**A** a**B** b**C** c

Correct Option

Solution :

(c)

Use 'then'

**D** d

## QUESTION ANALYTICS



Q. 3

[▶ Solution Video](#)[Have any Doubt ?](#)

Some friends went to sweet corner. Following is the information about the number of Rosogollas they ate etc.

(i) Gimmy ate 8 less than Akshit

(ii) Dilip and Roy together ate 37.

(iii) Jugal ate 8 more than Dilip.

(iv) Akshit ate 5 more than Dilip.

(v) Akshit and Gimmy together are 40.

If the cost of each Rosogolla is ₹ 2. Then total amount they had to pay is

**A** ₹ 218**B** ₹ 208

Correct Option

Solution :

(b)

The following equations are obtained,

$$A - G = 8 \quad \dots(i)$$

$$D + R = 37 \quad \dots(ii)$$

$$J - D = 8 \quad \dots(iii)$$

$$A - D = 5 \quad \dots(iv)$$

$$A + G = 40 \quad \dots(v)$$

Using equation (i) and (v)

$$\Rightarrow A = 24; \quad G = 16$$

$$\text{Hence, } D = 19; J = 27 \text{ and } R = 18$$

$$\text{Total cost } (24 + 19 + 27 + 18 + 16) \times 2 = ₹ 208$$

**C** ₹ 227

Q. 4

▶ Solution Video

⌚ Have any Doubt ?



In a class of 50 students, each boy contributed an amount equal to number of girls and each girl contributed an amount equal to number of boys. If the total contribution thus collected is ₹ 1250, how many boys are there in the class?

A 25

Correct Option

Solution :

(a)

$$\begin{aligned} \text{Let, the number of boys} &= x \\ \text{Then, number of girls} &= 50 - x \\ \therefore x(50 - x) + (50 - x)x &= 1250 \\ \Rightarrow 2x(50 - x) &= 1250 \\ \Rightarrow 50x - x^2 &= 625 \\ \Rightarrow x^2 - 50x + 625 &= 0 \\ \Rightarrow (x - 25)^2 &= 0 \\ \Rightarrow x &= 25 \\ \therefore \text{Number of boys in class} &= 25 \end{aligned}$$

B 50

C 100

D 75

Q. 5

? FAQ

▶ Solution Video

⌚ Have any Doubt ?



A square and a regular octagon have identical perimeter. The ratio of the areas of the octagon and the square is \_\_\_\_\_.

1.207 (1.20 - 1.25)

Correct Option

Solution :

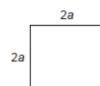
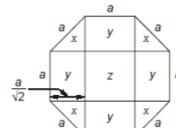
1.207 (1.20 - 1.25)

Sum of all of the interior angles of a polygon =  $(n - 2)180^\circ = (8 - 2)180^\circ = 1080^\circ$ Therefore, Interior angle of a regular octagon =  $\frac{1080}{8} = 135^\circ$ 

$$\begin{aligned} z &= a \times a = a^2 \\ x &= \frac{1}{2} \sqrt{2} \cdot \frac{a}{\sqrt{2}} = \frac{a^2}{4} \\ y &= a \cdot \frac{a}{\sqrt{2}} \end{aligned}$$

Total area of octagon is  $z + 4x + 4y$ 

$$\begin{aligned} &= a^2 + a^2 + \frac{4a^2}{\sqrt{2}} \\ &= (2 + 2\sqrt{2})a^2 = 4.828a^2 \end{aligned}$$



$$\begin{aligned} \text{Area of square} &= 4a^2 \\ \frac{\text{Area of octagon}}{\text{Area of square}} &= \frac{4.828a^2}{4a^2} \\ &= 1.207 \end{aligned}$$

Q. 6

▶ Solution Video

⌚ Have any Doubt ?



A, B, C, D are four friends living together in a flat and they have an agreement that whatever edible comes, they will share equally among themselves. One day A's uncle gave him a box of laddoos. Since no one was around. A divided the laddoos in a 4 equal parts and ate his share after which he put rest in the box. As he was closing the box, B walked in and took the box. B again divided it in four equal parts. A and B ate one part each and kept the remaining laddoos in the box. Suddenly C appeared, he again divided the laddoos in four equal parts, the three of them ate one part each and kept the remaining laddoos in the box. Later, when D came, he again divided laddoos in 4 equal parts and all four ate their respective share. In total D ate 3 laddoos. How many laddoos were given to A by his uncle?

A 128

Correct Option

Solution :

(a)

Let the number of Laddoos in box be  $x$ Initially A had  $\frac{1}{4}$ th part so  $\frac{3}{4}$ th part was left in box

$$\begin{aligned}
 & \frac{1}{4}x \quad \frac{1}{4}x \\
 & A + B \quad \text{Left in box} \\
 & \frac{2}{4} \left( \frac{3}{4}x \right) \quad \frac{2}{4} \left( \frac{3x}{4} \right) \\
 & A + B + C \quad \text{Left in box} \\
 & 3 \times \frac{1}{4} \times \frac{2}{4} \left( \frac{3x}{4} \right) \quad \frac{1}{4} \times \frac{2}{4} \left( \frac{3x}{4} \right) \\
 & \text{All ate } \frac{1}{4}^{\text{th}} \text{ part each}
 \end{aligned}$$

$$\begin{aligned}
 \therefore \text{part of D} &= \frac{1}{4} \left( \frac{1}{4} \right) \left( \frac{2}{4} \right) \left( \frac{3}{4} \right) x = 3 \\
 \therefore x &= 128 \text{ laddoos}
 \end{aligned}$$

**B** 125

**C** 113

**D** 192

QUESTION ANALYTICS



Q. 7

Solution Video

Have any Doubt ?



If  $2^x = 4^y = 8^z$  and  $xyz = 288$ , then the value of  $\frac{1}{2x} + \frac{1}{4y} + \frac{1}{8z}$  is

**A**  $\frac{11}{12}$

**B**  $\frac{11}{96}$

Correct Option

**C**  $\frac{29}{96}$

**D**  $\frac{29}{76}$

QUESTION ANALYTICS



Q. 8

FAQ

Solution Video

Have any Doubt ?



When a movie that is panned by most film critics is a popular success, it often takes as evidence of the poor taste of general audiences. But film critics belong to a fairly homogeneous class and their preferences are often rooted in the prejudices of that class. Their opinions are no more likely to be an unerring guide to quality than those of average movie goers. The passage best supports which of the following conclusions.

**A** Judgement of film quality by professional film critics are usually incorrect.

**B** Judgement of quality applied to movies are meaningless.

**C** Professional critics generally agree on the quality of any given movie.

**D** When film critics and general audiences disagree about a movie's quality, the critics' opinion is not necessarily most accurate.

Correct Option

**Solution :**  
(d)

QUESTION ANALYTICS



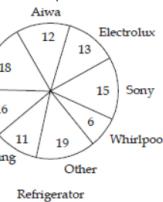
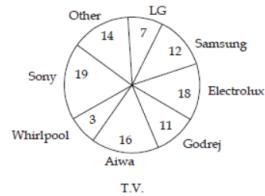
Q. 9

Solution Video

Have any Doubt ?



The two pie charts show the market share of different companies which produces TV and refrigerator in first quarter of 2019 - 2020.



If the turnover in the first quarter of 2019-20 of electrolux TV and refrigerator is ₹42 crores and ₹6 crores respectively then total quarterly turnover of Godrej and Aiwa in both categories together is approximately

**A** ₹ 63 crores

**B** ₹ 13 crores

**C** ₹ 76 crores

Correct Option

**Solution :**

(c) For T.V.

Electrolux : 18% share = ₹ 42 crores

Godrej + Aiwa:  $11 + 16 = 27\%$  share

$$= \frac{42}{18} \times 27 = ₹ 63 \text{ crores}$$

For refrigerator

Electrolux : 13% share = ₹ 6 crores

Godrej + Aiwa :  $16 + 12 = 28\%$  share

$$= \frac{6}{13} \times 28 = ₹ 12.92 \text{ crores}$$

Total quarterly turnover of Godrej and Aiwa =  $63 + 12.92 = ₹ 75.92 \approx ₹ 76$  crores

**D** ₹ 45 crores

QUESTION ANALYTICS

+

Q. 10

Solution Video

Have any Doubt ?

Q

A shopkeeper purchase good at ₹ 80 per unit and marked the price for selling at ₹ 120 per unit but he sells it after giving some discount at ₹ 96 per unit, then

**A** he earn a profit of 20% by selling goods.

Correct Option

**B** he gives a discount of 20% for selling the goods.

Correct Option

**C** marked price is 45% higher than cost price.

**D** marked price is 50% higher than cost price.

Correct Option

YOUR ANSWER - NA

CORRECT ANSWER - a,b,d

STATUS - SKIPPED

**Solution :**

(a, b, d)

C.P. = ₹ 80 per unit

S.P. = ₹ 96 per unit

M.P. = ₹ 120 per unit

$$\text{Profit} = \frac{96 - 80}{80} \times 100 = \frac{16}{80} \times 100 = 20\%$$

$$\text{Discount} = \frac{120 - 96}{120} \times 100 = \frac{24}{120} \times 100 = 20\%$$

$$\text{M.P. is higher than C.P by} = \frac{120 - 80}{80} \times 100\% = 50\%$$

QUESTION ANALYTICS

+



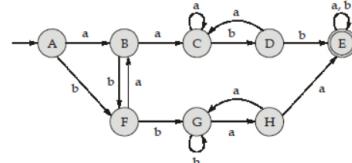
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**Q. 11**

The language accepted by the given Deterministic Finite Automata is



**A** Set of all strings of a's and b's where every string contains neither "aa" nor "bb" as a substring.

**B** Set of all strings of a's and b's where every string contains "aa" or "bb" as a substring.

**C** Set of all strings of a's and b's where every string contains "aa" and "bb" as a substring.

Correct Option

**Solution :**

(c)

The set of strings are accepted by the given DFA is = {aabb, bbaa, aaabb, bbaaa, ....}

Every string contains aa and bb as substring.

**D** None of these

QUESTION ANALYTICS

+

**Q. 12**
[Solution Video](#) [Have any Doubt ?](#)

 Simplified expression of  $(a + b)[a'(b' + c')]'$  +  $a'b' + a'c'$  is

**A**  $a + bc$

**B** 1

Correct Option

**Solution :**

(b)

 Step 1: Apply Demorgans law in  $[a'(b' + c')]$ ' to get output as  $a + bc$ 

 So the expression will be:  $(a + b)(a + bc) + a'b' + a'c'$ 

Step 2: With the help of distributive law to break the expression.

So, we will get

$$\begin{aligned}
 &= (a + b)(a + c) + a'b' + a'c' \text{ (apply distributive law in } a + bc) \\
 &= (a + b)(a + c) + a'b' + a'c' \text{ (according to idempotent law)} \\
 &= a + ac + ab + bc + a'b' + a'c' \\
 &= a + bc + a'b' + a'c' \text{ (since } a + ab = a, \text{ according to absorption law)} \\
 &= (a + a')(a + b') + a'c' + bc \text{ (applying distributive law at } a + a'b', \text{ note } a + a' = 1) \\
 &= (a + b') + a'c' + bc \\
 &= (a + b' + a')(a + b' + c') + bc \\
 &= (a + b' + c') + bc \text{ (since } a + a' = 1 \text{ and } 1 + b' = 1) \\
 &= (a + b' + c' + b)(a + b' + c' + c) = 1
 \end{aligned}$$

**C** 0

**D**  $a + bc + a'b' + a'c'$

QUESTION ANALYTICS

+

**Q. 13**
[FAQ](#) [Solution Video](#) [Have any Doubt ?](#)

Consider a MAN with server and destination of 20 Km apart and one way delay is 2 minutes. At what data rate does Round Trip Time (RTT) equals to transmission delay for 2 KB data?

**A** 41 bits/sec

**B** 66.6 bps

**C** 69 bps

D 68.26 bps

Correct Option

Solution:  
(d)

$$\begin{aligned} \text{RTT} &= 2 \times \text{one way delay} \\ &= 2 \times 2 \text{ min} = 4 \text{ min} \\ \text{TT} &= \frac{\text{Data size}}{\text{BW}} = \frac{2 \text{ KB}}{\text{BW}} \\ \text{TT} &= \text{RTT} \\ \frac{2 \text{ KB}}{\text{BW}} &= 4 \text{ min} \\ \frac{(2 \times 2^{10} \times 2^3)}{4 \times 60} &= 68.26 \text{ bps} \end{aligned}$$

QUESTION ANALYTICS

Q. 14

Solution Video

Have any Doubt?



There are 50 registers, and total 55 instructions available in a general purpose computer. The computer allows only 2-address instructions, where one operand can be a register and another can be a memory location. The memory is byte addressable with 64 KB (Kilo bytes) in size. The minimum number of bits to encode the instruction will be \_\_\_\_\_.

28

Correct Option

Solution:  
28

Total registers = 50; hence the number of bits required to represent one register will be 6 as  $50 < 2^6$ .

Total instruction = 55; hence again 6 bits will be required to represent an instruction.

$$\text{Total memory} = 64 \text{ KB} = 2^{16} \text{ B};$$

Hence 16 bits will be required to represent a memory location. An instruction has two parts, opcode and operand. In this problem there are only 2-address instructions, out of which one is register operand and other is memory operand. Hence total bits will be: 6 (opcode) + 6(register operand) + 16 (memory operand) = 28 bits.

QUESTION ANALYTICS

Q. 15

Solution Video

Have any Doubt?



Define a binary relation R on a set A to be antireflexive if  $xRx$  doesn't hold for any  $x \in A$ . The number of symmetric and irreflexive binary relations on a set of ten elements is

A  $2^{10}$

B  $2^{50}$

C  $2^{45}$

Correct Option

Solution:  
(c)

Represent the relation in the matrix form. So, total  $10 \times 10$  cells. Diagonal has all 0's for antireflexive.

For symmetric, we can assign 0 or 1 to every cell above diagonal and that will be replicated in the below diagonal. So, answer is  $2^{45}$  because there are 45 cells above diagonal.

D  $2^{90}$

QUESTION ANALYTICS

Q. 16

FAQ

Solution Video

Have any Doubt?



Suppose  $S(n)$  is a predicate on natural numbers (positive integers),  $n$  and suppose  $\forall k \in N (S(k) \rightarrow S(k+2))$ .

Now, if above assertion holds then consider the following statements:

$S_1 : \exists n \exists m > n [S(2n) \wedge \neg S(2m)]$

$S_2 : \exists n \exists m < n [S(2n) \wedge \neg S(2m)]$

Which of the following is correct for above statements?

A Both  $S_1, S_2$  always holds.

B  $S_1$  never holds but  $S_2$  may or may hold.

Correct Option

Solution:  
(b)

$S_1$ : This assertion says that  $S$  holds for some even number,  $2n$ , but not for some other larger even number,  $2m$ . However if  $S(2n)$  holds, we can apply  $\forall k \in N (S(k) \rightarrow S(k+2))$   $n - m$  times to conclude  $S(2m)$  also holds. This case is impossible.

$S_2$ : This may or may not hold.

C  $S_1$  may or may not hold but  $S_2$  never holds.

D Both  $s_1, s_2$  can never hold.

QUESTION ANALYTICS



Q. 17

Have any Doubt?



Consider the following C like code:

```
int Count(Node root)
{
    if(root == null) return 0;
    else if(root.left != null) || (root.right != null))
        return(Count(root.left) + (Count(root.right)));
    else return 1;
}
```

When a Binary tree is passed as input to this code, the above code counts.

A Number of internal nodes in a binary tree.

B Number of leaf nodes in a binary tree.

Correct Option

Solution :

(b)

This code is basically returning 1 for each leaf node and adding the number of leaf nodes in the left tree and in the right subtree. So, it counts number of leaves in the tree.

C Number of nodes in the binary tree.

D None of these

QUESTION ANALYTICS



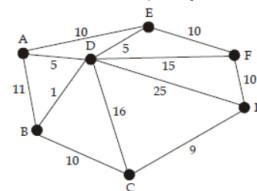
Q. 18

Solution Video

Have any Doubt?



The number of minimal spanning trees for the given graph below are \_\_\_\_\_.



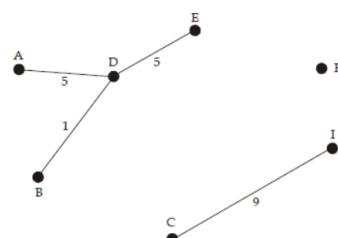
3

Correct Option

Solution :

3

If we apply Kruskal's algorithm for MST we get the following graph till the weight of the edges  $\leq 9$ .



Now we have 4 edges of weight 10 AE (this forms a cycle so it is ruled out), now we have (EF), (FI) and BD adding any two edges will make it a MST thus can be done in  $C(3, 2)$  ways. Therefore the number of minimal spanning tree is 3.

QUESTION ANALYTICS



Q. 19

Have any Doubt?



Consider the following grammar:

$S \rightarrow (S)$

$S \rightarrow x$

Which of the following statements is (are) true?

A The grammar is ambiguous.

B The grammar is suitable for top-down parsing.

Correct Option

C The grammar is suitable for bottom-up parsing.

Correct Option

D The grammar is LR(0).

Correct Option

YOUR ANSWER - NA

CORRECT ANSWER - b,c,d

STATUS - SKIPPED

**Solution :**

(b, c, d)  
Grammar is unambiguous and LL1, so, LR1. And the given grammar is also LR(0).

QUESTION ANALYTICS



Q. 20

? FAQ

Have any Doubt ?



Consider a system with a 6 bit virtual address space, and 16 byte pages/frames. The mapping from virtual page numbers to physical frame numbers of a process is (0, 8), (1, 3), (2, 11) and (3, 1). Translate the virtual address 40 to physical address. Note that all addresses are in decimal. Your answer must be in decimal. What is the physical address to which virtual address 40 is mapped to?

184

Correct Option

**Solution :**

184  
(b)  $40 = 10\ 1000 = 1011\ 1000 = 184$

QUESTION ANALYTICS



Item 11-20 of 65 « previous 1 2 3 4 5 6 7 next »



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**Q. 21**
[Solution Video](#)
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The system of simultaneous equations:

$$\begin{aligned}x + 2y + z &= 6 \\2x + y + 2z &= 6 \\x + y + z &= 5\end{aligned}$$

has

**A** Unique solution

**B** Infinite number of solutions

**C** No solution

Correct Option

**Solution :**

(c)

Rank of coefficient matrix = 2

Rank of augmented matrix = 3

 Since  $p(A) < p(A | B)$ , the system of equations is inconsistent and hence has no solution.

Option (c) is correct.

**D** Exactly two solutions

**QUESTION ANALYTICS**

**Q. 22**
[Solution Video](#)
[Have any Doubt ?](#)


Which of the following is CFL but not DCFL?

**A**  $L = \{a^p \mid P \text{ is prime}\}$ 
**B**  $L = \{a^m b^n \mid (m < n) \text{ or } (m > n)\}$ 
**C**  $L = \{a^m b^n c^k \mid (m = n) \text{ or } (n = k)\}$ 

Correct Option

**Solution :**

(c)

 (a)  $L = \{a^p \mid P \text{ is prime}\}$  is non CFL.

 (b)  $L = \{a^m b^n \mid (m < n) \text{ or } (m > n)\} = \{a^m b^n \mid (m \neq n)\}$  is DCFL.

 (c)  $L = \{a^m b^n c^k \mid (m = n) \text{ or } (n = k)\}$  is CFL but not DCFL.

 (d)  $L = \{a^m b^n c^k \mid m = n, n = k\} = \{a^m b^n c^n\}$  is non CFL.

**D**  $L = \{a^m b^n c^k \mid m = n, n = k\}$ 
**QUESTION ANALYTICS**

**Q. 23**
[Have any Doubt ?](#)


Stack A has the entries 1, 2, 3 (with 1 on top). Stack B is empty. An entry popped out of stack A can be printed immediately or pushed to stack B. An entry popped out of the stack B can be only be printed. In this arrangement, which of the following permutations of 1, 2, 3 are not possible?

**A** 2 1 3

**B** 2 3 1

**C** 3 1 2

Correct Option

**Solution :**

(c):

Option (a):

Pop 1 from stack A

Push 1 to stack B

Print 2

Print 1 from stack B

Print 3 from stack A

Order = 2 1 3

Option (b):

Pop 1 from stack A

Push 1 to stack B

Print 2 from stack A

Print 2 from stack A  
 Print 3 from stack A  
 Print 1 from stack A  
 Order = 2 3 1  
 Option (c):  
 Pop 1 from stack A  
 Push 1 to stack B  
 Pop 2 from stack A  
 Push 2 to stack B  
 Print 3 from stack A  
 Now, printing 1 will not be possible.

D 1 2 3

QUESTION ANALYTICS



Q. 24

? FAQ Solution Video

Have any Doubt ?



Let  $C(x)$  denote the predicate “ $x$  is in the correct place”, let  $E(x)$  denote the predicate “ $x$  is in excellent condition” and let  $T(x)$  denote the predicate “ $x$  is a tool” and suppose that the domain consists of all tools. Consider the following statements and their equivalent expressions in predicate calculus:

- I. Some tool is not in the correct place :  $\exists x(T(x) \wedge \neg C(x))$ .
- II. Some tool is not in the correct place :  $\exists x(\neg C(x))$ .
- III. All tools are in the correct place and are in excellent condition :  $\forall x(T(x) \rightarrow (C(x) \wedge E(x)))$ .
- IV. All tools are in the correct place are in excellent condition :  $\forall x(C(x) \wedge E(x))$ .

A I and II only

B I, II and III

Correct Option

C II, III and IV

Correct Option

D All I, II, III, IV

Correct Option

YOUR ANSWER - NA

CORRECT ANSWER - b,c,d

STATUS - SKIPPED

Solution :

(b, c, d)  
Since the domain is “All Tools”...  $T(x)$  is always true. So, no need to write it.

QUESTION ANALYTICS



Q. 25

? FAQ Solution Video

Have any Doubt ?



The value of  $\alpha = 0.8$  in the basic algorithm. The current RTT is 20 msec and the ACK's come after 21, 22, 23 ms respectively. What is the new RTT estimate using the basic algorithm? [Correct up to two places of decimal].

21.04 (21.04 - 21.05)

Correct Option

Solution :

$$\begin{aligned}
 \text{IRTT} &= 20 \text{ msec} \\
 \text{NRTT} &= 21, 22, 23 \text{ [Given]} \\
 21.04 \text{ (21.04 - 21.05)} & \\
 \text{ERTT} &= \alpha \times \text{IRTT} (1 - \alpha) \times \text{NRTT} \\
 \text{ERTT1} &= 0.8 \times 20 + (1 - 0.8) \times 21 = 20.2 \\
 \text{ERTT2} &= 0.8 \times 20.2 + (1 - 0.8) \times 22 = 20.56 \\
 \text{ERTT3} &= 0.8 \times 20.56 + (1 - 0.8) \times 23 = 21.048
 \end{aligned}$$

QUESTION ANALYTICS



Q. 26

Solution Video

Have any Doubt ?



Consider the following set of FD's:

$W \rightarrow Y$

$XZ \rightarrow W$

$Y \rightarrow X$

Which of the following dependencies cannot be derived from the above FD set?

A  $WZ \rightarrow X$

B  $YZ \rightarrow W$

C  $XY \rightarrow W$

Correct Option

Solution :

- (c)
  - (a)  $WZ \rightarrow X$  can be derived from the given FD set as  $WZ \rightarrow W$  (reflexivity),  $W \rightarrow X$  (transitivity of  $W \rightarrow Y$  and  $Y \rightarrow X$ ). Therefore,  $WZ \rightarrow X$  holds.
  - (b)  $YZ \rightarrow W$  can be derived from the given FD set as  $YZ \rightarrow XZ$  (augmentation of Z) and with transitivity of  $YZ \rightarrow XZ$  and  $XZ \rightarrow W$ ,  $YZ \rightarrow W$ . Thus, it holds.
  - (c)  $XY \rightarrow W$  cannot be derived from the FD set. Consider the example as

$w_1, x_1, y_1, z_1$   
 $w_2, x_1, y_1, z_2$

As we can see here XY cannot uniquely determine W, therefore, this dependency doesn't hold.

(d)  $W \rightarrow Y$  and  $Y \rightarrow X$  so  $W \rightarrow X$ .

D  $W \rightarrow X$

QUESTION ANALYTICS

Q. 27

? FAQ

► Solution Video

Have any Doubt ?



Which of the following statement is correct?

A When we use a max heap to implement a priority queue, the time complexity of both the add and delete operations are  $O(\log n)$ . Correct Option

B A complete binary tree with a height of h can have less nodes than a full binary tree with a height of h. Correct Option

C Operation Insert for a heap (using the standard array implementation) takes time  $O(\log n)$  in the worst case. Correct Option

D The running time of the build heap is  $O(n)$  in both worst or average case. Correct Option

YOUR ANSWER - NA

CORRECT ANSWER - a,b,c,d

STATUS - SKIPPED

Solution :

(a, b, c, d)

1. True. The operation add() and delete() spend  $O(\text{the height of min heap})$ . Because the min heap is a complete tree, the height of min heap  $\log n$ . The time complexity of add() and delete() =  $O(\log n)$ .
2. A complete binary tree is not required to fill completely the last level, but the full binary tree has its all level filled.
3. True, the height of the heap is  $\log(n)$ , so the insertion may affect the  $\log(n)$  nodes.

QUESTION ANALYTICS

Q. 28

? FAQ

Have any Doubt ?



Consider the following FORK-JOIN construct:

```
S1;
count1 := 2;
FORK L1;
S2;
S4;
count2 := 2;
FORK L2;
S5;
GO TO L3;
L1; S3;
L2; JOIN count1;
S6;
L3; JOIN count2;
S7;
```

Which statement(s) JOIN at S<sub>6</sub>?

A S<sub>4</sub> only Correct Option

B S<sub>5</sub> only

C S<sub>3</sub> only Correct Option

D S<sub>2</sub> only

YOUR ANSWER - NA

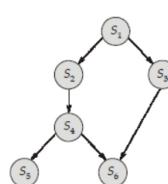
CORRECT ANSWER - a,c

STATUS - SKIPPED

Solution :

(a, c)

The corresponding precedence graph:





Therefore, statements  $S_4$  and  $S_3$  joins at  $S_6$ .

#### QUESTION ANALYTICS

Q. 29

[FAQ](#) [Solution Video](#) [Have any Doubt ?](#)

Registers  $R_1$  and  $R_2$  contain data values 100 and 150 respectively in decimal and the word length of the processor is 4 bytes. The effective address of the memory operand for the instruction "LOAD  $R_3, 10(R_1, R_2)$ " will be \_\_\_\_\_.

260

Correct Option

Solution :

260

$$\begin{aligned}\text{Effective address} &= 10 + \text{Content of } R_1 + \text{Content of } R_2 \\ &= 10 + 100 + 150 = 260\end{aligned}$$

#### QUESTION ANALYTICS

Q. 30

[Solution Video](#) [Have any Doubt ?](#)

A two-word instruction is stored in memory at an address designated by the symbol  $W$ . The address field of the instruction (stored at  $w + 1$ ) is designated by the symbol  $Y$ . The operand used during the execution of the instruction is stored at an address symbolized by  $Z$ . An index register contains the value  $X$ . Match the following:

Match the following:

- |             |                      |
|-------------|----------------------|
| A. Direct   | i. $Z = Y + (W + 2)$ |
| B. Indirect | ii. $Z = Y + X$      |
| C. Relative | iii. $Z = Y$         |
| D. Indexed  | iv. $Z = M[Y]$       |

A - i, B - ii, C - iii, D - iv

B - iii, A - iv, C - ii, D - i

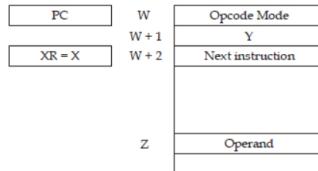
C - ii, A - iv, B - iii, D - i

D - iii, A - iv, C - i, B - ii

Correct Option

Solution :

(d)



$Z = \text{Effective address}$

- |             |                     |
|-------------|---------------------|
| A. Direct   | : $Z = Y$           |
| B. Indirect | : $Z = M[Y]$        |
| C. Relative | : $Z = Y + (W + 2)$ |
| D. Indexed  | : $Z = Y + X$       |

#### QUESTION ANALYTICS

Item 21-30 of 65 [« previous](#) [1](#) [2](#) [3](#) [4](#) [5](#) [6](#) [7](#) [next »](#)



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## GATE MOCK TEST 1 (GATE - 2021) - REPORTS

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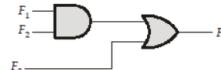
ALL(65)    CORRECT(0)    INCORRECT(0)    SKIPPED(65)

Q. 31

Have any Doubt?



Given  $F_1, F_3$  and  $F$  in canonical SOP form for the circuit:



Given,

$$F_1 = \text{Sum}(4, 5, 6, 7, 8)$$

$$F_3 = \text{Sum}(1, 6, 15)$$

$$F = \text{Sum}(1, 6, 8, 15)$$

Then  $F_2$  is \_\_\_\_\_.

**A** Sum(4, 6)

**B** Sum(4, 8)

**C** Sum(6, 8)

Correct Option

**Solution:**

(c) From the circuit

$$F = F_1 \cdot F_2 + F_3$$

$$\text{Sum}(1, 6, 8, 15) = \text{Sum}(4, 5, 6, 7, 8) \cdot F_2 + \text{Sum}(1, 6, 15) \quad \dots(i)$$

Equation 1 says we can get  $\text{Sum}(1, 6, 15)$  from  $F_3$ , so only 8 left.

Now from option (a), (b) and (d) we can get (4, 6), (4, 8) and (4, 6, 8) respectively for  $\text{Sum}(4, 5, 6, 7, 8) \cdot F_2$  which is not required as minterm 4 is undesired. But option (c)  $\text{Sum}(4, 5, 6, 7, 8) (6, 8) + (1, 6, 16)$  are  $\text{Sum}(6, 8) + \text{Sum}(16, 15)$

$\text{Sum}(1, 6, 8, 15)$

Therefore answer is option (c).

**D** Sum(4, 6, 8)

QUESTION ANALYTICS



Q. 32

? FAQ    Have any Doubt?



Consider the CFG fragment with non-terminal symbols {decl, type, id\_list}, with start symbol S, terminal symbols {id, :, ; var, integer, real} and the productions P listed below:

(1) decl → var id\_list : type; \$

(2) type → integer

(3) type → real

(4) id\_list → id\_list, id

(5) id\_list → id

Then the entry in  $M[id\_list, id]$  in LL(1) parse table is

**A** [id\_list → id, id]

**B** [id\_list → id\_list, id], [id\_list → id]

Correct Option

**Solution:**

(b)

First(decl) = {var}

First(type) = {integer, real}

First(id\_list) = {id}

LL(1) parse table:

	id	:	;	integer	real
decl	decl → var id_list : type; \$				
Type				Type → integer	Type → real
id_list	id_list → id_list, id id_list → id				

**C** [id\_list → id\_list, id]

**D** [id\_list → id]

QUESTION ANALYTICS



Q. 33

Solution Video

Have any Doubt?



If an element in a binary heap is stored in the position i and the root is at position 1, then where is the parent stored?



8

Correct Option

**Solution :**

8

For element 0, 4 swaps are performed

0	1	2	3	5	4	10	8	7
---	---	---	---	---	---	----	---	---

For element 4, 1 swap is performed

0	1	2	3	4	5	10	8	7
---	---	---	---	---	---	----	---	---

For element 8, 1 swap is performed

0	1	2	3	4	5	8	10	7
---	---	---	---	---	---	---	----	---

For element 7, 2 swaps are performed

0	1	2	3	4	5	7	8	10
---	---	---	---	---	---	---	---	----

Total swaps that are performed are  $4 + 1 + 1 + 2 = 8$ .**QUESTION ANALYTICS****Q. 37**[FAQ](#)[Have any Doubt ?](#)

In a system which has only 3 processes, there are 2 copies of  $R_1$  resource, 3 copies of  $R_2$  resource. Say, in the current snapshot of the system, Process  $P_1$  holds 2 copies of resource  $R_1$  and needs 1 copy of  $R_2$  to complete its execution.  $P_2$  holds 2 copies of  $R_2$  and needs 2 copies of  $R_1$ .  $P_3$  needs 2 copies of  $R_1$  and holds 1 copy of  $R_2$ . At this moment,  $P_1$  gives up and releases the resource copies that it holds only to request them again at a much later point in time. The probability that the system will be in a deadlock again is \_\_\_\_\_. (Upto 2 decimal places).

0.33

Correct Option

**Solution :**

0.33

 $P_1$  holds 2 copies of  $R_1$ . And  $P_2$  and  $P_3$  requires 2 copies of  $R_1$  each.

Now, allocation may happen in either of the following ways:

1.  $P_2$  gets 1 copy of resource and  $P_3$  gets 1 copy of resource -- leads to deadlock.
2.  $P_2$  gets both the resources -- deadlock free.
3.  $P_3$  gets both the resources -- deadlock free.

Therefore, 1 out of 3 possibilities leads to a deadlock.

Therefore,  $\frac{1}{3} = 0.33$

**QUESTION ANALYTICS****Q. 38**[Solution Video](#)[Have any Doubt ?](#)

For each of the pair of boolean formulae P and Q.

- I.  $P = X \vee Y$ ,  $Q = X \wedge Y$
- II.  $P = X \wedge (Y \vee Z)$ ,  $Q = (X \vee Y) \wedge (X \vee Z)$
- III.  $P = X \rightarrow Y$ ,  $Q = \neg X \rightarrow \neg Y$

Which of the following options is correct about the formula  $P \rightarrow Q$ ?**A** I is Tautology**B** II is Tautology

Correct Option

**Solution :**

(b)

I. Not a tautology, since  $P \rightarrow Q$  is  $(X + Y) \rightarrow XY = (X' Y' + XY) \neq 1$ .

II. Is a tautology.

$$\begin{aligned} P \rightarrow Q & (X(Y + Z)) \rightarrow (X + Y)(X + Z) \\ &= (X(Y + Z))' + (X + Y)(X + Z) \\ &= X' + Y'Z' + X + XZ + XY + XZ \\ &= (X + X') \text{ is present which is equal to 1. Hence tautology} \end{aligned}$$

III. Not a tautology.

**C** III is Tautology**D** None of the above**QUESTION ANALYTICS****Q. 39**[Solution Video](#)[Have any Doubt ?](#)

Consider an instruction pipeline with five stages without any branch prediction: Instruction Fetch (IF), Instruction Decode (ID), Operand Fetch (OF), Execute (EX) and Operand Write (OW). The stage delays for IF, ID, OF, EX and OW are 5 nsec, 7 nsec, 8 nsec and 6 nsec respectively. There are intermediate storage buffers after each stage and the delay of each buffer is 1 nsec. A program consisting of  $I_2$  instructions  $I_1, I_2, \dots, I_{12}$  is executed in the pipelined processor. Instruction  $I_4$  is the only branch instruction and its branch target is  $I_9$ . If the branch is taken during the execution of this program, the time needed to complete the program is:

**A** 132 nsec

**B** 165 nsec

Correct Option

Solution :  
(b)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
$I_1$	IF	ID	OF	EX	OW										
$I_2$		IF	ID	OF	EX	OW									
$I_3$			IF	ID	OF	EX	OW								
$I_4$				IF	ID	OF	EX	OW							
$I_5$					-	-	-	-	-						
$I_6$					-	-	-	-	-						
$I_7$					-	-	-	-	-						
$I_8$					-	-	-	-	-						
$I_9$							IF	ID	OF	EX	OW				
$I_{10}$								IF	ID	OF	EX	OW			
$I_{11}$									IF	ID	OF	EX	OW		
$I_{12}$										IF	ID	OF	EX	OW	

Total 15 clock cycles are needed.

So, here maximum delay is 10 ns. Buffer delay given in 1 ns. So, each stage takes 11 ns in total.

Time required to complete the program is  $15 \times 11 = 165$  nsec.

**C** 176 nsec

**D** 328 nsec

QUESTION ANALYTICS



Q. 40

Solution Video

Have any Doubt ?



Consider a computer with the following characteristics: total of 1 Mbyte of main memory; word size of 1 byte; block size of 16 bytes; and cache size of 64 Kbytes. For the main memory address of CABBE, give the corresponding tag, cache line address and word offsets for a direct mapped cache.

**A** C, AB, BE

**B** C, ABB, E

Correct Option

Solution :  
(b)

Because the block size is 16 bytes and the word size is 1 byte, this means there are 16 words per block. We will need 4 bits to indicate which word we want out of a block.

Each cache line/slot matches a memory block. That means each cache line contains 16 bytes. If the cache is 64 Kbytes then  $64\text{ Kbytes}/16 = 4096$  cache lines.

To address these 4096 cache lines, we need 12 bits ( $2^{12} = 4096$ ).

Consequently, given a 20 bit (1 Mbyte) main memory address:

Bits 0 – 3 indicate the tag (4 bits)

Bits 4 – 15 indicate the cache line/slot (12 bits)

Bits 16 – 19 indicate the word offset

CABBE = 1100 1010 1011 1011 1110

Tab = 1100 = C

Line = 1010 1011 1011 = ABB

Word offset = 1110 = E

Tag	Line	Offset
1100	1010 1011 1011	1110

**C** CA, BB, E

**D** None of these

QUESTION ANALYTICS





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**Q. 41**

There are 2504 computer science students at a school of these, 1876 have taken a course in C programming, 999 have taken a course in Java and 345 have taken a course in Python. Further, 876 have taken courses in both C and Java, 231 have taken courses in both Java and Python and 290 have taken courses in both C and Python. If 189 of these students have taken courses in C, Java and Python, how many of these 2504 students have not taken a course in any of these three programming languages?

**492**
[Correct Option](#)
**Solution :**
**492**

Total sample space 2504

$$N(C) = 1876$$

$$N(J) = 999$$

$$N(P) = 345$$

$$N(C \cap J) = 876$$

$$N(J \cap P) = 231$$

$$N(C \cap P) = 290$$

$$N(C \cap J \cap P) = 189$$

$$N((C \cup J \cup P)) = N(\text{total set}) - N((C \cup J \cup P))$$

$$N((C \cup J \cup P)) = N(C) + N(J) + N(P) - N(J \cap P) - N(C \cap P) - N(C \cap J) - N(C \cap J \cap P)$$

$$= 1876 + 999 + 345 - 231 - 876 - 290 + 189 = 2012$$

$$N((C \cup J \cup P)) = 2504 - 2012 = 492$$

QUESTION ANALYTICS


**Q. 42**
[Have any Doubt?](#)


In the following given code, a concept of function pointer is implemented.

```
#include <stdio.h>
int a(int x)
{
    while(-- x >= 0)
    {
        printf("%d", x - 2);
    }
}
int main()
{
    int (*p) (int) = a;
    (*p) (6);
    return 0;
}
```

Choose the strongest right option for the above given code.

**A** It gives output as 6, 5, 4, 3, 2, 1.

**B** It gives output as 4, 2, 0, -2, -4, -6.

**C** There is no concept of function pointer in C.

**D** It gives output as 3, 2, 1, 0, -1, -2.

[Correct Option](#)
**Solution :**
**(d)**

Answer is (d) it gives output as 3, 2, 1, 0, -1, -2

Function pointer concept: C allows to make such pointers that are capable of holding address of a function.

So here 6 will go to the function so we will do a(6).

-6 >= 0	-5 >= 0	-4 >= 0	-3 >= 0	-2 >= 0	-1 >= 0	-0 >= 0
5 >= 0	4 >= 0	3 >= 0	2 >= 0	1 >= 0	0 >= 0	-1 >= 0 (failed here)
pf(5 - 2)	pf(4 - 2)	pf(3 - 2)	pf(2 - 2)	pf(1 - 2)	pf(0 - 2)	
3	2	1	0	-1	-2	

QUESTION ANALYTICS


**Q. 43**
[FAQ](#)
[Solution Video](#)
[Have any Doubt?](#)


Consider the following language:

$L = \{w : w$  is the unary notation for a natural number  $n$  such that there exists a pair  $p$  and  $q$  of twin primes, both  $> n\}$ . Two numbers  $p$  and  $q$  are a pair of twin primes iff  $q = p + 2$  and both  $p$  and  $q$  are prime. For example, (3, 5) is a pair of twin primes. Which of the following is true?

**A** *L* is regular.

Correct Option

**Solution :**

(a)

$L = \{w : w$  is the unary notation for a natural number such that there exists a pair  $p$  and  $q$  of twin primes, both  $> n\}$ .  $L$  is regular. Unfortunately, this time we don't know how to build a FSM for it. We can, however, prove that it is regular by considering the following two possibilities:

- If there is an infinite number of twin primes. In this case, for every  $n$ , there exists a pair of twin primes greater than  $n$ . Thus  $L = 1^*$ , which is clearly regular.
- If there is not an infinite number of twin primes. In this case, there is some longest pair. There is thus also a largest  $n$  that has a pair greater than it. Thus the set of such  $n$ 's is finite and so is  $L$  (the unary encodings of those values of  $n$ ). Since  $L$  is finite, it is clearly regular.

It is not known which of these cases is true. But interestingly, from our point of view, it doesn't matter.  $L$  is regular in either case. It may bother you that we can assert that  $L$  is regular when we cannot draw either an FSM or a regular expression for it. It shouldn't bother you. We have just given a non constructive proof that  $L$  is regular (and thus, by the way, that some FSM  $M$  accepts it). Not all proofs need to be constructive.

**B** *L* is non-regular CFL.

**C** *L* is CSL but not CFL.

**D** *L* is not CSL.

QUESTION ANALYTICS

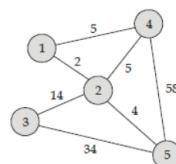
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**Q. 44**

? FAQ Have any Doubt ?

□

Consider the following graph which represents 5 locations across a city and a person has to travel all of them starting from vertex 1 and returning back, what is the cost of the optimal Hamiltonian path.



**A** 1-2-3-4-5-1

**B** 1-5-3-2-4-1

**C** 1-4-3-5-2-1

**D** 1-4-5-3-2-1

Correct Option

**Solution :**

(d)

For the above graph, only one of the options is the Hamiltonian path exists which is the only route for the optimal Hamiltonian path which is 1-4-5-3-2-1 or 1-2-3-5-4-1.

QUESTION ANALYTICS

+

**Q. 45**

? FAQ Have any Doubt ?

□

Consider the following CFG, where the set of terminals is  $\{a, b, \#, %, !\}$ :

$S \rightarrow \%aT \mid U!$

$T \rightarrow aS \mid baT \mid \epsilon$

$U \rightarrow \#aTU \mid \epsilon\}$

**A** (a) The FIRST sets for each of the non-terminals S, T, U is as follows:

S :  $\{\%, \#, \}\}$

T :  $\{a, b, \epsilon\}$

U :  $\{\#, \epsilon\}$

Correct Option

**B** The FOLLOW sets for each of the non-terminals S, T, U is as follows:

S :  $\{\#, !, \$\}$

T :  $\{\#, !, \$\}$

U :  $\{!\}$

Correct Option

**C** The grammar is LL(1).

Correct Option

**D** The grammar is LR(1)

Correct Option

YOUR ANSWER - NA

CORRECT ANSWER - a,b,c,d

STATUS - SKIPPED

**Solution :**

(a, b, c, d)

The first and follows sets are correct.

The LL(1) parsing table for the grammar is as follows:

	a	b	#	%	!	s
S			S → U!	S → %aT	S → U!	
T	T → aS	T → b a T	T → ε		T → ε	T → ε
U			U → #aTU		U → ε	

So, grammar is LL1 and every LL1 grammar is LR1 so it is LR1.

#### QUESTION ANALYTICS

Q. 46

Solution Video

Have any Doubt?



Consider the following languages:

$L_1 = \{<M> \mid M \text{ is a TM that accepts all even numbers}\}$ .

$L_2 = \{<M> \mid M \text{ is a TM and } |L(M)| \geq 3\}$ .

Which of the above languages is decidable?

A  $L_1$  only

B  $L_2$  only

C Both  $L_1$  and  $L_2$

D None of these

Correct Option

Solution :

(d)

Using Rice theorem, both  $L_1$  and  $L_2$  are Not decidable.

$L_1$ : "Accepting all even numbers" is non-trivial property of RE languages. Hence, by Rice theorem,  $L_1$  is Undecidable. Property "containing at least 3 strings" is non-trivial property of RE languages.

#### QUESTION ANALYTICS

Q. 47

FAQ

Solution Video

Have any Doubt?



Which of the following is a poset?

Is  $(S, R)$  a poset if  $S$  is the set of all people in the world and  $(a, b) \in R$ , where  $a$  and  $b$  are people,

A If  $a$  is taller than  $b$

B  $a$  is not taller than  $b$

Correct Option

C  $a = b$  or  $a$  is an ancestor of  $b$

Correct Option

D All of above

YOUR ANSWER - NA

CORRECT ANSWER - b,c

STATUS - SKIPPED

Solution :

(b, c)

A relation  $R$  on a set  $A$  is reflexive if  $(a, a) \in R$  for every element  $a \in A$ .

A relation  $R$  on a set  $A$  is antisymmetric if  $(b, a) \in R$  and  $(a, b) \in R$  implies  $a = b$ .

A relation  $R$  on a set  $A$  is transitive if  $(a, b) \in R$  and  $(b, c) \in R$  implies  $(a, c) \in R$ .

$S = \text{Set of all people in the world}$

(a)

$R = \{(a, b) \mid a \text{ is taller than } b\}$

$R$  is not reflexive, because an individual is not taller than themselves.

$R$  is antisymmetric, because  $(a, b) \in R$  and  $(b, a) \in R$  cannot both be true at the same time (if  $a$  is taller than  $b$ , then  $b$  cannot be taller than  $a$ ).

$R$  is transitive, because if  $(a, b) \in R$  and  $(b, c) \in R$ , then  $a$  is taller than  $b$  and  $b$  is taller than  $c$ , which implies that  $a$  is taller than  $c$  and thus  $(a, c) \in R$ .

$(R, S)$  is not a poset, because  $R$  is not reflexive.

(b)  $R = \{(a, b) \mid a \text{ is not taller than } b\}$

$R$  is reflexive, because an individual is not taller than themselves.

$R$  is antisymmetric, because  $(a, b) \in R$  and  $(b, a) \in R$  implies  $a$  is not taller than  $b$  and  $b$  is not taller than  $a$ . Both statements can only be true if  $a = b$ .

$R$  is transitive, because if  $(a, b) \in R$  and  $(b, c) \in R$ , then  $a$  is not taller than  $b$  and  $b$  is not taller than  $c$ , which implies that  $a$  is not taller than  $c$  and thus  $(a, c) \in R$ .

$(R, S)$  is a poset, because  $R$  is reflexive, antisymmetric and transitive.

(c)  $R = \{(a, b) \mid a = b \text{ or } a \text{ is ancestor of } b\}$

$R$  is reflexive, because all elements with  $a = b$  are included in the relation  $R$ .

$R$  is antisymmetric, because  $(a, b) \in R$  and  $(b, a) \in R$  implies  $(a \text{ is an ancestor of } b \text{ or } a = b)$  and  $(b \text{ is an ancestor of } a \text{ or } a = b)$ ,  $a$  cannot be an ancestor of  $b$  when  $b$  is an ancestor of  $a$ , thus the statements can only be true if  $a = b$ .

$R$  is transitive, because if  $(a, b) \in R$  and  $(b, c) \in R$ , then  $(a \text{ is an ancestor of } b \text{ or } a = b)$  and  $(b \text{ is an ancestor of } c \text{ or } b = c)$ , which implies that  $(a \text{ is an ancestor of } c \text{ or } a = c)$  and thus  $(a, c) \in R$ .

$(R, S)$  is a poset, because  $R$  is reflexive, antisymmetric and transitive.

(d) False as option (a) is the right answer.

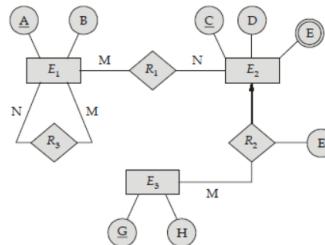
#### QUESTION ANALYTICS



Q. 48

[FAQ](#)[Have any Doubt ?](#)

Consider the following relation:



What is the minimum number of relations required for building relational model of the above ER model?

6

Correct Option

Solution :

6

Total 6 relations are required based on the following analysis:

- For entity  $E_1$  and  $E_2$ , we need 4 relations in minimum. Because the relation between  $E_1$  and  $E_2$  is many-to-many, therefore  $R_1$  will have a separate relation as well as  $E_2$  consist of a multivalued attribute. Thus, it will form a separate relation. Hence, we have relation for  $E_1$ ,  $R_1$ ,  $E_2$  and  $E$ . Therefore, # of relation = 4.
- For entity  $E_2$  and  $E_3$ ,  $E_3$  will have separate relation because of the one-to-many relation ( $R_2$ ) between them. Therefore, # of relations = 5.
- For self referential + many-to-many + both side partial relation  $R_3$  will result in one separate relation. Therefore, # of relations = 6.

Hence, the total number of relations required for the above ER diagram are 6

QUESTION ANALYTICS



Q. 49

[FAQ](#)[Have any Doubt ?](#)

Consider the following statements:

A TSL instruction set is a busy waiting solution.

Correct Option

B If the P() and V() semaphore operations are not executed atomically, then mutual exclusion can be violated.

Correct Option

C Binary semaphore implementation does not satisfy bounded waiting

D Binary semaphore is applicable only for two processes.

YOUR ANSWER - NA

CORRECT ANSWER - a,b

STATUS - SKIPPED

Solution :

(a, b)

QUESTION ANALYTICS



Q. 50

[FAQ](#)[Solution Video](#)[Have any Doubt ?](#)

A RAM chip has a capacity of 1024 words of 8 bits each. The number of 2-to-4 decoders with enable lines needed to construct a  $16 \times 16$  RAM system will be \_\_\_\_\_.

5

Correct Option

Solution :

5

To construct a memory system with 16 K words using  $1024 \times 8$  RAM chips, we have to connect 16 such chips in parallel. The decoder will have to select one of the 16 chips. To construct a  $4 \times 16$  decoder, we require  $5 \times 4$  decoders.

QUESTION ANALYTICS





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**Q. 51**
[▶ Solution Video](#)
[Have any Doubt ?](#)


Which one of the following represent the array if bubble sort to sort the elements in ascending order is run after one iteration

A 1, 2, 5, 7, 8, 6, 4, 3, 9

[Correct Option](#)

B 1, 2, 5, 6, 7, 8, 4, 3, 9

[Correct Option](#)

C 3, 2, 5, 9, 8, 6, 4, 1, 7

D None of these

YOUR ANSWER - NA

CORRECT ANSWER - a,b

STATUS - SKIPPED

**Solution :**

(a, b)

After one iteration the greatest element reaches its correct position i.e. the last position, out of all the options only in option (b). The largest element is not present in the last position.

In the options (a) and (b) the largest element that is 9 is present in the last position but in case of the (c) option it is not the case, therefore (c) option is not a possible outcome after one iteration of the bubble sort.

QUESTION ANALYTICS


**Q. 52**
[FAQ](#)
[▶ Solution Video](#)
[Have any Doubt ?](#)


For order M, the root node will have keys between 1 to 2 M and for other nodes keys will be in between M to 2 M, where the size of the disk block is given as 2048 bytes while the block pointer and record pointer are of 30 and 25 bytes respectively. Which of the following is correct regarding the order of the B<sup>+</sup> tree if the size of the search key is given as 20 bytes.

A  $M_{leaf} = 20$  and  $M = 22$

[Correct Option](#)

**Solution :**

(b)

The definition of order given in the question is based on number of keys. Since, order will be based on maximum occupancy which is given as 2 M keys.

Order for non-leaf node of B<sup>+</sup> tree:

$$\Rightarrow M_b * (2M) + M_k * (2M - 1) \leq B \\ \Rightarrow 30 * 2M * (2M - 1) \leq 2048 \\ \Rightarrow 60M + 40M - 20 \leq 2048 \\ \Rightarrow 100M \leq 2068$$

$$\Rightarrow M = \frac{2068}{100} = 20.68 = 20$$

Order of leaf node of B<sup>+</sup> tree:

$$\Rightarrow M_b * 1 + (M_k + M_r) * 2M \leq B \\ \Rightarrow 30 * 1 + (20 + 25) * 2M \leq 2048 \\ \Rightarrow 90M \leq 2048 - 30 \\ \Rightarrow M = \frac{2018}{90} = 22.4 = 22$$

C  $M_{leaf} = 20$  and  $M = 20$

D  $M_{leaf} = 23$  and  $P = 22$

QUESTION ANALYTICS


**Q. 53**
[FAQ](#)
[▶ Solution Video](#)
[Have any Doubt ?](#)


The minimum levels of B<sup>+</sup> tree index required for 5000 keys and order of B<sup>+</sup> tree node (P) is 10 are \_\_\_\_\_. (Assume P is the max pointer possible to store in B+ tree node)

4

[Correct Option](#)

**Solution :**

4

Maximum number of keys in B<sup>+</sup> tree of order 10 and height H is:

$$10^{(H+1)} - 1 = 5000$$

$$10^{(H+1)} = 5001$$

$H + 1 = 4$   
 $H = 3$   
 If we consider root at level 1 than level = height + 1  
 So, number of levels = 4.

#### QUESTION ANALYTICS

Q. 54

FAQ Solution Video

Have any Doubt?



When elements of priority queue are used for creating max-heap. And initially there are 6 elements in this. 20, 16, 10, 6, 4, 2. Then after constructing max heap find. No of swaps after inserting 2 more elements '3' and '9' and then deletion of root element.

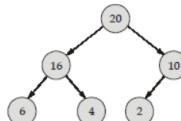
3

Correct Option

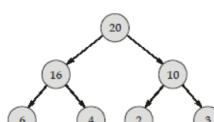
Solution :

3

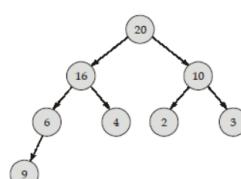
Step 1: The max heap for the given elements is



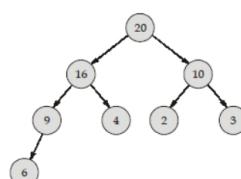
Step 2: Insert 3 in the heap



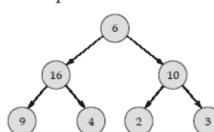
Step 3: Insert 9



Swap 6 and 9



After deleting the root node the heap is



Please note that for deletion of the root node we need to swap the leaf node with root node.

There after as mentioned we will have 2 swaps.

Total number of swaps are 1(insertion) + 2(swaps after deletion) = 3.

#### QUESTION ANALYTICS

Q. 55

Solution Video

Have any Doubt?



Which statement is correct about TCP congestion and flow control?

- A Three duplicate ACK means the strong possibility of congestion.
- B After sending a segment TCP always wait for ACK before sending a new segment.
- C Congestion avoidance is applied when the timeout occurs in AIMD.

- D The rate of increase of window size in the slow-start phase is more than the congestion avoidance phase.

Correct Option

Solution :

(d)

1. Three duplicate ACK means the weak possibility of congestion in TCP.
2. TCP does not wait for ACK after sending the segment because next coming higher ACK will nullify the effect of individual ACK's.
3. After timeout we do not apply the congestion avoidance phase but we apply the slow start phase.
4. Yes in slow start the window size grows exponentially but in the congestion avoidance phase the window size grows linearly.

Q. 56

[▶ Solution Video](#)[Have any Doubt ?](#)

For what value of the constant  $c$  is the function  $f$  continuous on  $(-\infty, \infty)$ ?

$$f(x) = \begin{cases} cx^2 + 2x, & \text{if } x < 2 \\ 2x + 4, & \text{if } x \geq 2 \end{cases}$$

1

Correct Option

**Solution :**

1

**Continuity:**

$y_1 = cx^2 + 2x$  is continuous on  $(-\infty, 2)$  as a polynomial for all  $c$

$y_2 = 2x + 4$  is continuous on  $[2, +\infty)$  as a polynomial

We check continuity at  $x = 2$ 

- $f(2) = 2.2 + 4 = 8$
  - $\lim_{x \rightarrow 2^-} (cx^2 + 2x) = 4c + 4$
  - $\lim_{x \rightarrow 2^+} (2x + 4) = 8$
- $$\Rightarrow 4c + 4 = 8 = 4c = 4$$
- $$c = 1$$

$\Rightarrow$  For  $c = 1$   $f$  is continuous at  $x = 2$ .

$\Rightarrow$  For  $c = 1$   $f$  is continuous for all  $x \in (-\infty, +\infty)$

Q. 57

[Have any Doubt ?](#)

An empty queue is given in which 5 elements are going to be inserted then for enqueue it is taking 3 sec and for dequeue it is taking 3 seconds. And there is time elapse between enqueue-enqueue and dequeue-dequeue of 1 sec. And for enqueue-dequeue is of 2 seconds. Then calculate the total time of all the 5 elements (from enqueueing all elements to dequeuing all).

**A** 30 sec**B** 39 sec**C** 40 sec

Correct Option

**Solution :**

(c)

Here, first we enqueue all the elements in the queue and then all the elements are dequeued from the queue.

For enqueue 5 elements =  $3 \times 5 = 15$ , 4 gaps = 4 elapsed time

For enqueue-dequeue = 2 because just after inserting 5<sup>th</sup> element, we are performing dequeue.

For dequeue 5 elements =  $3 \times 5 = 15$ , 4 gaps = 4 elapsed time

So total time =  $15 + 4 + 2 + 15 + 4 = 40$  sec

**D** 55 sec

Q. 58

[Have any Doubt ?](#)

Consider three CPU intensive processes, which require 10, 20 and 30 units of time and arrive at times 0, 2 and 6 respectively. How many context switches are needed if the operating system implements a shortest remaining time first scheduling algorithm? Do not count the context switches at time zero and at the end.

**A** 1**B** 2

Correct Option

**Solution :**

(b)

Shortest remaining time first: Select the process with the smallest amount of remaining time among all the process to execute first.

So here we will 1<sup>st</sup> select  $P_1$  then  $P_2$  and at last  $P_3$ .

$P_1$	$P_2$	$P_3$
0 - 10	10 - 30	30 - 60

It is mentioned in question, do not count the context switches at time zero and at the end.

So, we will have take only 2 context switch into account i.e.  $P_1$  to  $P_2$  and  $P_2$  to  $P_3$ .

**C** 3**D** 4

Q. 59

[FAQ](#) [Solution Video](#) [Have any Doubt ?](#)


Number of states in a DFA that accepts the language over the alphabet {0, 1} where words start and end with a 1, have even length and where any 0 in the word is immediately followed by at least a 1  
 A. Example of accepted words: 1011, 101101, 1111  
 B. Example of non accepted words: 101, 1001, 010

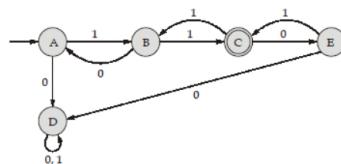
5

Correct Option

**Solution :**

5

Possible strings in the language is = {11, 1011, 101111, 101011 .....



Q. 60

[Solution Video](#) [Have any Doubt ?](#)
In the Floyd Warshall algorithm for all pairs shortest path. The matrix  $D^i$  represents

- A The shortest paths of length  $i$  in between all the vertices.
- B The shortest path of the first  $i$  vertices among themselves.
- C Intermediate paths of length  $i$  in the shortest path between all pairs of vertices.
- D None of above

Correct Option

**Solution :**

(d)

 $D^i$  in the Floyd Warshall algorithm represents the shortest paths between all the vertices including the vertices labelled  $\leq i$ .



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**Q. 61**

We are sending a packet from the source to the router. The router supports the maximum of M bytes of the fragment, the intermediate fragment payload size is 32 bytes. The size of the header supported is of 20 bytes, for some fragment whose (MF bit = 1), what is the fragment number for an offset value is 24?

7

[Correct Option](#)
**Solution :**

7 MF = 1 means intermediate fragment

Size of payload = 32 B

Offset range of 1<sup>st</sup> packet:

$$\frac{32}{8} = 4 \text{ (0 to 3)}$$

Fragment number of offset value 24 is 7.

0 to 3 = 1<sup>st</sup>

4 to 7 = 2<sup>nd</sup>

8 to 11 = 3<sup>rd</sup>

12 to 15 = 4<sup>th</sup>

16 to 19 = 5<sup>th</sup>

20 to 23 = 6<sup>th</sup>

24 to 27 = 7<sup>th</sup>

So 7<sup>th</sup> fragment for offset 24.

QUESTION ANALYTICS


**Q. 62**
[Solution Video](#)
[Have any Doubt?](#)


The function  $y = |2 - 3x|$

A is continuous  $\forall x \in R$  and differentiable  $\forall x \in R$

B is continuous  $\forall x \in R$  and differentiable  $\forall x \in R$  except  $x = \frac{3}{2}$

C is continuous  $\forall x \in R$  and differentiable  $\forall x \in R$  except  $x = \frac{2}{3}$

[Correct Option](#)
**Solution :**

(c)

$$y = \begin{cases} 2-3x, & 2-3x \geq 0 \\ 3x-2, & 2-3x < 0 \end{cases}$$

$$\Rightarrow y = \begin{cases} 2-3x, & x \leq \frac{2}{3} \\ 3x-2, & x > \frac{2}{3} \end{cases}$$

As y is polynomial it is continuous and differentiable at all points but do not know at  $x = \frac{2}{3}$ .

To check continuity at  $x = \frac{2}{3}$

$$\text{Left limit} = 2 - 3 \times \frac{2}{3} = 0$$

$$\text{Right limit} = 3 \times \frac{2}{3} - 2 = 0$$

$$f(a) = f\left(\frac{2}{3}\right) = 2 - 3 \times \frac{2}{3} = 0$$

LL = RL = f(a), y is continuous  $\forall x \in R$

To check differentiability at  $x = \frac{2}{3}$

Left derivative =  $0 - 2 = -3$

Right derivative =  $3 - 0 = 3$

$$\therefore LD \neq RD, y \text{ is not differentiable at } x = \frac{2}{3}$$

D is continuous  $\forall x \in R$  except  $x = 3$  and differentiable  $\forall x \in R$

QUESTION ANALYTICS


**Q. 63**
[FAQ](#)
[Solution Video](#)
[Have any Doubt?](#)


A 5 stage pipelined processor has the following stages:  
IF : Instruction fetch, ID : Instruction decode, EX : Execute  
MA : Memory access, WB : Write back  
IF → ID → EX → MA → WB  
Each stage needs one cycle for all instructions.  
 $I_1$  : Load  $R_{1'}$  [1000] :  $R_1 \leftarrow M[1000]$   
 $I_2$  : Load  $R_{2'}$  [5 $R_1$ ] :  $R_2 \leftarrow M[R_1 + 5]$   
 $I_3$  : MUL  $R_{4'}$   $R_{1'}$   $R_3$  :  $R_4 \leftarrow R_1 \times R_3$   
 $I_4$  : DIV  $R_{5'}$   $R_{1'}$   $R_4$  :  $R_5 \leftarrow R_4 / R_1$   
 $I_5$  : SUE  $R_{6'}$   $R_{4'}$   $R_5$  :  $R_6 \leftarrow R_4 - R_5$

Number of cycles needed to execute these instructions using operand forwarding is \_\_\_\_\_.

10

Correct Option

Solution :  
10

	1	2	3	4	5	6	7	8	9	10	11
$I_1$	IF	ID	EX	MA	WB						
$I_2$		IF	ID	EX	MA	WB					
$I_3$			IF	ID		EX	MA	WB			
$I_4$				IF		ID	EX	MA	WB		
$I_5$					IF		ID	EX	MA	WB	

QUESTION ANALYTICS



Q. 64

Have any Doubt ?



What will be the output of this code?

```
int main()
{
    int a[4] = {5, 6, 7, 8};
    int *p = a + 3;
    printf("%d", p[-2]);
    return 0;
}
```

6

Correct Option

Solution :  
6

Here, we are assuming array elements are stored in array with initial address 1000 then

Address	1000	1004	1008	1012
Value	5	6	7	8

Here,  $*p = a + 3$  means moving pointer after crossing 3 elements

$*p = a + 3 = 1012 = 8$  // here it will point to address 1012 which is storing element 8

$p[-2] = *(p - 2)$  it means go back skipping two elements.

So, now  $p$  will point to value 6.

QUESTION ANALYTICS



Q. 65

Solution Video

Have any Doubt ?



We have a  $2 \times 1$  MUX (where  $I_0$ ,  $I_1$  are the input lines, and  $S_0$  is the select line). We want to implement the function  $F = A + B$ , what is the value of  $I_0$ ,  $I_1$  and  $S_0$  respectively?

(A) A, B, 1

(B) B, A, A

Correct Option

Solution :  
(b)

$$F = \bar{S}_0 I_0 + S_0 I_1$$

Now we can check by substituting the given options in the above equation.

For (a)  $F = 0.A + 1.B = B$  therefore, it is wrong option

For (b)  $F = A'.B + A.A = A'.B + A = (A + A') . (A + B) = 1.(A + B) = (A + B)$

For (c)  $F = 0'B + 0B = B$  therefore, it is wrong option

Hence, the answer is option (b).

(C) 0, B, A

(D) B, A, 0

QUESTION ANALYTICS



