



Kunal Jha
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 Computer Science Engineering(CS)

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FULL SYLLABUS TEST-4 (BASIC LEVEL) (GATE - 2021) - REPORTS

OVERALL ANALYSIS COMPARISON REPORT **SOLUTION REPORT**

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

Q. 1

Solution Video

Have any Doubt ?



Out of the options given below, select whichever word you consider the most appropriate for the blank space.
 Speeding and blocking are traffic offences which lead to ____ accidents.

- A Troublesome
- B Final
- C Great
- D Gruesome

Correct Option

Solution :

(d)

QUESTION ANALYTICS



Q. 2

FAQ Solution Video Have any Doubt ?



Out of the following four sentences, select the most suitable sentence with respect to grammar and usages.

- A Take this medicine when you have eaten food.
- B Take this medicine when you are eating food.
- C Take this medicine when you ate food.
- D Take this medicine when you could eat food.

Correct Option

QUESTION ANALYTICS



Q. 3

Solution Video Have any Doubt ?



An article is sold for Rs 24 with a discount of 20%. If the same article is sold at a discount of 30%, then the new selling price of the article will be

- A Rs. 25
- B Rs. 27
- C Rs. 21

Correct Option

Solution :

(c)

Let the marked price of article is MP
 when 20% discount is given, SP becomes 80% of MP which is Rs. 24
 $80\% \text{ of } MP = 24$
 $\frac{80}{100}MP = 24$
 $MP = \text{Rs. } 30$
 Now if 30% discount is given SP becomes 70% of MP
 $\text{New selling price} = \frac{70}{100} \times 30 = \text{Rs. } 21$

- D Rs. 18

QUESTION ANALYTICS



Q. 4

Solution Video Have any Doubt ?



Given $3^a = 4$, $4^b = 5$, $5^c = 6$, $6^d = 7$, $7^e = 8$, $8^f = 9$. The value of "abcdef" is

A 1

B 2

Correct Option

Solution :

(b)

Given, $3^a = 4$
means $4^b = (3^a)^b$
 $= 3^{ab}$

Like wise keep replacing successive values

We will end up getting 3^{abcdef}

So, $3^{abcdef} = 9$
 $abcdef = 2$

C 3

D 4

QUESTION ANALYTICS



Q. 5

Solution Video

Have any Doubt ?



A vessel can be filled up completely by 3 individual pipes in 10, 15 and 18 hours respectively. If all these three pipes are opened simultaneously, then the 60% of the vessel will be filled in _____ minutes.

162

Correct Option

Solution :

162

Using conventional approach, we can say that if all the 3 pipes are opened simultaneously, in one

hour they will fill up $\frac{1}{10} + \frac{1}{15} + \frac{1}{18} = \frac{9+6+5}{90} = \frac{20}{90} = \frac{2}{9}$ th of vessel. This leads to the entire vessel

getting filled up in $\frac{9}{2}$ hours or 270 minutes. Time required to fill up 60% of the vessel will be
 $270 \times 60\% = 162$ minutes.

QUESTION ANALYTICS



Q. 6

Solution Video

Have any Doubt ?



Two ships left the sea port simultaneously and goes in two mutually perpendicular direction. Half an hour later, the shortest distance between them was 17 km and after another 15 minutes, one ship was 10.5 km move farther from the origin than the other. The speed of both the ships are

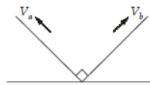
A 16 km/hour and 30 km/hour

Correct Option

Solution :

(a)

Let the speeds of ships are V_a and V_b



Distance between them, after half an hour will be

$$\sqrt{\left(V_a \times \frac{1}{2}\right)^2 + \left(V_b \times \frac{1}{2}\right)^2} = 17$$

$$\left(V_a \times \frac{1}{2}\right)^2 + \left(V_b \times \frac{1}{2}\right)^2 = 17^2$$

$$V_a^2 + V_b^2 = 1156$$

... (i)

⇒ After 45 minutes

$$\frac{3}{4}V_a - \frac{3}{4}V_b = 10.5$$

$$V_a - V_b = 14$$

... (ii)

From equation (i) and (ii), we get

$$V_a = 30 \text{ km/hour}$$

$$V_b = 16 \text{ km/hour}$$

B 18 km/hour and 32 km/hour

C 12 km/hour and 26 km/hour

D 22 km/hour and 36 km/hour

QUESTION ANALYTICS



Q. 7

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

In this question, 2 statement, S_1 and S_2 are given and these 2 statements are followed by 2 conclusions C_1 and C_2 . Read the conclusion and then decide as to which of the following conclusions logically follow based on the given statements.

Statement:

S_1 : All ballet dancers are girls.

S_2 : All girls are beautiful.

Conclusions:

C_1 : All ballet dancers are beautiful.

C_2 : Some girls are ballet dancers.

A Only conclusion C_1 follows.

B Only conclusion C_2 follows.

C Either C_1 follows or C_2 follows.

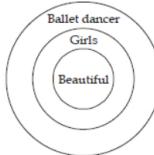
D Both C_1 as well as C_2 follows.

Correct Option

Solution :

(d)

We can represent the given statement as follows :



A look at the diagram drawn leads us to conclude that "All ballet dancer are beautiful". Which is C_1 . Likewise, we can conclude that through all ballet dancer are girls but not all girls are ballet dancer implying C_2 is also a valid conclusion, leading us to option (d).

QUESTION ANALYTICS

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Q. 8

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

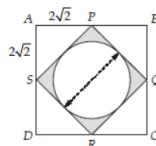
ABCD is a square with each side having a length $4\sqrt{2}$ cm and P, Q, R and S are the mid point of sides AB, BC, CD and DA respectively. A circle is drawn inside the quadrilateral formed by joining PQRS touching all the sides. The area of this circle will be

A $16\pi \text{ cm}^2$

B $4\pi \text{ cm}^2$

Correct Option

Solution :
(b)



Since we are joining midpoints of the sides of the square ABCD

$$\therefore AP = AS = 2\sqrt{2}$$

$$\therefore PS = 4$$

$$\Rightarrow \text{Diameter of circle} = 4 \text{ cm}$$

$$\Rightarrow \text{Area of circle} = \frac{\pi}{4} \times 4^2 = 4\pi \text{ cm}^2$$

C $8\pi \text{ cm}^2$

D $6\pi \text{ cm}^2$

QUESTION ANALYTICS

+

Q. 9

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

In a 100 m race, Ravi beats Sahil by 6 seconds whereas in the same race Sahil beats Tony by 3 seconds. If Ravi beats Tony by 25 meters, then the time taken by Ravi to complete the race is

A 27 seconds

Correct Option

Solution :
(a)

$$\text{Total distance} = 100 \text{ m}$$

Ravi beats Sahil by 6 seconds,

Sahil beats Tony by 3 seconds,

So Ravi beats Tony by 9 seconds

and also given that Ravi beats Tony by 25 m.

It means that, Tony has taken 9 seconds to travel 25 m

... (i)

$$\text{Speed of Tony} = \frac{25}{9} \text{ m/s}$$

... (ii)

From (i) and (ii),

$$\frac{100}{T_{\text{speed}}} - \frac{100}{R_{\text{speed}}} = 9$$

$$\frac{\frac{100}{25}}{9} - R_{\text{time}} = 9$$

$$R_{\text{time}} = 27 \text{ seconds}$$

Time taken by Ravi to complete the race is 27 seconds.

B 54 seconds

C 36 seconds

D 18 seconds

 QUESTION ANALYTICS



Q. 10

 Solution Video

 Have any Doubt?



The calendar for the year 2007 will be the same for the year

A 2024

B 2018

Correct Option

C 2029

Correct Option

D 2032

YOUR ANSWER - NA

CORRECT ANSWER - b,c

STATUS - SKIPPED

Solution :

(b, c)

Number of odd days in one ordinary year = 1

Number of odd days in one leap year = 2

Counting the number of odd days from the year 2007 onwards as follows:

Years	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Odd day	1	2	1	1	1	2	1	1	1	2	1	1

By taking the total odd days accumulated from 2007 to 2017, we get

$1 + 2 + 1 + 1 + 1 + 2 + 1 + 1 + 2 + 1 = 14 \Rightarrow$ Equivalent to '0' odd days

So, 2018 will be ordinary year like 2007

Likewise 2029 will also be ordinary year like 2007,

So 2018 and 2029 have the same calendar as 2007.

 QUESTION ANALYTICS



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Q. 11
[FAQ](#)
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A binary single-precision floating point number contains the sequence of bits 10001111000000000100000000000. Information is stored in the following left-to-right order: sign bit, exponent (-127) and mantissa (with an implied unit bit). Which of the following representations in decimal is equivalent?

 A $2^{31} \times (1 + 2^{-12})$
 B $-1 \times 2^{31} \times (1 + 2^{-12})$
 C $-1 \times 2^{-65} \times (1 + 2^{-10})$
 D $-1 \times 2^{-96} \times (1 + 2^{-11})$

Correct Option

Solution:

(d)

Sign bit S = 1

Biased exponent E = 000 111 11 = 32

True exponent = 32 - 127 = -96

Mantissa F = 0000 0000 0010 ...

 Hence, $1.F = 1.0000 0000 0010 \dots 0 = 1 + 2^{-11}$

Hence, answer is option (d).

 QUESTION ANALYTICS

Q. 12
[FAQ](#)
[Have any Doubt ?](#)


According to the TCP/IP protocol suite, match the following lists:

List-I

- A. ICMP
- B. PPP
- C. DHCP
- D. SCTP
- E. RPC
- F. MIME

List-II

- I. Data link layer
- II. Network layer
- III. Transport layer
- IV. Application layer

 A-I, B-I, C-III, D-II, E-III, F-IV

 B-II, B-I, C-II, D-III, E-IV, F-IV

Correct Option

Solution:

(b)

 C-II, B-II, C-III, D-IV, E-I, F-III

 D-II, B-II, C-IV, D-III, E-II, F-IV

 QUESTION ANALYTICS

Q. 13
[Have any Doubt ?](#)


A CPU has an arithmetic unit that adds bytes and then sets its V, C and Z flag bits as follows. The V-bit is set if arithmetic overflow occurs (in two's complement arithmetic). The C-bit is set if a carry-out is generated from the most significant bit during an operation. The Z-bit is set if the result is zero.

What are the values of the V, C and Z flag bits (in that order) after the 8-bit bytes 1100 1100 and 1000 1111 are added?

 A 000

 B 110

Correct Option

Solution:

(b)

1100 1100

1000 1111

1 0101 1011

There is a carry-out generated from the most significant bit during an operation, so C = 1.

To check overflow, we can check the MSB bits of the two numbers being added. Since, both are 1 but result is 0 hence, overflow has occurred. (Or we can check by seeing that there is out-carry from MSB but there is No in-carry into MSB). Hence, V = 1.

Result is not zero, hence, Z = 0.

 C 111

...

D 0 0 1

QUESTION ANALYTICS

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Q. 14

? FAQ

Have any Doubt ?

Q

Let N^* denote the non-zero natural numbers. Define a binary relation R on $N^* \times N^*$ by $(m, n) R(s, t)$ if $\gcd(m, n) = \gcd(s, t)$. The binary relation R is

A Reflexive, not symmetric, transitive.

B Reflexive, symmetric, transitive.

Correct Option

Solution :

(b)

Reflexive because $(a, b) R(a, b)$.

Symmetric because $\gcd(m, n) = \gcd(s, t)$ implies that $\gcd(s, t) = \gcd(m, n)$.

Transitive because $\gcd(m, n) = \gcd(s, t)$ and $\gcd(s, t) = \gcd(a, b)$ implies that $\gcd(m, n) = \gcd(a, b)$.

C Reflexive, symmetric, not transitive.

D Reflexive, not Symmetric, not transitive.

QUESTION ANALYTICS

+

Q. 15

Have any Doubt ?

Q

If X, Y and Z are boolean variables, which of the following is/are true?

- I. $X \wedge (Y \vee Z) = (X \wedge Y) \vee (X \wedge Z)$
- II. $X \vee (Y \wedge Z) = (X \vee Y) \wedge (X \vee Z)$
- III. $((X \wedge Y) \vee Z) = (Z \vee (Y \wedge X))$

A II only

B I and II only

C I and III only

D All of these

Correct Option

Solution :

(d)

All the statements are true.

Statement I is the distributive property of AND operator over OR operator.

Statement II is the distributive property of OR operator over AND operator.

Statement III uses the commutative property of OR, AND operators.

QUESTION ANALYTICS

+

Q. 16

? FAQ

Have any Doubt ?

Q

Consider the following statements:

- I. If L is a regular language then the set of strings in L of odd length is also a regular language.
- II. If L is a regular language then the set of strings in L of even length is also a regular language.

Which of the above statements is/are true?

A Only I

B Only II

C Both I and II

Correct Option

Solution :

(c)

Let L be any language and let $\text{Even}(L)$ and $\text{Odd}(L)$ be defined as following:

$\text{Even}(L) =$ the set of strings in L of even length

$\text{Odd}(L) =$ the set of strings in L of odd length

Then note that $\text{Even}(L) = L \cap \text{Even}(\Sigma^*)$

Also note that $\text{Odd}(L) = L \cap \text{Odd}(\Sigma^*)$

So, if L is regular then $\text{Even}(L)$ and $\text{Odd}(L)$ will also be regular because $\text{Odd}(\Sigma^*)$ and $\text{Even}(\Sigma^*)$ are both regular and regular languages are closed under intersection.

D None of these

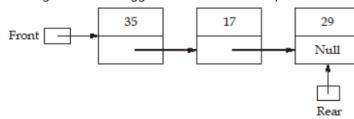
QUESTION ANALYTICS

+

Q. 17

[Have any Doubt ?](#)

The diagram below suggests how we could implement a double-ended linked list, in which we maintain a reference to both the first and last nodes in the linked list.



Which one of the following operations would be inefficient to carry out when there are a large number of elements in the linked list?

- A Insertion at the end to which front refers.
- B Insertion at the end to which rear refers.
- C Deletion from the end to which front refers.
- D Deletion from the end to which rear refers.

Correct Option

Solution :

(d)

In order to delete the node to which rear refers, we need to update the next reference in the **second-to-last** node, and we need to change the rear reference so that it refers to that node. But we don't have a reference to the second-to-last node and thus we would need to begin at the front and traverse almost the entire list to obtain a reference to that node before we could perform the deletion. So this operation required $O(n)$ steps, while the other operations all require $O(1)$ steps.

QUESTION ANALYTICS



Q. 18

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

Given a hash table and its hashing function $h(x) = x \bmod 10$.

The keys 24, 89, 18, 39, 48, 69 are inserted into the above hash table. Determine the number of times the collisions occur at location 8 after insertion last element into the hash table using linear probing.

- A 1 time

Correct Option

Solution :

(a)

0	39
1	48
2	69
3	
4	24
5	
6	
7	
8	18
9	89

18 is placed at position 8 without any collision while placing 48 one collision will occur at position '8'.

- B 0 time
- C 2 times
- D None of these

QUESTION ANALYTICS



Q. 19

[Have any Doubt ?](#)

Consider the basic block B :

$$\begin{aligned} q &= 3 \\ r &= 10 \\ s &= q + r \\ t &= 2 \times r + s \\ t &= q \\ u &= q + r \\ v &= q + t \\ w &= 3 + x \end{aligned}$$

Now consider the following basic block B_2 :

$$\begin{aligned} q &= 3 \\ r &= 10 \\ s &= q + r \\ t &= q \\ u &= q + r \\ v &= q + t \\ w &= 3 + x \end{aligned}$$

State which optimization was performed on the basic block B to get B_2 .

- A Constant propagation/folding
- B Copy photograph

C Common sub-expression elimination

D Dead code elimination

Correct Option

Solution :

(d)

Dead code elimination is a compiler optimization to remove code which does not affect the program results. Removing such code has several benefits: it shrinks program size, an important consideration in some contexts and it allows the running program to avoid executing irrelevant operations, which reduces its running time. It can also enable further optimizations by simplifying program structure. Dead code includes code that can never be executed (unreachable code) and code that only affects dead variables (written to, but never read again), that is, irrelevant to the program. In basic block B, we can replace $t = 2 \times r + s$ is a dead code because t is assigned q in the very next statement making $t = 2 \times r + s$ irrelevant to the program.

 QUESTION ANALYTICS



Q. 20

 Have any Doubt ?



A starvation free job scheduling policy guarantees that no job waits indefinitely for service. Which of the following job scheduling policies is starvation free?

A Round Robin

Correct Option

Solution :

(a)

Round Robin is a fair algorithm and no process starves.

B Priority queuing

C Shortest job first

D Youngest job first

 QUESTION ANALYTICS



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Q. 21
[▶ Solution Video](#)
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If 4 distinct integers a, b, c, d are randomly selected (one after other) from 1 – 20 what is the probability that $a < b < c < d$?

A $\binom{20}{4}$
 $\frac{1}{20^4}$

B $\frac{20P_4}{20^4}$

C $\frac{1}{20^4}$

D $\binom{20}{4}$
 $\frac{1}{20P_4}$

Correct Option

Solution :

(d)

 Among 20 Integers, we first select 4 integers in ${}^{20}C_4$ ways, lets say 15, 7, 8, 10.

 To arrange these 4 selected numbers, we have $4!$ ways.

 Out of these $4!$ ways, only one permutation is there of order $a < b < c < d$, (7, 8, 10, 15).

 So favourable outcome = ${}^{20}C_4$

 Total Outcomes = ${}^{20}C_4 \times 4!$

$$P = \frac{{}^{20}C_4}{20P_4} \text{ or simply } \frac{1}{(4!)}.$$

[QUESTION ANALYTICS](#)

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


Consider the following statements:

- I. $\{a^m b^{2n} \mid m \geq 0 \text{ and } n \geq 0\}$ is regular.
- II. $\{a^p b^{2q} \mid p, q \text{ prime}\}$ is regular.

Which of the above statements is/are true?

A Only I

Correct Option

Solution :

(a)

Language in statement I is regular because it is just any number of a's followed by even number of b's. Language in statement II is not regular because finite automata can't find prime numbers.

B Only II

C Both I and II

D None of these

[QUESTION ANALYTICS](#)

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


Consider the following statements:

- I. If we are given pre-order and post-order traversal of a binary tree, then we can always construct that binary tree uniquely from given pre-order and post-order traversal.
 - II. If we are given pre-order and post-order traversal of a full binary tree, then we can always construct that binary tree uniquely from given pre-order and post-order traversal.
- (Note that a Full binary tree is a tree in which every node has either 0 or 2 children.)

Which of the above statements are correct?

A Only I

B Only II

Correct Option

Solution :

(b)

If we are given pre-order and post-order traversal of a binary tree, then we can not always construct that binary tree uniquely from given pre-order and post-order traversal, we need Inorder traversal to uniquely construct binary tree along with pre-order or post-order. But if we are given pre-order and post-order traversal of a full binary tree, then we can always construct that binary tree uniquely from given pre-order and post-order traversal. In general, if a node has only one subtree, then the pre-order and post-order traversals do not give you enough information to determine which side the subtree goes on. Since, for full binary tree, no node has only one subtree, hence, we can

uniquely construct full binary tree using preorder and postorder.

C Both I and II

D None of these

QUESTION ANALYTICS



Q. 24

? FAQ

Have any Doubt?



Which of the following inference system is valid?

A $((p \vee q) \rightarrow r, r) \Rightarrow \neg p$

B $(p, \neg p \leftrightarrow q) \Rightarrow \neg q$

Correct Option

Solution :

(b)

Option (b) is valid inference because if p is true then $p \rightarrow q$ will make q false and hence, $\neg q$ is true.

C $(p \wedge q \rightarrow r, \neg r) \Rightarrow (p \vee q)$

D $(p \wedge q) \Rightarrow (p \leftrightarrow \neg q)$

QUESTION ANALYTICS



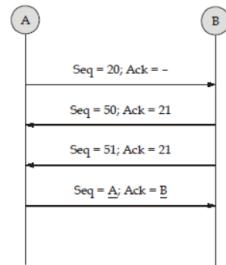
Q. 25

? FAQ

Have any Doubt?



Consider the following figure for TCP connection release.



What will be B values, if A is 21?

52

Correct Option

Solution :

52

B = 52

QUESTION ANALYTICS



Q. 26

? FAQ

Solution Video

Have any Doubt?



Which of the above statement(s) are correct?

A Every BCNF decomposition is dependency preserving.

B A necessary condition for a relation to be in 2NF but not in 3NF is that some non-prime attribute must be determined by a non-prime attribute or a set containing a non-prime attribute

Correct Option

C If relation R is in 3NF and every key is simple, then R is in BCNF.

Correct Option

D A necessary condition for a relation to be in 3NF but not in BCNF is that it should have overlapping candidate keys - two candidate keys of two or more attributes and at least one common attribute.

Correct Option

YOUR ANSWER - NA

CORRECT ANSWER - b,c,d

STATUS - SKIPPED

Solution :

(b, c, d)

(a) False (not necessary that every BCNF is dependency preserving).

(b) True

(c) True

(d) True

QUESTION ANALYTICS



Q. 27

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

Consider the following statements:

- I. In a preorder traversal of a binary search tree (with more than 2 elements), the first item printed out can never be the smallest one.
- II. In a preorder traversal of a min heap, the first item printed out is always the smallest one.
- III. In a preorder traversal of a AVL tree (with more than 2 elements), the first item printed out can never be the smallest one.

Which of the above statements is/are true?

 A Only I

 B Only III

 C Both II and III

Correct Option

Solution :

(c)

AVL tree is the balanced binary search tree, so, we can never have the smallest element at the root node. In BST if BST is right skewed then smallest element is on root node. In min-heap smallest element is always on the root node.

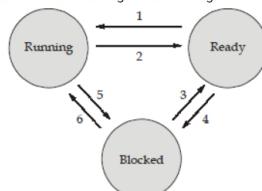
 D All of these

+

Q. 28

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

Consider the following transition diagram in which a thread moves between each of the 3 states:



Below we give some conditions that cause the thread to move between each of the 3 states, and causes each arrow:

- P. Process is scheduled and run by the scheduler
- Q. Time slice runs out, but process is still wanting to run.
- R. I/O completes, or lock is acquired. Woken up by a semaphore or conditional.
- S. Any blocking action. I/O request, lock blocks.

Match the transitions in the diagram with the conditions that cause them:
Which of the following is/are correct?

 A 1-P

Correct Option

 B 2-Q

Correct Option

 C 6-R

 D 5-S

Correct Option

YOUR ANSWER - NA

CORRECT ANSWER - a,b,d

STATUS - SKIPPED

Solution :

(a, b, d)

+

Q. 29

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

A 64-bit processor has '64' registers and uses '20' bit instruction format. It has two types of instructions: M-type and R-type. Each M-type instruction contains an opcode, and a memory address. Each R-type instruction contains an opcode and two register names. Main memory is 8 K words, and it is byte addressable.
If there are 6 distinct R-type opcodes, then the maximum number of distinct M-type opcodes is _____.

 15

Correct Option

Solution :

15

$$\text{Main memory} = 8 \text{ K words and } 1 \text{ word} = 64 \text{ bit} = 8 \text{ B}$$

$$\text{So, } 8 \text{ K} \times 8 \text{ B} = 64 \text{ KB}$$

$$\text{Instruction length is } 20, \text{ so, maximum possible encodings} = 2^{20}$$

It is given that there are 6 R-type instructions.

Let's assume the maximum M-type instructions to be x.

Therefore,

$$2^{20} \geq (6 \times 2^{12}) + (x \times 2^{16})$$

$$x \leq 15.6$$

So, maximum 15 M-type instructions possible.

+

Q. 30

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

Q. 34
Let R = (A, B, C), S = (C, D, E)

- I. $\{<a> \mid \exists b (<a, b> \in r \wedge b = 10)\}$
- II. select A from r where B = 10
- III. select * from r except select * from s
- IV. select * from r where (A, B, C) not in (select * from s)

Consider the following queries:

Which of the following is/are true? (Two queries are said to be equivalent when they produce same output i.e. same set of records. Note- Assume distinct tuples are returned by SQL)

A Query I and II are equivalent.

Correct Option

B Query I and IV are equivalent.

C Query II and IV are equivalent.

D Query III and IV are equivalent.

Correct Option

YOUR ANSWER - NA

CORRECT ANSWER - a,d

STATUS - SKIPPED

Solution :

(a, d)

 QUESTION ANALYTICS

+

Item 21-30 of 65 « previous 1 2 3 4 5 6 7 next »



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

Q. 31

? FAQ ▶ Solution Video ⚡ Have any Doubt ?

How many minimum number of NAND gates do you need to realize $F(A, B) = \overline{A + B}$, when variables are only available in original form, not in complementary form?

A 2

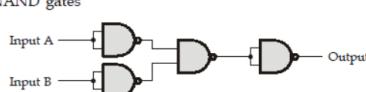
B 3

C 4

Correct Option

Solution :

(c) NOR gate from NAND gates



So 4 NAND gate required. Option (c) is the correct answer.

D 5

QUESTION ANALYTICS

Q. 32

? FAQ ⚡ Have any Doubt ?

Consider the following grammar:

E → E(T) | T

T → T * F | id

F → (id)

Which of the following can be the correct handle in bottom up parsing for the above grammar?

A id * (id)

B id * F

C E(id)

D (id)

Correct Option

Solution :

(d)

Handle is the right hand side part of any production that helps in the reduction to a non-terminal at LHS in bottom up parsing.

⇒ (id) is RHS part of production F.

∴ Option (d) is correct.

QUESTION ANALYTICS

Q. 33

? FAQ ⚡ Have any Doubt ?

Suppose a complete binary tree of n elements is stored in an array A in the standard fashion. That is, store the root in A[1] and for every node stored in A[k], store its children in A[2k] and A[2k + 1]. Consider the following statements:

I. A list of the array elements A[1], A[2], A[3], ..., A[n] forms a breadth first traversal of the complete binary tree.

II. A list of the array elements A[1], A[2], A[3], ..., A[n] forms a depth first traversal of the complete binary tree.

III. A list of the array elements A[1], A[2], A[3], ..., A[n] forms a pre-order traversal of the complete binary tree.

Which of the above statements are true?

A I only

Correct Option

Solution :

(a)

Complete binary tree is a binary tree in which all the levels are completely full except maybe the last level and all the nodes in the last level are as far left as possible. So, when we store a complete binary tree in array in standard fashion as described in the question, we basically are storing elements in the breadth first traversal order.

B I and III only

C II and III only

D None of these

Q. 34

FAQ Solution Video Have any Doubt ?

An $n \times n$ array v is defined as follows:

$$v[i, j] = i + j \text{ for all } i, j, i \leq n, 1 \leq j \leq n$$

The sum of the elements of the array v is

A $n \times n(3n + 1)$

B $2n \times n(n + 1)$

C $n \times n(n + 1)$

Correct Option

Solution :

(c)

First row will have values: 2, 3, 4, 5, ..., $n + 1$

Second row will have values: 3, 4, 5, 6, ..., $n + 2$

Third row will have values: 4, 5, 6, 7, ..., $n + 3$

And so on...

n^{th} row will have values: $n + 1, n + 2, n + 3, \dots, n + n$

Summation of first row will be $n(3 + n)/2$

This much summation will come from each row i with additional summation of $(i - 1)n$, for each i .

So, total = $n(n(n + 3)/2) + n + 2n + 3n \dots + (n - 1)n = n \times n(n + 1)$

OR

Make a 3×3 matrix using the given rule you will get sum of all elements as 36. Now check all the options by putting 3 in each.

D $n \times n(n + 1)/2$

Q. 35

FAQ Have any Doubt ?

Consider the following statements regarding set of "All non-regular" languages:

- I. It is closed under union.
- II. It is closed under concatenation.
- III. It is closed under complementation.
- IV. It is an uncountable set.

Which of the above statements is/are correct?

A IV only

B II and IV only

C III and IV only

Correct Option

Solution :

(c)

Complement of non-regular language is always a non-regular language. We can show it by contradiction. Let L be a non-regular language and L^c be regular. So now since we know that regular languages are closed under complementation, $(L^c)^c$ i.e. L must be regular, which is not true.

We can use the above result to show that non-regular languages are not closed under union. Let L be a non-regular language, L^c be its complement. We know $L \cup L^c = \Sigma^*$, which is regular.

Set of non-regular languages is not closed under concatenation, to show that let's take two non-regular languages as follows:

$$L_1 = \{\epsilon, a\} \cup \{a^n \mid n \text{ is a prime number}\}$$

$$L_2 = \{\epsilon\} \cup \{a^n \mid n \text{ is a composite number}\}$$

L_1 and L_2 both languages are non-regular language (CSL) but $L_1 \cdot L_2$ is Σ^* i.e. regular.

And since set of non-regular languages contain not RE language too, so, it is an uncountable set.

D II, III and IV only

Q. 36

FAQ Have any Doubt ?

Let T denote a non empty binary tree in which every node either is a leaf or has two children. Then,

$n(T)$ denotes the number of non-leaf nodes of T (where $n(T) = 0$, if T is a leaf),

$h(T)$ denotes the height of T (where $h(T) = 0$, if T is a leaf),

T_L denotes the left subtree of T and T_R denotes the right subtree of T .

If F is a function defined by

$$F(T) = \begin{cases} 0 & \text{if } T \text{ is a leaf} \\ F(T_L) + F(T_R) + \min(h(T_L), h(T_R)) & \text{otherwise} \end{cases}$$

Then $F(T) =$

A $n(T) + h(T) - 1$

B $n(T) + h(T)$

C $n(T) - h(T) - 1$

D $n(T) - h(T)$

Correct Option

Solution :

(d)
A simple trick answers this question completely. So consider a tree which has just one node which is the root node. For this tree, we have $n(T) = 0$, $h(T) = 0$ and $F(T) = 0$. This makes choices (a), (c) to be incorrect. Now consider a tree with three nodes (one parent node with two children). For such a tree, we have $n(T) = 1$, $h(T) = 1$ and $F(T) = 0$. This makes choice (b) incorrect.
Hence the answer is choice (d).

QUESTION ANALYTICS



Q. 37

? FAQ

Have any Doubt ?



Consider the following algorithm for a solution to the critical section problem for two processes.
Here turn = 0 indicates process P_0 and turn = 1 indicates process P_1

```

bool flag[2] = {false, false};
turn = 0 or 1
do
{
    flag[i] = true;
    while (flag[j])
    {
        If (turn == j)
        {
            flag[i] = false;
            while (turn == j);
            flag[i] = true;
        }
        /* Critical Section */
        turn = j;
        flag[i] = false;
        /* Remainder Section */
    } while (true);
}

```

Which of the following is false?

A Mutual exclusion is satisfied.

B Progress is satisfied.

C Bounded waiting is satisfied.

D Deadlock may occur.

Correct Option

Solution :

(d)
This algorithm is called Dekker's solution.

1. Mutual exclusion: There are two cases to consider:
(a) A process is inside the C.S.: Without loss of generality, assume process j is inside the C.S. Before entering the C.S. the process sets its own flag to 1. If process i tries to enter the C.S. it will see that $\text{flag}[j]$ is up and gets caught up in the while loop. It will continue in the while loop until the other process sets its own flag to 0, which happens only at the end of the C.S.
(b) Two processes are trying to enter simultaneously: In this situation, if both processes reach their respective while loop at the top, then the variable turn will ensure that only one of them passes through. The variable turn is alternating between the allowing either process, and is only modified at the exit of a C.S.
2. Progress: There are two cases to consider:
(a) One process is trying to enter with no competition: In such a case, the flag of the other process is down, and the process goes past the while look into the critical section directly.
(b) Two processes are trying to enter simultaneously: In this case if the first process is trapped into the while loop, then the variable turn will make one of the two variables lower its flag and goes into a loop waiting for the variable turn to change (the inner while loop).
The other process whose turn is set by the variable turn will be able to get through.
3. Bounded Waiting: Assume there is a process blocked inside the inner while loop, while another process is in C.S. In such a case, if the process inside the critical section tries to reenter, it will be blocked because on exit of the C.S. it has already set the variable turn to point to the other process. Therefore, the process that just got out of the C.S. will be forced to wait for its own turn. So, bounded waiting is taken care of.

QUESTION ANALYTICS



Q. 38

? FAQ

Have any Doubt ?



In a certain pipelined processor a branch instruction can cause 2 stalls if it is not dealt properly. We can avoid this penalty if a clever compiler can fill the immediate next 2 slots with independent instructions. Two compilers A and B generate code for this processor.
Compiler A can fill the first delay slot 35% of the time and second delay slot 85% of the time.
Compiler B can fill the first delay slot 20% of the time and second delay slot 100% of the time.
Assume that 30% of the instructions are branch instructions. What is the % of the improvement in CPI (Clocks Per Instruction) with compiler A over compiler B?

A 0

Correct Option

Solution :

(a)
Let's call the system with compiler A, B as system A, B respectively.
30% of the instructions are branch instructions.
For remaining 70% instructions, both systems will take 1 cycle per instruction.
For these 30% branch instructions:
System A: Compiler A can fill the first delay slot 35% of the time (which means 65% of the time there will be a stall cycle) and second delay slot 85% of the time (which means 15% of the time there will be a stall cycle).
So, number of stalls per branch instruction: $[(0.65) + (0.15)] = 0.80$
System B: Compiler B can fill the first delay slot 20 % of the time (which means 80% of the time there will be a stall cycle) and second delay slot 100 % of the time(there will be No stall cycle). So, number of stalls per branch instruction: $[(0.80) + (0.00)] = 0.80$
Hence, % of the improvement in CPI (Clocks Per Instruction) with compiler A over compiler B is 0%.

B 5

C 10

D 15

QUESTION ANALYTICS



Q. 39

? FAQ Have any Doubt ?



Let $S = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$. What is the smallest integer K such that any subset of S of size K contains two disjoint subsets of size two, $\{x_1, x_2\}$ and $\{y_1, y_2\}$, such that $x_1 + x_2 = y_1 + y_2 = 9$?

A 8

B 6

C 7

Correct Option

Solution :

(c)

We must have two disjoint pairs of elements such that their sum is 9. Total such pairs possible is 5.

$\{0, 9\}, \{1, 8\}, \{2, 7\}, \{3, 6\}, \{4, 5\}$.

So, we can apply pigeon hole principle, in worst case, select one element from each pair and then if we select 2 more elements then we are guaranteed to have a set which contains two disjoint subsets of size two, $\{x_1, x_2\}$ and $\{y_1, y_2\}$, such that $x_1 + x_2 = y_1 + y_2 = 9$.

D 5

QUESTION ANALYTICS



Q. 40

? FAQ Have any Doubt ?



A direct mapped cache of size 2^n blocks with 2^m word blocks, with word size 4 bytes, will require a tag field whose size is? Assume byte-addressable main memory size as 2^{32} bytes.

A $32 - n + m$

B $32 - n - m$

C $32 - n - m - 2$

Correct Option

Solution :

(c)

Given, main memory size = 2^{32} bytes = 32 bit

Block offset = $2^m \times 4 = 2^{m+2}$

T	n	$m+2$
---	---	-------

$$\begin{aligned} \text{So, } T + n + (m+2) &= 32 \\ T &= 32 - n - m - 2 \end{aligned}$$

So option (c) is the answer.

D $32 - m + n$

QUESTION ANALYTICS





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Q. 41
[FAQ](#) [Have any Doubt?](#)


Let $K(A, B)$ be the complete bipartite graph with A, B being the two parts, and let $|A| = 10, |B| = 17$. Let u, v in A be two different vertices. We obtain a new graph G by adding an edge between u, v . The chromatic number of G is _____?

3
[Correct Option](#)
Solution :
3

Since we have added an edge between u and v , we have to give them different color, say, Red and Blue.
 Since v and u both are adjacent to every vertex of Part B, so, we have to give vertices of part B a different color, say, Green.
 We can give the remaining vertices of part A the color of either u or v .
 So, total 3 colors required minimum which is chromatic number.

[QUESTION ANALYTICS](#)

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


The value printed by the following program is _____.

```
#include <stdio.h>
void foo1 (int* ptr, int num) {
    num = num + 5;
    *ptr = *ptr * num;
    return;
}
void foo2 (int* ptr, int num) {
    num = num - 10;
    *ptr = *ptr / num;
    return;
}
void main( ) {
    int i = 5, j = 10, k = 20;
    foo2 (&j, k);
    foo1 (&i, j);
    printf("%d", i + j);
}
```

31
[Correct Option](#)
Solution :
31

j 's address and k 's value are passed to the function of foo2 .
 foo2 modifies j value to 1 and k value remains same 1's address j 's value are passed to the function of foo1 .
 foo2 modifies i value to 30. j value remains same.
 $\therefore i + j = 31$ will be printed.

[QUESTION ANALYTICS](#)

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


Which of the following languages is undecidable?

A $L_1 = \{M \mid M \text{ is a TM and } L(M) \text{ is infinite}\}.$
[Correct Option](#)
B $L_2 = \{M \mid M \text{ is a TM and } L(M) \text{ is finite}\}.$
[Correct Option](#)
C $L_3 = \{M \mid M \text{ is a TM and } L(M) \text{ is countable}\}.$
D $L_4 = \{M \mid M \text{ is a TM and } L(M) \text{ is uncountable}\}.$
YOUR ANSWER - NA
CORRECT ANSWER - a,b
STATUS - SKIPPED
Solution :
(a, b)

"Being finite" is non-trivial property of RE languages. Hence, by Rice theorem, L_1 is undecidable. Property "being infinite" is non-trivial property of RE languages.
 Every RE language is countable, so "being countable" is trivial property of RE languages. Hence, by Rice theorem, L_1 is decidable. Property "being uncountable" is trivial property of RE languages. So decidable. L_3 : "is countable" is trivial property of RE languages (because EVERY RE language is countable).
 Hence, by Rice theorem, L_3 is decidable. L_4 : "is uncountable" is trivial property of RE languages (because NO RE language is uncountable). Hence, by Rice theorem, L_4 is decidable.

QUESTION ANALYTICS

Q. 44

Solution Video

Have any Doubt ?



What is the worst case running time of the following code in "big O" notation in terms of the variable n. You should give the tightest bound possible.

```
int f3(int n) {
    int sum = 73;
    for (int i = 0; i < n; i++) {
        for (int j = i; j >= 5; j--) {
            sum--;
        }
    }
    return sum;
}
```

A $O(n)$

B $O(n^* n)$

Correct Option

Solution :

(b)
i-loop is running n times and for each $i \geq 5$, j loop is running $(i - 4)$ times.
So, time complexity (roughly) = $1 + 2 + \dots + (n - 5) = O(n^* n)$.

C $O(n^* n^* n)$

D $O(n^* n^* n^* n)$

QUESTION ANALYTICS

Q. 45

FAQ Have any Doubt ?



Consider the following left and right recursive grammars for the language a^* .

$G_1: S \rightarrow aS \mid \epsilon$

$G_2: S \rightarrow Sa \mid \epsilon$

Which of the following is true about shift-reduce parsing of the above two grammars?

A G_1 can be parsed with shift-reduce parser.

Correct Option

B G_2 can be parsed with shift-reduce parser.

Correct Option

C Shift-reduce parser for G_1 requires an unbounded stack size to parse large strings (like a million a's).

Correct Option

D Shift-reduce parser for G_2 requires a constant stack size to parse large strings (like a million a's).

Correct Option

YOUR ANSWER - NA

CORRECT ANSWER - a,b,c,d

STATUS - SKIPPED

Solution :

(a, b, c, d)

Consider what happens with the right recursive grammar for a^* : $S \rightarrow aS \mid \epsilon$. The resulting shift-reduce machine will shift the entire input onto the stack, before performing the first reduction. It will accept in the language, but it requires an unbounded stack size. Now consider $S \rightarrow Sa \mid \epsilon$. This machine will initially reduce by $S \rightarrow \epsilon$ and then alternate between shifting an "a" on to the stack and reducing by $S \rightarrow Sa$. The stack space used is thus constant. In general, using left recursion in grammars to shift-reduce parsers helps limit the size of the stack.

QUESTION ANALYTICS

Q. 46

Have any Doubt ?



Consider the following grammar:

$S \rightarrow rI \mid rSI \mid SS$

Which of the following strings can be generated by this grammar?

A rrIIrl

Correct Option

B rllrrrrl

C rrlrlrlrlrlrl

D rrrlllrlrlrl

Correct Option

YOUR ANSWER - NA

CORRECT ANSWER - a,d

STATUS - SKIPPED

Solution :

(a, d)

The given grammar is grammar for the language "properly balanced parentheses". Here r denote left bracket i.e. "(" and I represents ")". So, answer is option (a), (d) because only (a), (d) is balanced parentheses and (b) and (c) are not.

Q. 47

FAQ Solution Video Have any Doubt ?



Which of the following statements are true?

- A** In a relation R , if some set of attributes X is such that closure set of X contains all the attributes of R i.e. X determines every attribute of R then X is a candidate key of R .

- B** It is possible for a relation to have no non-trivial functional dependencies.

Correct Option

- C** If set of all attributes combined form a candidate key for some relation R then R does not contain any non-trivial FD.

Correct Option

- D** In a relation R , if X is some set of attributes and Y is some prime attribute such that X determines Y is a non-trivial FD. Then R has at least two candidate keys.

Correct Option

YOUR ANSWER - NA

CORRECT ANSWER - b,c,d

STATUS - SKIPPED

Solution :

(b, c, d)

In option (a), in a relation R , if some set of attributes X is such that closure set of X contains all the attributes of R i.e. X determines every attribute of R then X is a super key, not necessarily a candidate key of R . So, option (a) is false. Remaining all are true.

Q. 48

FAQ Solution Video Have any Doubt ?



The lost update anomaly is said to occur if a transaction T_j reads a data item X , then another transaction T_k writes that data item X (possibly based on a previous read), after which T_j writes the data item X . The update performed by T_k has been lost, since the update done by T_j ignored the value written by T_k . Which of the above statements is/are true?

- A** Lost update problem may exist in strict recoverable schedules.

- B** Lost update problem may exist in conflict serializable schedules.

Correct Option

- C** Lost update problem may exist in view serializable schedules.

Correct Option

- D** None of these

YOUR ANSWER - NA

CORRECT ANSWER - b,c

STATUS - SKIPPED

Solution :

(b, c)

In view serializable schedules, there could be lost update problem.

Example:

T_1	T_2	T_3
	R(X)	
W(X)		
	W(X)	
		W(X)

This schedule has lost update problem but it is view serializable (view equivalent to T_2 , T_1 , T_3 serial schedule).

Q. 49

FAQ Solution Video Have any Doubt ?



Which of the below arguments/statements is not correct?

- A** FCFS scheduling results in the shortest possible average response time if the jobs happen to arrive in the ready queue with the shortest completion times first (or, as a special case, if all jobs have the same completion time).

- B** Round Robin scheduling behaves identically to FCFS if all the job lengths are longer than the length of the time slice.

Correct Option

- C** Round Robin scheduling performs poorly compared to FCFS if all the job lengths are less than the time slice length.

Correct Option

- D** The dispatcher is responsible for setting thread priorities.

Correct Option

YOUR ANSWER - NA

CORRECT ANSWER - b,c,d

STATUS - SKIPPED

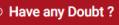
Solution :

(b, c, d)

FCFS scheduling results in the shortest possible average response time if the jobs happen to arrive in the ready queue with the shortest completion times first (or, as a special case, if all jobs have the same completion time).

Round Robin scheduling behaves identically to FCFS if the job lengths are no longer than the length of the time slice. Round Robin scheduling performs poorly compared to FCFS if the job lengths are all the same and much greater than the time slice length. Option (b) is false. The dispatcher is only responsible for switching threads: the scheduler determines the thread priorities, based on the system's

Q. 50

[FAQ](#)
 Have any Doubt ?


A certain pipelined RISC machine has 8 general-purpose registers R_0, R_1, \dots, R_7 and supports the following operations.

- | | |
|---------------------------|--|
| ADD R_{s1}, R_{s2}, R_d | Add R_{s1} to R_{s2} and put the sum in R_d |
| MUL R_{s1}, R_{s2}, R_d | Multiply R_{s1} by R_{s2} and put the product in R_d |

Both these operations use register addressing mode for sources and destination.

An operation normally takes one cycle; however, an operation takes two cycles if it produces a result required by the immediately following operation in an operation sequence. Consider the expression $AB + ABC + BC$, where variables A, B, C are located in registers R_0, R_1, R_2 . If the contents of these three registers must not be modified, what is the minimum number of clock cycles required for an operation sequence that computes the value of $AB + ABC + BC$?

 A 5

 B 6

Correct Option

Solution :

(b)

$R_0 \leftarrow A; R_1 \leftarrow B, R_2 \leftarrow C$

System has only two types of operations, addition and multiplication (both these operations use register addressing mode for sources and destination).

We need to compute $AB + ABC + BC$ in minimum number of clock cycles.

NOTE that An operation normally takes one cycle; however, an operation takes two cycles if it produces a result required by the immediately following operation in an operation sequence.

So, we will try that we don't have to use result of a instruction in the immediately following instruction.

Hence, we can get this sequence:

$R_3 \leftarrow R_0 R_1$ (one cycle)

$R_4 \leftarrow R_1 R_2$ (one cycle)

$R_5 \leftarrow R_3 R_2$ (one cycle)

$R_6 \leftarrow R_3 + R_4$ (two cycle because we have to use this result in next instruction)

$R_7 \leftarrow R_4 + R_5$ (one cycle)

So, total 6 cycles required.

We cannot do better than this.

 C 7

 D 8



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Q. 51

Consider the following instance of the 0/1 Knapsack problem:

 $n = 4, W = 10, (P_1, P_2, P_3, P_4) = (10, 40, 30, 50)$ and $(w_1, w_2, w_3, w_4) = (5, 4, 6, 3)$

What is the maximum profit?

 90

[Correct Option](#)
Solution :

90

The maximum profit is obtained by choosing items 2 and 4.

QUESTION ANALYTICS


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


Consider the following schedule:

 $S = (2, W, x), (1, W, z), (1, W, x), C_1, (2, W, y), (2, R, y), (3, W, z), (3, W, m), C_3, (2, R, m), C_2$

 Where C_i means commit of i^{th} transaction. Triple $(i, W/R, x)$ means transaction i writes/reads item x .

A S is conflict serializable.

B S is view serializable but not conflict serializable.

C S is not view serializable.

[Correct Option](#)
Solution :

(c)

Check for View serializability:

Transaction 2 is reading item m which is written by trans 3, hence, in the view equivalent serial schedule, trans 2 must appear after (not necessarily immediately) trans 3.
 $(3 \rightarrow 2)$ Transaction 1 is doing final write of item x which is also written by trans 2, hence, in the view equivalent serial schedule, trans 1 must appear after (not necessarily immediately) trans 2.
 $(2 \rightarrow 1)$ Transaction 3 is doing final write of item z which is also written by trans 1, hence, in the view equivalent serial schedule, trans 3 must appear after (not necessarily immediately) Trans 1.
 $(1 \rightarrow 3)$ But now we have a contradiction. $3 \rightarrow 2 \rightarrow 1$ but also $1 \rightarrow 3$.
 Hence, not view serializable.

D None of these

QUESTION ANALYTICS


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


Consider table R with attributes A, B, C, D and E. How many maximum possible candidate keys are there for R?

 10

[Correct Option](#)
Solution :

10

 Maximum number of possible candidate keys for n attribute is ${}^nC_{\lceil \frac{n}{2} \rceil}$.

 So ${}^5C_2 = 10$

QUESTION ANALYTICS


Q. 54
[Solution Video](#) [Have any Doubt ?](#)

 Consider n matrices $A_1, A_2, A_3, \dots, A_n$ with dimensions $p_0, p_1, p_2, \dots, p_n$

 Dimension of A_i is $p_{[i-1]} \times p_i$

The optimal solution to find a minimum number of multiplications required to perform

 $A_{[1 \times \dots \times n]} = A_1 \times A_2 \times A_3 \dots \times A_n$, whose size is $p_0 \times p_n$ is given below.

 $m[i, j] = 0; \text{ if } i = j$
 $= \min_{1 \leq k < j} (\text{expr}); i < j$

What is expr?

A $m[i + 1, k + 1] + m[k + 1, j] + p_{i-1} * p_k * p_j$
B $m[i, k + 1] + m[k, j] + p_{i-1} * p_k * p_j$

C $m[i, k] + m[k + 1, j] + p_{i-1} * p_k * p_j$

Correct Option

Solution :
(c)
By dynamic programming, we will get the recurrence relation in option (c) for matrix chain multiplication.

D $m[i, k] + m[k + 1, j] + p_i * p_k * p_j$

QUESTION ANALYTICS

Q. 55

? FAQ

Have any Doubt ?



Consider the following statements:

S_1 : The longer the frames or the shorter the propagation time, the higher utilization can be achieved in CSMA LANs.

S_2 : In CSMA/CD LANs, the amount of time that it takes to detect a collision is never greater than the end-to-end propagation delay.

A Only S_1 is correct.

Correct Option

Solution :

(a)
Only S_1 is true as link utilization will increase with increase in frame size but it will decrease if a frame takes large Pt. S_2 is false as to detect collision in CSMA/CD, $TT \geq 2^k PT$ always.

B Only S_2 is correct.

C Both S_1 and S_2 are correct.

D Both S_1 and S_2 are false.

QUESTION ANALYTICS

Q. 56

Solution Video

Have any Doubt ?



Consider the following system of linear equations:

$$x_1 - 2x_4 = -3$$

$$2x_2 + 2x_3 = 0$$

$$x_3 + 3x_4 = 1$$

$$-2x_1 + 3x_2 + 2x_3 + x_4 = 5$$

Which of the following is true for the solutions of this system?

A There is a unique solution.

B There are infinitely many solutions.

Correct Option

Solution :

(b)

First replace R_4 by $R_4 + 2R_1$ and replace R_4 by $R_4 + \left(-\frac{3}{2}\right)R_2$. (One could also scale R_2 before

adding to R_4 , but the arithmetic is rather easy keeping R_2 unchanged).

Finally, replace R_4 by $R_4 + R_3$.

$$\begin{bmatrix} 1 & 0 & 0 & -2 & -3 \\ 0 & 2 & 2 & 0 & 0 \\ 0 & 0 & 1 & 3 & 1 \\ -2 & 3 & 2 & 1 & 5 \end{bmatrix} \sim \begin{bmatrix} 1 & 0 & 0 & -2 & -3 \\ 0 & 2 & 2 & 0 & 0 \\ 0 & 0 & 1 & 3 & 1 \\ 0 & 3 & 2 & -3 & -1 \end{bmatrix} \sim \begin{bmatrix} 1 & 0 & 0 & -2 & -3 \\ 0 & 2 & 2 & 0 & 0 \\ 0 & 0 & 1 & 3 & 1 \\ 0 & 0 & -1 & -3 & -1 \end{bmatrix} \sim \begin{bmatrix} 1 & 0 & 0 & -2 & -3 \\ 0 & 2 & 2 & 0 & 0 \\ 0 & 0 & 1 & 3 & 1 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

The system is now in triangular form and has infinitely many solutions.

C There is no solution.

D There are exactly 2 solutions.

QUESTION ANALYTICS

Q. 57

? FAQ

Have any Doubt ?



We have a singly linked list constructed out of nodes defined as follows:

struct node {int value; struct node *next;};

In the function shown below, the parameter "first" refers to the first node of the linked list, if there is one, and has the value null otherwise. The intent of the function is to remove the last node of the linked list.

void removelast (struct node *first)

{

 struct node *p, *q;

 p = first;

 q = p -> next;

 while (q -> next != null) {

 p = q;

 q = q -> next;

}

```
p → next = null;  
}
```

Which of the following describes the class of the linked lists for which this function works correctly?

A No linked list

B All non-empty linked list

C All linked lists with more than one node

Correct Option

Solution :

(c)
If the list is empty then p will be null and $q = p \rightarrow \text{next}$ will fail.
If the list has only one node, then p will be null and $q \rightarrow \text{next}$ will fail.
So, answer is option (c).

D All linked lists

QUESTION ANALYTICS



Q. 58

FAQ

Solution Video

Have any Doubt ?



Suppose two threads execute the following C code concurrently, assessing shared variables a, b, and c:

Initialization

```
int a = 4;  
int b = 0;  
int c = 0;  
Thread 1  
if (a < 0) {  
    c = b - a;  
}  
if else {  
    c = b + a;  
}
```

Thread 2

```
b = 10;  
a = -3;
```

What are the possible values for c after both threads complete? You can assume that reads and writes of the variables are atomic and that the order of statements within each thread is preserved in the code generated by the C compiler. Statement X = Y*Z reads Y, then reads Z from memory, performs Y*Z, stores/writes it to memory X How many different values are possible for c after both threads complete?

A 2

B 3

C 4

D 5

Correct Option

Solution :

(d)
Values of c that are possible are: 4, 7, 13, 14, -3
4 is possible when we run T_1 completely then T_2 .
13 is possible when we run T_2 completely then T_1 .
14 is possible when we run T_2 's "b = 10" then run T_1 completely.
7 is possible when we run T_1 's "If (a < 0)" then run T_2 completely then run T_1 's "c = b + a".
-3 is possible when we run T_1 's "If (a < 0)" then in T_1 's "c = b + a" we just read b then run T_2 completely then read a and then run T_1 's "c = b + a".

QUESTION ANALYTICS



Q. 59

FAQ

Have any Doubt ?



Consider the following statements:

I. There exists a RE language for which there is no ambiguous grammar possible.

II. There exists a RE language for which there is no unambiguous grammar.

Which of the above statements is/are correct?

A Both I and II

Correct Option

Solution :

(a)
Statement I is correct and the only language, for which it is true, is empty language. Since empty language does not contain any string, we can't make at least two parse trees for any string in the language.
Statement II is also true and such languages are called inherently ambiguous languages. While some RE languages have both ambiguous and unambiguous grammars, there exist context-free languages for which no unambiguous grammar can exist. An example of an inherently ambiguous language is the union of $\{a^n b^m c^m d^m \mid n, m > 0\}$ with $\{a^n b^n c^m d^m \mid n, m > 0\}$.
The set is context-free, since the union of two context-free languages is always context-free. But there is no way to unambiguously parse string in the (non-context-free) common subset $\{a^n b^n c^m d^m \mid n > 0\}$.

B Only I

C Only II

D None of I and II of correct

Q. 60

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

Consider a recursive function $\text{fun}(n)$:

The time complexity of this function is $O(n^\alpha)$, then the least possible value (accurate upto 2 decimal positions) of α is _____.

```
int fun (int n) {
    int i, a;
    for (i = 0; i < n; i++)
        a++;
    return (fun(2n/3) + fun(2n/3) + fun(2n/3));
}
```

2.70 (2.70 - 2.72)

Correct Option

Solution :

2.70 (2.70 - 2.72)

The recurrence relation for the given function is

$$T(n) = 3T\left(\frac{2n}{3}\right) + n$$

Using Master method, $a = 3; b = \frac{3}{2}$

Applying Master method is

$$f(n) = n, n^{\log_b a} = n^{\log_3 2^3} = n^{2.77}$$



Kunal Jha
 Course: GATE
 Computer Science Engineering(CS)

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FULL SYLLABUS TEST-4 (BASIC LEVEL) (GATE - 2021) - REPORTS

OVERALL ANALYSIS

COMPARISON REPORT

SOLUTION REPORT

ALL(65)

CORRECT(0)

INCORRECT(0)

SKIPPED(65)

Q. 61

Have any Doubt?



An IP datagram of length (including a header of 20 bytes) 1800 bytes needs to cross an Ethernet followed by a WAN to reach its destination. The MTU for Ethernet is 1500 bytes. For the WAN, the MTU is given to be 576 bytes. The datagram of 1800 bytes cannot be carried in one unit by Ethernet. Hence 2 fragments are required (Frag1 and Frag2). At the entry to the WAN, the router has to further fragment Frag1. What will be the 'Fragment offset' of the last sub fragment of Frag1?

138

Correct Option

Solution :

138

The datagram of 1800 bytes cannot be carried in one unit by Ethernet. Hence 2 fragments are required.

	Data	Header	Total
Frag1	1480	20	1500 bytes
Frag1	300	20	320 bytes

1780 bytes
of data

At the entry to the WAN, the Router has to further fragment Frag1. Frag2 goes through the WAN as it is.

Since every sub-fragment must have an IP header of 20 bytes, the WAN can carry a maximum data size of 556 bytes. However 556 is not divisible by 8, as required fragment offset. Hence we decide to send 552 bytes of data in the first sub-fragment of Frag1.

	Data	Header	Total
Frag1A	552	20	572
Frag1B	552	20	572
Frag1C	376	20	396

1480 bytes
of data

Hence at destination would reach 4 fragments namely Frag1A, Frag1B, Frag1C and Frag2.

	MFB	FO	TL
Frag1A	1	0	572
Frag1B	1	69	572
Frag1C	1	138	396
Frag2	0	185	320

QUESTION ANALYTICS



Q. 62

Solution Video

Have any Doubt?



The value of k, for which the following system of equations does not have any solution is _____.

$$\begin{aligned}x_1 + x_2 + x_3 &= 6 \\4x_1 + kx_2 - kx_3 &= 0 \\3x_1 + 2x_2 - 4x_3 &= -8\end{aligned}$$

3

Correct Option

Solution :

3

$$\begin{aligned}\Rightarrow \left| \begin{array}{ccc|c} 1 & 1 & 1 & 6 \\ 4 & k & -k & 0 \\ 3 & 2 & -4 & -8 \end{array} \right| &= D \left| \begin{array}{ccc|c} 1 & 1 & 1 & 6 \\ 0 & k-4 & -k-4 & -24 \\ 0 & -1 & -1 & -26 \end{array} \right| \\ \Rightarrow \left| \begin{array}{ccc|c} 1 & 1 & 1 & 6 \\ 0 & 0 & -8k+24 & -26k+80 \\ 0 & -1 & -7 & -26 \end{array} \right| & \\ \Rightarrow -8k+24 &= 0 \\ \Rightarrow k &= 3\end{aligned}$$

QUESTION ANALYTICS



Q. 63

FAQ Have any Doubt?



Consider a non-pipelined processor using the 5-stage datapath with 2 GHz clock speed. Assume that due to clock skew and pipeline registers, pipelining the processor lengthens the clock cycle period by 10%. Also, assume that the processor uses a unified single-ported cache for data and instruction accesses, resulting in a structural hazard between IF and MEM stages. Suppose that data references represent 30% of the instructions executed and that the ideal CPI of the pipelined processor, ignoring the structural hazard is 1. How much speedup can we gain from pipelining?(Give ans upto 2 decimal places)

3.50(3.49-3.50)

Correct Option

Solution :

Without pipelining: Clock period = $\frac{1}{2}$ GHz = 0.5 ns CPI = 5
 With pipelining: Clock period is lengthened by 10%.
 Therefore: Clock period = $0.5 + (10\% \times 0.5) = 0.55$ ns
 3.50(3.49 - 3.50) MEM stage. Each of these instructions results in a structural hazard with a stall penalty of 1 cycle.
 Therefore: CPI = Ideal CPI + Stall CPI = $1 + (0.3)(1) = 1.3$
 Speedup from pipelining = $\frac{(0.5 \text{ ns} \times 5)}{(0.5 \text{ ns} \times 1.3)} = 3.5$

QUESTION ANALYTICS

Q. 64

Have any Doubt?



Consider the following C program:

```
main() {
    int numbers [10] = {1, 0, 0, 0, 0};
    int i, j;
    for (j = 0; j < 5; ++j)
        for (i = 0; i < j; ++i)
            numbers[j] += numbers[i];
    for (j = 0; j < 5; ++j)
        printf("%d", numbers[j]);
}
```

What will be the output?

11248

Correct Option

Solution:

11248

	0	1	2	3	4	...
Initially, numbers	1	0	0	0	0	...
j = 0;						
i = 0						
j = 1;						
i = 0 \Rightarrow	1	1	0	0	0	...
j = 2;						
i = 0 \Rightarrow	1	1	1	0	0	...
i = 2 \Rightarrow	1	1	2	1	0	...
j = 3;						
i = 0 \Rightarrow	1	1	2	1	0	...
i = 1 \Rightarrow	1	1	2	2	0	...
i = 2 \Rightarrow	1	1	2	4	0	...
j = 4;						
i = 0 \Rightarrow	1	1	2	4	1	...
i = 1 \Rightarrow	1	1	2	4	2	...
i = 2 \Rightarrow	1	1	2	4	4	...
i = 3 \Rightarrow	1	1	2	4	8

Now, print a[0] to a[4]
 $\Rightarrow 11248$

QUESTION ANALYTICS

Q. 65

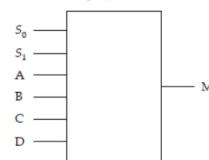
Solution Video

Have any Doubt?



A multiplexer, shown below on the right, has 6 inputs, S_0 , S_1 , A, B, C and D. The truth table on the left describes its function.

S_0	S_1	
0	0	A
0	1	B
1	0	C
1	1	D



It is desired to implement the function $F = (X \oplus Y) \oplus Z$ using the multiplexer. If X is applied to S_0 and Y is applied to S_1 , what inputs should be applied to A, B, C and D to realize the function F?

A A = B = C = D = Z

B A = X \oplus Y, B = X \oplus Z, C = Y \oplus Z, D = Z

C A = D = Z, B = C = \bar{Z}

Correct Option

Solution:
(c)

$$R_{eq} = (X \oplus Y) \oplus Z$$

Using option (c)

$$\begin{aligned}
 X &= s_0, Y = s_1 \\
 A &= D = Z, C = B = \bar{Z} \\
 \bar{X}\bar{Y}Z + \bar{X}Y\bar{Z} + X\bar{Y}\bar{Z} + XYZ &= (\bar{X}\bar{Y} + XY)Z + (\bar{X}Y + X\bar{Y})\bar{Z} \\
 &= (X \cdot Y)Z + (X \oplus Y)\bar{Z} \\
 &= (\bar{X} \oplus \bar{Y})Z + (X \oplus Y)\bar{Z} \\
 &= (X \oplus Y) \oplus Z
 \end{aligned}$$

D The function F can not be realized with any of the inputs shown above.

 QUESTION ANALYTICS



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