TOPICWISE : ALGORITHMS-2 (GATE - 2019) - REPORTS

Q. 1

What is the best data structure to implement topological sort on directed graph?

FAQ | Have any Doubt ?

A Heap

B Queue

C Stack — Your answer is **Correct**

Solution :
(c)
The best data structure used to implement topological sort is stack, since topological sort based on depth first traversal.

D Array

QUESTION ANALYTICS +

Q. 2

Which of the following procedure is suitable to find the longest path from a given vertex to any other given vertex in a directed acyclic graph (weighted) with few negative edge weights.

FAQ | Have any Doubt ?

A Divide and conquer

B Greedy approach

C Dynamic programming — Your answer is **Correct**

Solution :
(c)
Shortest path or longest path computation is possible using dynamic programming for directed acyclic graphs with presence of negative edge weights.

D All of these

QUESTION ANALYTICS +

Q. 3

A hash table of size 10, is shown in the figure with symbols stored from *a* to *g* using some hash function with linear probing. The worst case number of comparisons required when the symbol being searched is not in the table is?

0	*a*
1	*b*
2	*c*
3	
4	*d*
5	
6	*e*
7	*f*
8	*g*
9	

Have any Doubt ?

A 5

B 4 — Correct Option

Solution :
(b)
The search using linear probing stops whenever it finds an empty slot.
∴ (*e*, *f*, *g* and then empty slot) and (*a*, *b*, *c* and the empty slot) are worst case searches.
Both searches above has 4 comparisons.

C 3

D 7 — Your answer is **Wrong**

QUESTION ANALYTICS +

Q. 4

Which of the following statement is true?

Have any Doubt ?

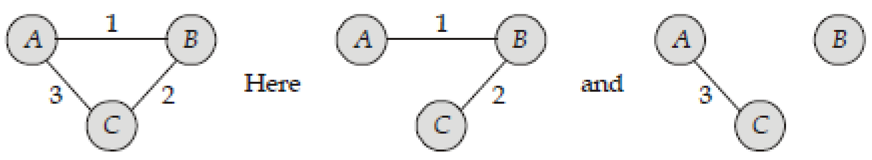
A For a directed graph, the absence of back edges in a DFS tree can have cycle.

B If all edge in a graph have distinct weight then the shortest path between two vertices is unique. Your answer is **Wrong**

C The depth of any DFS (Depth First Search) tree rooted at a vertex is atleast as depth of any BFS tree rooted at the same vertex. Correct Option

Solution :
(c)

(i) For a directed graph, the absence of back edge in DFS tree means no cycle present. So false.

(ii)


Two paths are possible but cost is same. So false.

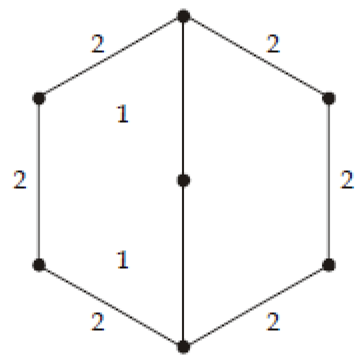
(iii) Depth of any vertex in BFS always less than equals to depth of same vertex in DFS. So true.

D Both (a) and (c)

QUESTION ANALYTICS +

Q. 5

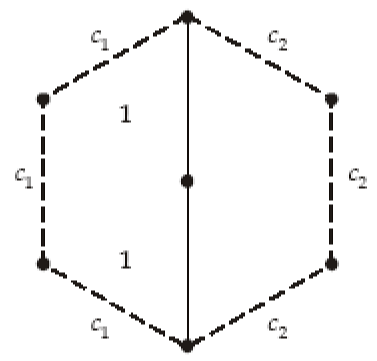
Consider the following graph in which x represent the number of minimum cost spanning tree and y represent the number of second minimum cost spanning tree (minimum spanning tree with cost less than all other minimum spanning tree except actual minimum cost spanning tree). Which of the following represents $|2^x - 2^y|$ where $|\,|$ represent mod value?



Have any Doubt ?

A 3584 Correct Option

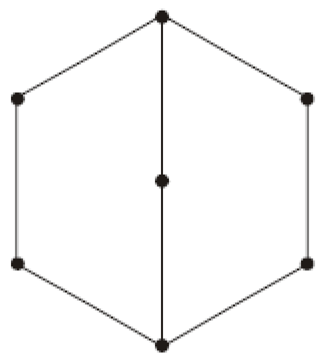
Solution :
(a)



Three choices from c_1 and Three choices from c_2

$$\Rightarrow \quad 3c_2 \times 3c_2 = 9$$

$$\text{So,} \quad x = 9$$



We want second minimum spanning tree so for middle point we have 2 choices and rest there are 6 edges.

$$\Rightarrow \quad 6c_5 \times 2c_1 = 12$$

$$\text{So,} \quad y = 12$$

$$|2^9 - 2^{12}| = 2^9 \times (1 - 2^3)$$

$$= 2^9 \times 7$$

$$= 3584$$

B 3840

C 4200

D 4820

QUESTION ANALYTICS +

Q. 6

Consider two strings A = "abbaccda" and B = "abcaa" consider "x" be length of the longest common subsequence between A and B and "y" be the number of distinct such longest common subsequences between A and B. Then $10x + 2^y$ is ________.

FAQ Have any Doubt ?

44 Correct Option

Solution :
44

$$A = \text{"abbaccda"}$$

$$B = \text{"abcaa"}$$

Length will be "abca" i.e. 4

Number of such strings = "abca", "abaa"

$$\text{So,} \quad 10x + 2^y = 10 \times 4 + 2^2$$

$$= 40 + 4$$

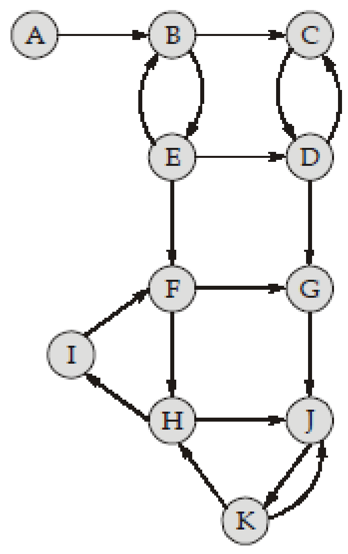
$$= 44$$

Your Answer is 48

QUESTION ANALYTICS

Q. 7

Consider the following graph:



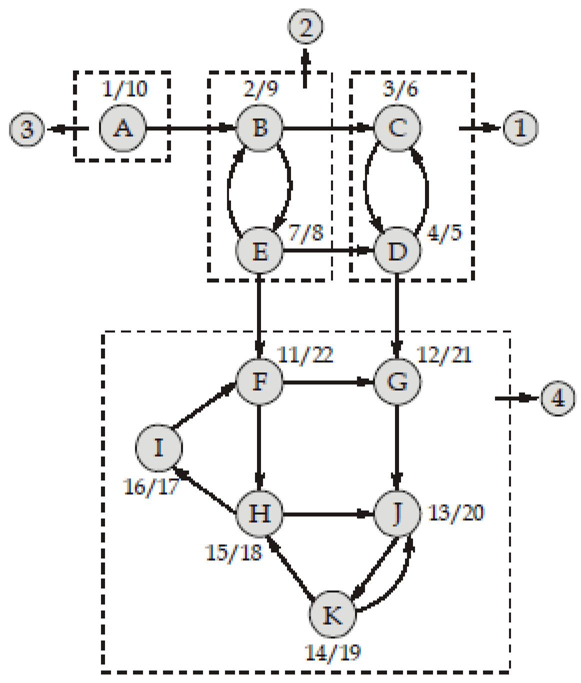
The number of strongly connected components of the graph are ________.

FAQ Have any Doubt ?

4

Correct Option

Solution :
4



Your Answer is 5

QUESTION ANALYTICS

Q. 8

The post order traversal of binary search tree is given by 2, 7, 6, 10, 9, 8, 15, 17, 20, 19, 16, 12. The height of the tree is ________.

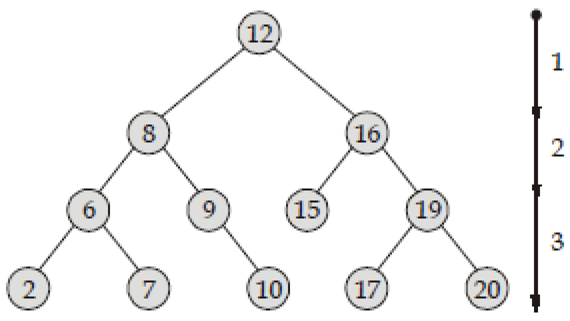
FAQ Have any Doubt ?

3

Correct Option

Solution :
3

Post order: 2, 7, 6, 10, 9, 8, 15, 17, 20, 19, 16, 12
Inorder of BST must be sorted order:
2, 6, 7, 8, 9, 10, 12, 15, 16, 17, 19, 20
So, tree will be:

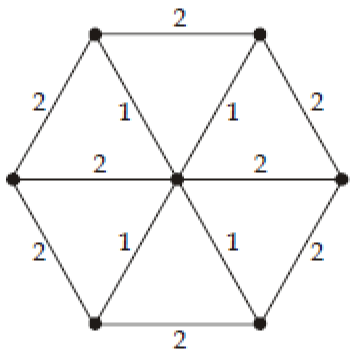


Your Answer is 6

QUESTION ANALYTICS

Q. 9

Consider the following graph:



The number of distinct minimum spanning trees for weighted graph are ________.

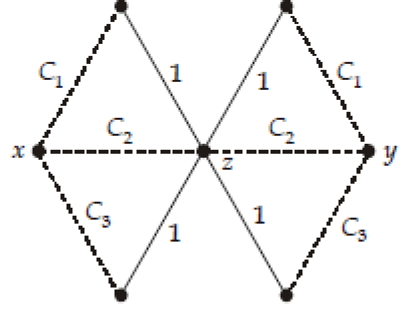
Have any Doubt ?

9

Correct Option

Solution :
9

All minimum cost edge will be present in MST if not involve in cycle



Now, to connect 'x' and 'y' we have 3 choices each so, number of Minimum Spanning Tree (MST) are 3 × 3 = 9.

Your Answer is 3

QUESTION ANALYTICS +

Q. 10

Match **List-I** (Dynamic algorithm) with **List-II** (Average case running time) and select the correct answer using the codes given below the lists:

List-I (Dynamic algorithm)	List-II (Average case running time)
A. Matrix chain multiplication	1. $O(mn)$
B. Travelling salesman problem	2. $O(n^3)$
C. 0/1 knapsack	3. $O(n^n)$
D. Fibonacci series	4. $O(n)$

Codes:

	A	B	C	D
(a)	1	3	2	4
(b)	1	3	3	2
(c)	2	3	3	2
(d)	2	3	1	4

FAQ Have any Doubt ?

A a

B b

C c

D d Your answer is **Correct**

Solution :
(d)
A. Matrix chain multiplication : (n^3)
B. Travelling salesman problem : (n^n)
C. 0/1 knapsack : (mn)
D. Fibonacci series : $O(n)$

QUESTION ANALYTICS +

Q. 11

Which of the following represents the number of elements that can be sorted in $\Theta(n)$ times using merge sort?

Have any Doubt ?

A $\Theta(\log n)$

B $\Theta(n)$

C $\Theta\left(\frac{n}{\log n}\right)$ Your answer is **Correct**

Solution :
(c)
Time complexity to sort n elements using merge sort = $\Theta(n\log n)$

$$\Theta(n) = \Theta\left(\frac{n}{\log n}\log\frac{n}{\log n}\right)$$

$$\Theta(n) = \Theta\left(\frac{n}{\log n}[\log n - \log\log n]\right)$$

$$\Theta(n) = \Theta\left(\frac{n}{\log n}\log n\right) \quad [\log n - \log\log n = O(\log n)]$$

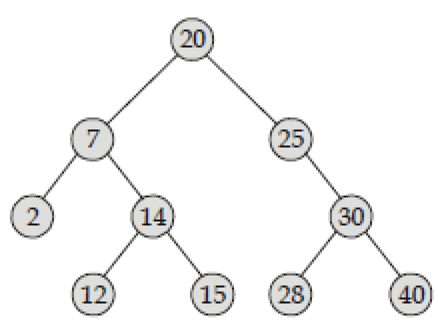
$$\Theta(n) = \Theta(n)$$

D $\Theta(\sqrt{n})$

QUESTION ANALYTICS +

Q. 12

Consider we constructed binary search tree shown below starting with an empty tree and elements 2, 7, 12, 14, 15, 20, 25, 28, 30 and 40 are come in any order:



Which of the following about the order of elements in input sequence can be true?

FAQ Have any Doubt ?

A 12 comes before 7 and 2 comes after 7 — Your answer is **Wrong**

B 28 comes after 25 and 20 comes after 7

C 20 comes before 7 and 12 comes after 7 — Correct Option

Solution :
(c)
We know that ‘a’ comes before ‘b’ iff ‘b’ is child of ‘a’ and ‘b’ comes after ‘a’ iff ‘b’ is child of ‘a’.
Option (a) 7 is not the child of 12. So false
Option (b) 20 is not child of 7. So false
Option (d) 14 is not child of 15. So false
Only option (c) is correct i.e. ‘7’ is child of ‘20’ and ‘12’ is child of ‘7’.

D 25 comes before 28 and 14 comes after 15

QUESTION ANALYTICS +

Q. 13

Let G = (V, E) be a directed graph. Each edge of G is represented as (i, j) with length $l[i, j]$. If there is no edge from i to j then
i to j then $l[i, j] = \infty$. Assume n vertices in V and $d^k{}_{i,j}$ is the length of shortest path from i to j that does not pass through any vertex in $\{k + 1, k + 2, ..., n\}$.

$$d^k{}_{i,j} = \begin{cases} l[i, j] & \text{if } k = 0 \\ \min\{A, B\} & \text{if } 1 \le k \le n \end{cases}$$

If the above $d^k{}_{i,j}$ computed recursively to find all pairs shortest path, identify A and B respectively?

FAQ | Have any Doubt ?

A $d_{i,j}^{k-1}$ and $d_{i,j}^{j-1} + d_{k,j}^{j-1}$

B $d_{i,j}^{k-1}$ and $d_{i,k}^{k-1} + d_{k,j}^{k-1}$ — Correct Option

Solution :
(b)

$$\begin{cases} l[i, j], & \text{if } k = 0 \\ \min\left\{d_{i,j}^{k-1},\ d_{i,k}^{k-1} + d_{k,j}^{k-1}\right\}, & \text{if } 1 \le k \le n \end{cases}$$

$\therefore$ Option (b) is correct.

C $d_{i,j}^{k}$ and $d_{i,k}^{k} + d_{k,j}^{k}$

D $d_{i,j}^{k}$ and $d_{i,k}^{k} + d_{j,k}^{k}$

QUESTION ANALYTICS +

Q. 14

Consider two Person (Person X, Person Y). Person X who was given a problem to calculate $A_1 \times A_2 \times A_3$ with dimension 3×100, 100×2 and 2×2 in minimum multiplication. Person X is the knows only Greedy algorithm (multiply matrix which gives less number of multiplication) and solve $A_1 \times A_2 \times A_3$ with M_1 multiplications. Person Y solved the same problem using Dynamic algorithm with M_2 multiplications. How many number of multiplications saved by Person Y than
Person X?

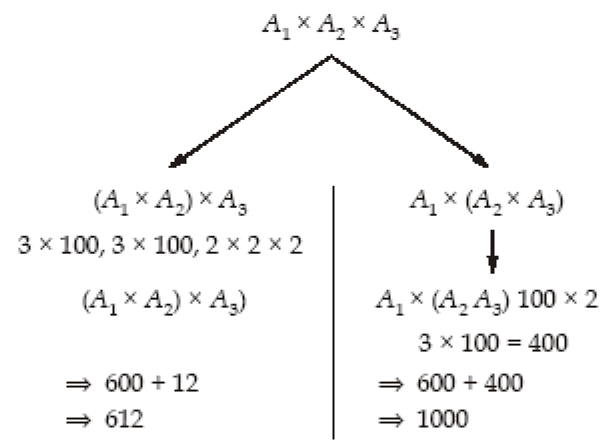
Have any Doubt ?

A 368

B 388 — Correct Option

Solution :
(b)

$A_1 A_2 A_3 = A_1 \times (A_2 \times A_3)$
$3 \times 100,\ 100 \times 2,\ 2 \times 2$
By **Person X applying Greedy:**
$A_1 \times (A_2 \times A_3)$
$3 \times 100,\ 100 \times 2,\ 2 \times 2$
$(A_2A_3) \to 100 \times 2,\ 2 \times 2 = 200 \times 2 = 400$
$A_1 \times (A_2A_3) \to 3 \times 100,\ 100 \times 2 = 300 \times 2 = 600$
Total number of multiplication required = 600 + 400 = 1000
Person Y with Dynamic:



Number of multiplication saved by Person Y = 1000 – 612 = 388

C 420

D 488

QUESTION ANALYTICS

Q. 15

The number of different orders are possible for elements 1, 2, 3, 4, 5, 6, 7 to be inserted in to empty AVL tree such that no rotation will be done and element '4' is root are ________.

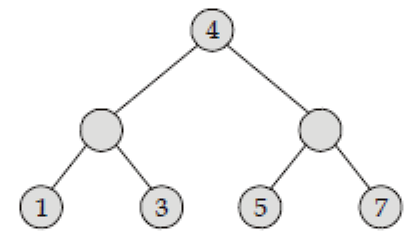
FAQ Have any Doubt ?

80

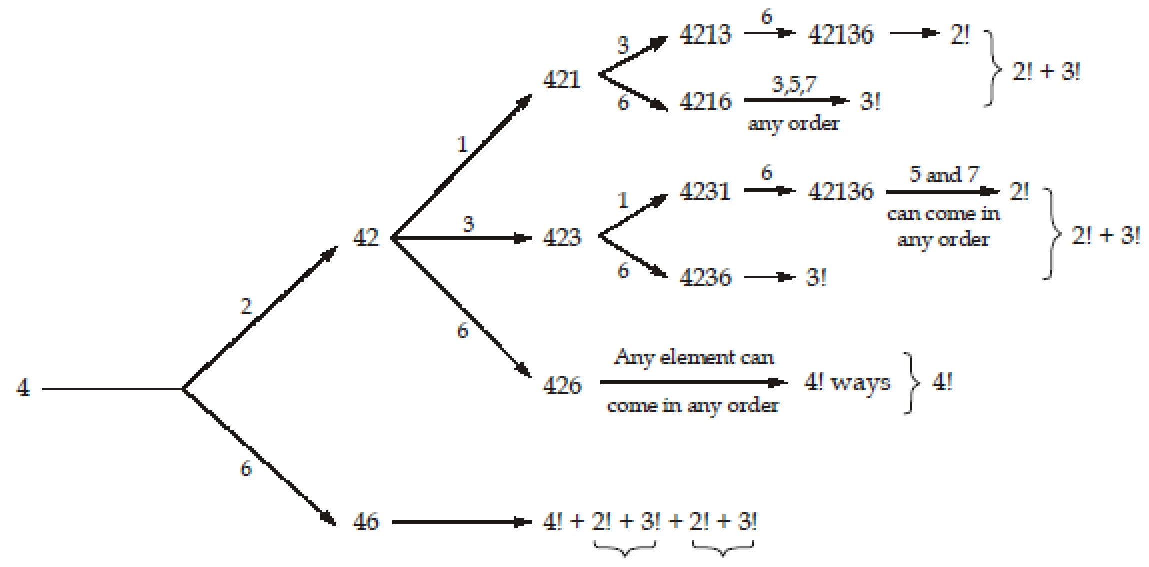
Correct Option

Solution :
80

Since 4 is root element, so



(1, 3, 5, 7) can be inserted in any order since these are leaf nodes. However, 6 needs to be inserted before 5 and 7 and 2 needs to be inserted before 1 and 3.
4 being the root node, needs to be inserted first of all.



$$\begin{aligned}\text{Total possibilities} &= 2(4! + 2(2! + 3!)) \\ &= 2(24 + 2(2 + 6)) \\ &= 2(24 + 16) = 2(40) \\ &= 80 \text{ ways}\end{aligned}$$

QUESTION ANALYTICS

Q. 16

The number of distinct BFS traversal possible on complete graph of 5 vertices are ________ [vertices are labeled as A, B, C, D and E].

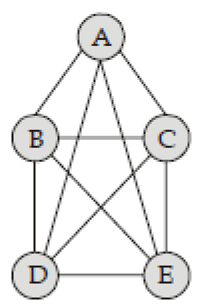
Have any Doubt ?

120

Correct Option

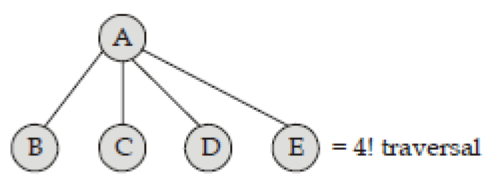
Solution :
120

Complete graph on 5 vertices:



BFS traversal:

1. We have 5 choices to select initial vertex i.e. A, B, C, D and E.
2. With initial vertex as A



So total number of traversal are 5 × 4! = 5! = 120

Note: Number of BFS traversals on complete graph with n vertex are $n!$

Your Answer is 36

QUESTION ANALYTICS

Q. 17

Consider an initially empty hash table of length 10. Following set of keys are inserted using open addressing with hash function $h(k) = k \bmod 10$ and linear probing.

	0
91	1
	2
33	3
44	4
23	5
64	6
77	7
	8
	9

The number of different insertion sequence of the key values using the given hash function and linear probing will result in the hash table shown in above ________.

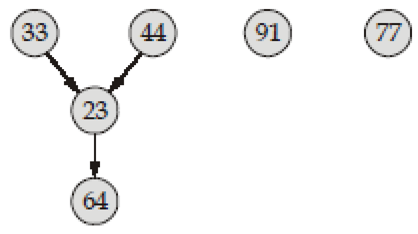
FAQ Have any Doubt ?

60

Correct Option

Solution :
60

Here some of the dependencies are presents:



So, number of possibilities are:

1. 2 choices for 33 and 24 either 33 then 44 or 44 then 33.
2. After that 23 will be come.
3. After that 64 will come.

Now, here 91 and 77 can come in any order i.e. 5×6

So, total choices will be $= 2 \times 5 \times 6$

$= 60$

QUESTION ANALYTICS