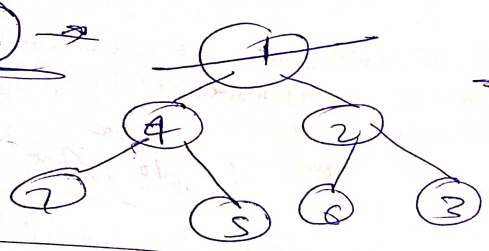
Q.41 (A) In binary tree, a full node is defined to be a node with 2 children. Use induction on the height of the binary tree to prove that the number of full nodes plus one is equal to the number of leaves.

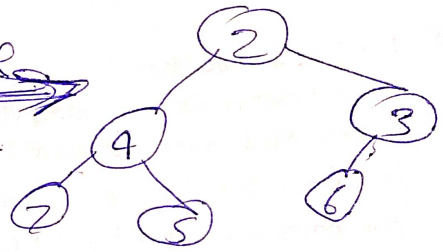
(B) Draw the min-heap that results from insertion of the following elements in order into an initially empty min-heap: 7,6,5,4,3,2,1. Show the result after the deletion of the root of this heap.

[GATE 1999]

Q1 (B) →



delete Root



Q2 (A) → Let No. of Full Node = F | No. of leaf = L

at Root (1 leaf Node)

$(F+1)_{L_T} + (F+1)_{R_T} = L_{L_T} + L_{R_T}$

$2(F+1) = 2L \Rightarrow$ (F+1 = L) Proved

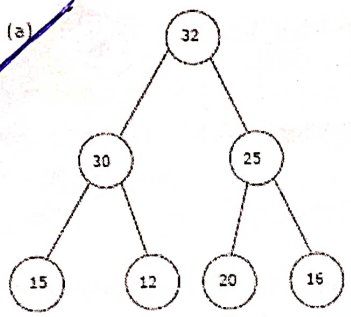
Q.42 In a heap with n elements with the smallest element at the root, the 7th smallest element can be found in time

(A) $\Theta(n \log n)$ (B) $\Theta(n)$ (C) $\Theta(\log n)$ (D) $\Theta(1)$

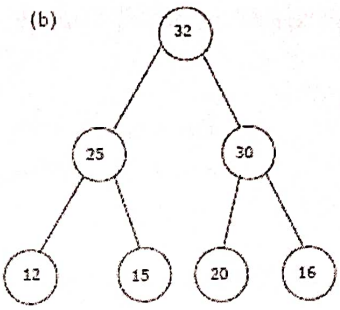
[GATE 2003]

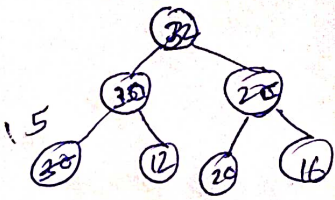
Q.43 The elements 32, 15, 20, 30, 12, 25, 16 are inserted one by one in the given order into a Max Heap. The resultant Max Heap is.

(a)

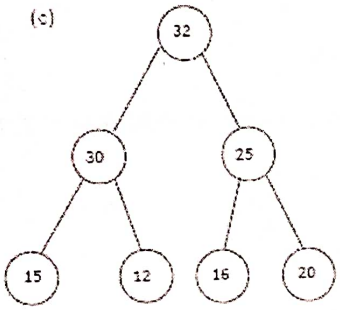


(b)

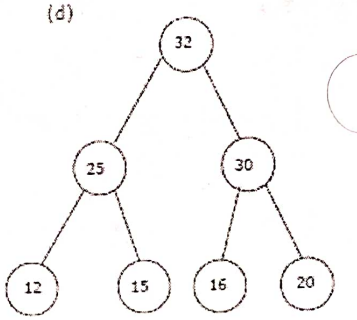




(c)



(d)



[GATE 2004]

Q.44 A 3-ary max heap is like a binary max heap, but instead of 2 children, nodes have 3 children. A 3-ary heap can be represented by an array as follows: The root is stored in the first location, a[0], nodes in the next level, from left to right, is stored from a[1] to a[3]. The nodes from the second level of the tree from left to right are stored from a[4] location onward. An item x can be inserted into a 3-ary heap containing n items by placing x in the location a[n] and pushing it up the tree to satisfy the heap property.

Which one of the following is a valid sequence of elements in an array representing 3-ary max heap?

(A) 1, 3, 5, 6, 8, 9 (B) 9, 6, 3, 1, 8, 5

(C) 9, 3, 6, 8, 5, 1 (D) 9, 5, 6, 8, 3, 1

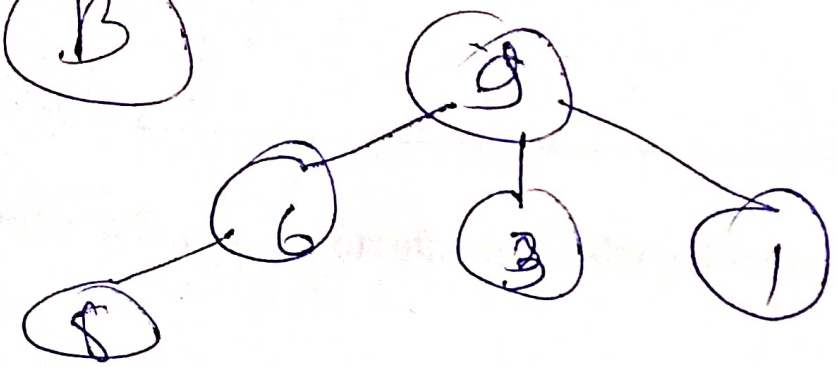
[GATE 2006]

99 ⇒ 8

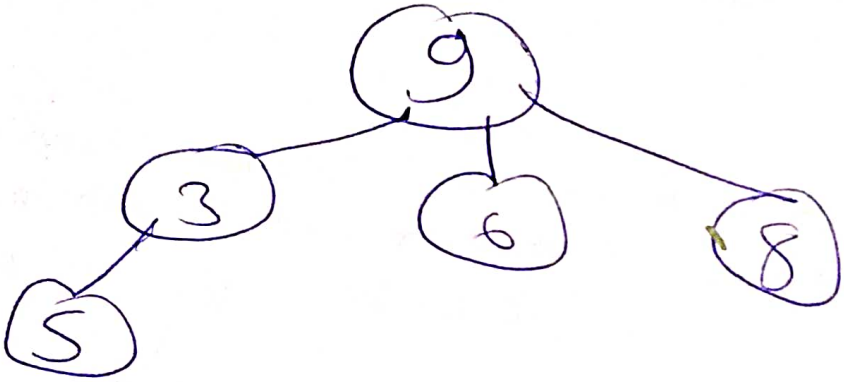
A X

B

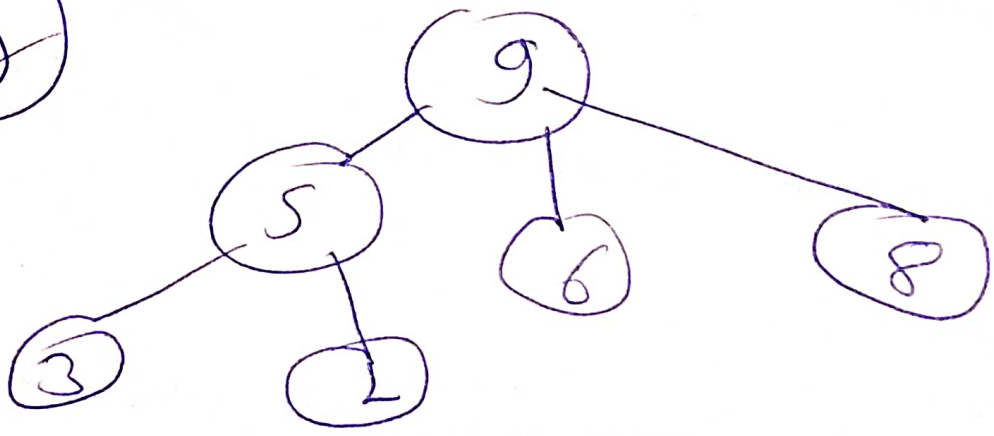
X



X C



D



Q.45 Consider a binary max-heap implemented using an array.

What is the content of the array after two delete operations on {25,14,16,13,10,8,12}

(A) {14,13,12,10,8}

(B) {14,12,13,8,10}

(C) {14,13,8,12,10}

(D) {14,13,12,8,10}

Q.46 The preorder traversal of a binary search tree is 15, 10, 12, 11, 20, 18, 16, 19. Which one of the following is the postorder traversal of the tree ?

(A) 10, 11, 12, 15, 16, 18, 19, 20

(B) 11, 12, 10, 16, 19, 18, 20, 15

(C) 20, 19, 18, 16, 15, 12, 11, 10

(D) 19, 16, 18, 20, 11, 12, 10, 15

[GATE 2020]

Q.47 In a balanced binary search tree with n elements, what is the worst case time complexity of reporting all elements in range [a,b] ? Assume that the number of reported elements is k.

(A) Θ(log n)

(B) Θ(log(n)+k)

(C) Θ(k log n)

(D) Θ(n log k)

[GATE 2020]

[GATE 2009]

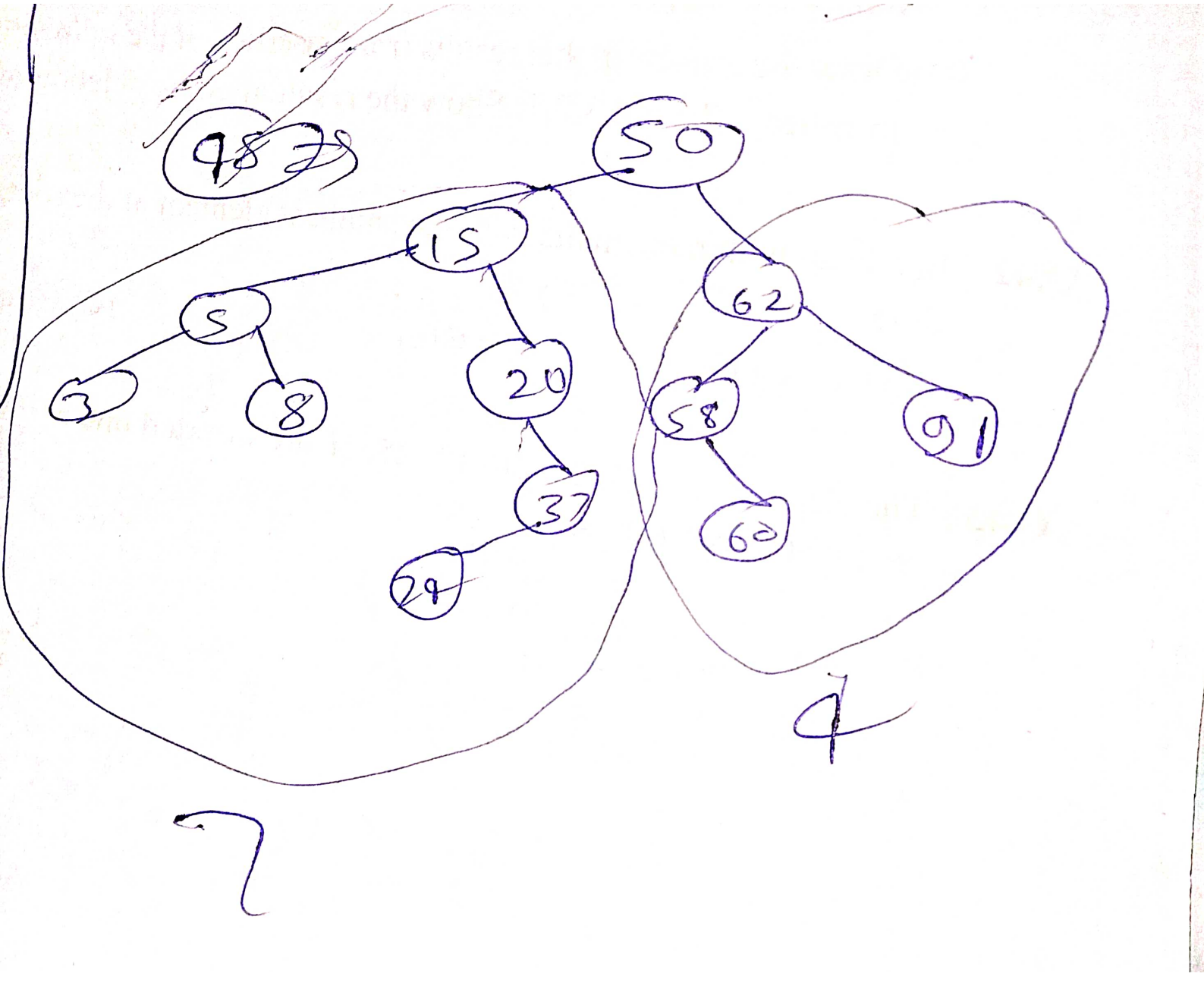
Q.48 A binary search tree is generated by inserting in order the following integers:

50, 15, 62, 5, 20, 58, 91, 3, 8, 37, 60, 24

The number of nodes in the left subtree and right subtree of the root respectively is

(A) (4, 7) (B) (7, 4) (C) (8, 3) (D) (3, 8)

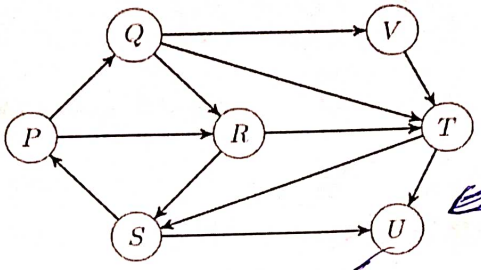
[GATE 1996]


98
50
15
5
62
3
8
20
58
91
37
60
29

Q.49 Level order traversal of a rooted tree can be done by starting from the root and performing

(A) preorder traversal
(B) in-order traversal
(C) depth first search
(D) breadth first search **[GATE 2004]**

Q.50 Which of the following is the correct decomposition of the directed graph given below into its strongly connected components? **[GATE 2006]**



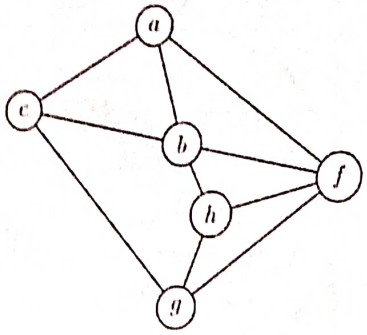
(A) {P,Q,R,S},{T},{U},{V}
(B) {P,Q,R,S,T,V},{U}
(C) {P,Q,S,T,V},{R},{U}
(D) {P,Q,R,S,T,U,V}

Q.51 Linked lists are not suitable data structures for which one of the following problems?

(A) Insertion sort
(B) Binary search
(C) Radix sort
(D) Polynomial manipulation

[GATE 1994]

Q.52 Consider the following graph:



A among the following sequences:

I. abeghf

II. abfehg

III. abfhge

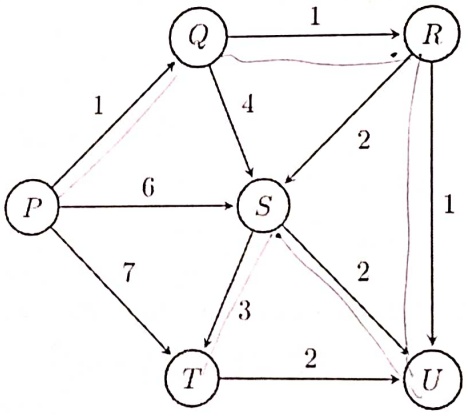
IV. afghbe

Which are the depth-first traversals of the above graph? **[GATE 2003]**

(A) I, II and IV only (B) I and IV only

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

Q.53 Suppose we run Dijkstra's single source shortest path algorithm on the following edge-weighted directed graph with vertex PP as the source. **[GATE 2004]**

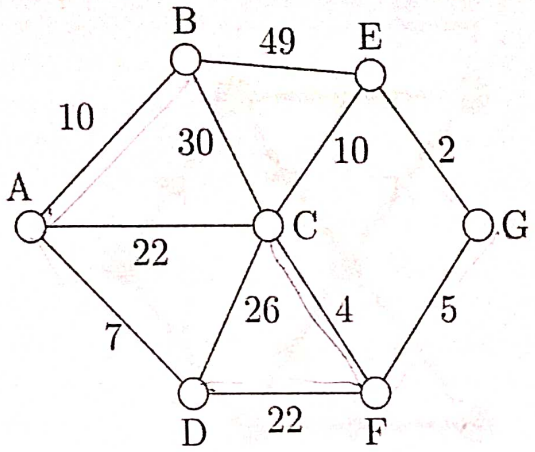


In what order do the nodes get included into the set of vertices for which the shortest path distances are finalized?

(A) P,Q,R,S,T,UP,Q,R,S,T,U (B) P,Q,R,U,S,TP,Q,R,U,S,T

(C) P,Q,R,U,T,SP,Q,R,U,T,S (D) P,Q,T,R,U,S

Q.54 Consider the undirected graph below:



Using Prim's algorithm to construct a minimum spanning tree starting with node A, which one of the following sequences of edges represents a possible order in which the edges would be added to construct the minimum spanning tree?

(A) (E, G), (C, F), (F, G), (A, D), (A, B), (A, C)
(B) (A, D), (A, B), (A, C), (C, F), (G, E), (F, G)
(C) (A, B), (A, D), (D, F), (F, G), (G, E), (F, C)
(D) (A, D), (A, B), (D, F), (F, C), (F, G), (G, E)

[GATE 2004]

Q.55 Let s and t be two vertices in a undirected graph G=(V,E) having distinct positive edge weights. Let [X,Y] be a partition of V such that s∈X and t∈Y. Consider the edge e having the minimum weight amongst all those edges that have one vertex in X and one vertex in Y.

GATE 2005

The edge e must definitely belong to:

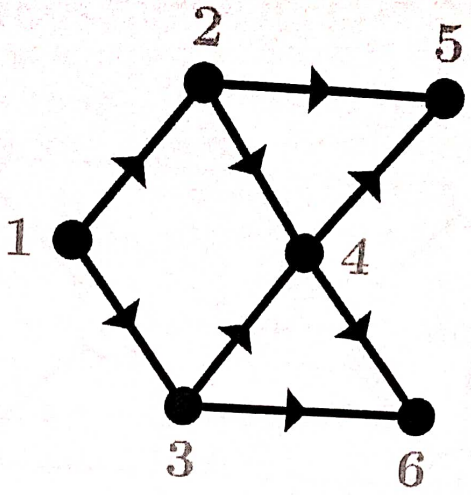
(A) the minimum weighted spanning tree of G
(B) the weighted shortest path from s to t
(C) each path from s to t
(D) the weighted longest path from s to t

Q.56 In an unweighted, undirected connected graph, the shortest path from a node S to every other node is computed most efficiently, in terms of *time complexity*, by

(A) Dijkstra's algorithm starting from S.
(B) Warshall's algorithm.
(C) Performing a DFS starting from S.
(D) Performing a BFS starting from S.

[GATE 2007]

Q.57 Consider the DAG with V={1,2,3,4,5,6} shown below.



Which of the following is not a topological ordering?

[GATE 2007]

(A) 1 2 3 4 5 6

(B) 1 3 2 4 5 6

(C) 1 3 2 4 6 5

(D) 3 2 4 1 6 5

Q.58 A depth-first search is performed on a directed acyclic graph. Let d[u] denote the time at which vertex uu is visited for the first time and f[u] the time at which the DFS call to the vertex u terminates. Which of the following statements is always TRUE for all edges (u,v) in the graph ?

[GATE 2007]

(A) d[u]<d[v]

(B) d[u]<f[v]

(C) f[u]<f[v]

(D) f[u]>f[v]

Q.59 Consider a weighted, undirected graph with positive edge weights and let uvuv be an edge in the graph. It is known that the shortest path from the source vertex ss to uu has weight 53 and the shortest path from ss to vv has weight 65. Which one of the following statements is always TRUE?

[GATE 2007]

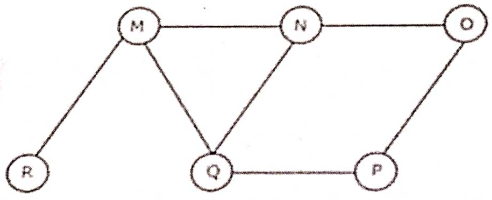
(A) Weight (u,v)≤12

(B) Weight (u,v)=12

(C) Weight (u,v)≥12

(D) Weight (u,v)>12

Q.60 The Breadth First Search algorithm has been implemented using the queue data structure. One possible order of visiting the nodes of the following graph is:



(A) MNOPQR

(B) NQMPOR

(C) QMNPRO

(D) QMNPOR

[GATE 2008]