

PAST PAPERS BY WAQAR SIDDHU

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1

What are the essential elements of an algorithm?

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1

What is overall time for Kruskal's algorithm if the graph is sparse?

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1

What is DFS and how does it work?

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What is Bellman-Ford algorithm's running time?

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1

Explain the following two basic cases according to Floyd-Warshall Algorithm,

- 1. Don't go through vertex k at all.
- 2. Do go through vertex k.

Answer (Please <u>click here</u> to Add Answer)		V	/uAr	1SI
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1

Describe 2-d maxima problem in mathematical or algorithmic form.

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Describe Minimum Spanning Trees Problem with examples.

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Let the adjacency list representation of an undirected graph is given below:

Is there any isolated vertex? If yes, Name the vertex.

What general property of the list indicates that the graph has an isolated vertex?

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- You are given the task of laying down new railway lines which will connect all n cities. Thus for any pair of cities, you will end up with track connecting them. Note that two routes may share the same track; track laid between Lahore and Islamabad can be used to travel in both directions. Your goal is to use the minimum amount of track. How would you achieve the goal now? (Note : consider the scenario carefully and name only the best suited algorithm)
- Dijkstra's algorithm
- 2 Prims Algorithm

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3 Folloyed Warshal Agorithm

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track; track laid between Lahore and Islamabad can be used to travel in both directions. Your goal is to use the minimum amount of track. How would you achieve the goal now? (Note : consider the scenario carefully and name only the best suited algorithm)

- 1 Dijkstra's algorithm
- 2 Prims Algorithm

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- 3 Folloyed Warshal Agorithm
- 4 Bellman Ford Algorithm.

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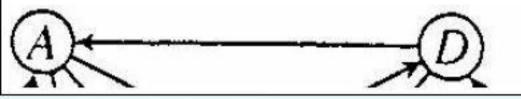
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Show the result of time stamped DFS algorithm on the following graph. Take node E as a starting node. [You can show final result in exam software and need not to show all intermediate steps].



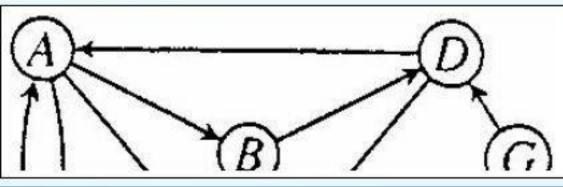
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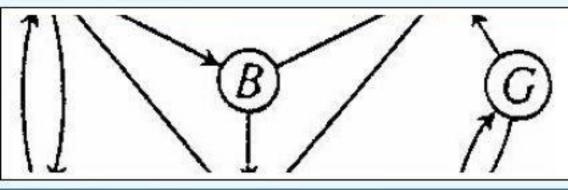
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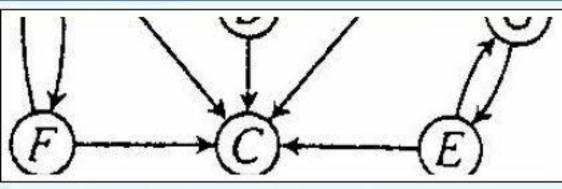
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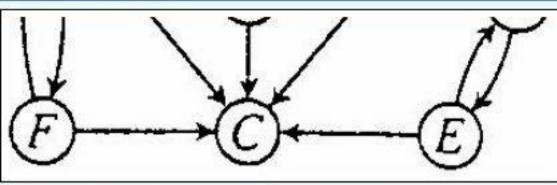
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1

Develop the running time complexity analysis for the following piece of code. Adopt step wise approach along with asymptotic notation at the end. i=1 while (i < n) { i++ } for (i=1;i <= n ;i=i*2)</pre>

Answer (Please click here to Add Answer)

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i=1
while (i < n) {
 i++
}
for (i=1; i <= n ; i=i*2)
for (j = 1; j <= i; ++j)</pre>

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1

Kruskal's algorithm can return different spanning trees for the same input graph G depending upon how ties are broken when edges are sorted. Prove that, for each minimum spanning tree T of G, there is a way to sort the edges of G in Kruskal's algorithm so that the algorithm returns T.

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Define Back Edge

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Given an adjacency list for G, what is the time complexity to compute G^T.?

Answer (Please <u>click here</u> to Add Answer)

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Marks: 2 (Budgeted Time 4 Min)

Given a digraph G = (V, E), consider any DFS forest of G and consider any edge (u, v) $\in E$. Prove that If this edge is a tree, forward or cross edge, then f [u] > f [v] and if this edge is a back edge, then f [u] \leq f [v].

Answer (Please <u>click here</u> to Add Answer)	VuAnsv
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How the Dijkstra's algorithm works?

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Modify QUICKSORT algorithm such that it sorts array into non-increasing order.

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Marks: 3 (Budgeted Time 6 Min)



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What do you mean by polynomial time algorithm? Explain what kind of problem can be solved by using polynomial time algorithm?

Answer (Please click here to Add Answer)

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You are given the task of laying down new railway lines which will connect all *n* cities. Thus for any pair of cities, you will end up with track connecting them. Note that two routes may share the same track; track laid between Lahore and Islamabad can be used to travel in both directions. Your goal is to use the minimum amount of track. How would you achieve the goal now? (Note : consider the scenario carefully and name only the best suited algorithm)

- 1 Dijkstra's algorithm
- 2 Prims Algorithm

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3 Folloyed Warshal Agorithm

Answer (Please <u>click here</u> to Add Answer)

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Considering the recursive version of depth-first traversal implementing Timestamp Structure in pseudo code format, only write DFSVISIT routine in pseudo code format

Answer (Please <u>click here</u> to Add Answer)

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1

Develop the running time complexity analysis for the following piece of code. Adopt step wise approach along with asymptotic notation at the end. i=1 while (i < n) { i++ }

for (i=1;i <= n ;i=i*2)</pre>

Answer (Please <u>click here</u> to Add Answer)

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Write pseudo code for Kruskal's algorithm.

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Question No : 49 of 52

track; track laid between Lahore and Islamabad can be used to travel in both directions. Your goal is to use the minimum amount of track. How would you achieve the goal now? (Note : consider the scenario carefully and name only the best suited algorithm)

- 1 Dijkstra's algorithm
- 2 Prims Algorithm

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- 3 Folloyed Warshal Agorithm
- 4 Bellman Ford Algorithm.

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Marks: 5 (Budgeted Time 10 Min)

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What is heap and heap order?

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Define free tree.

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A free tree is a tree with no vertex designated as the root vertex. A free tree with n vertices has a unique path between any two vertices of a free tree. Adding any edg Breaking any edge on this cycle restores the free tree.	exactly n – 1 edges. There exists a e to a free tree creates a unique c



Marks: 2 (Budgeted Time 4 Min)



Question No : 43 of 52

The following adjacency matrix represents a graph that consists of four vertices labeled 0, 1, 2 and 3. The entries in the matrix indicate edge weights.

	0	1	2	3
0	0	1	0	3
1	2	0	4	0
2	0	1	0	1
3	2	0	0	0

Answer the following question:

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Question No : 43 of 52

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	0	1	2	3
0	0	1	0	3
1	2	0	4	0
2	0	1	0	1
3	2	0	0	0

Answer the following question:

Can an adjacency matrix for a directed graph ever *not* be square in shape? Why or why not?

Answer (Please click here to Add Answer)

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Where clique cover problem arises?

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The clique cover problem arises in applications of clustering. We put an edge between two nodes if they are similar enough to be clustered in the same group. We want to know whether it is possible to cluster all the vertices into k groups.



Marks: 2 (Budgeted Time 4 Min)





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Consider a digraph G = (V, E) and any DFS forest for G. Prove that G has a cycle if and only if the DFS forest has a back edge.

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Question No : 46 of 52

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Describe three asymptotic notations.

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Question No : 47 of 52

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Briefly discuss at least three variants of the shortest path problem.

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Question No : 48 of 52

1

What do you mean by polynomial time algorithm? Explain what kind of problem can be solved by using polynomial time algorithm?

Answer (Please click here to Add Answer)

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Question No : 49 of 52

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Suppose you could reduce an NP-complete problem to a polynomial time problem in polynomial time. What would be the consequence?

Answer (Please click here to Add Answer)

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According to Dijkstra's Algorithm, write the pseudo code to relax a vertex.

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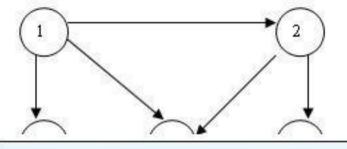
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Find the adjacent list for the following graph



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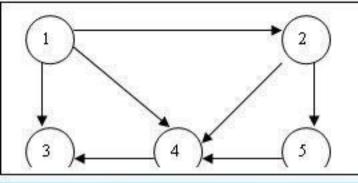
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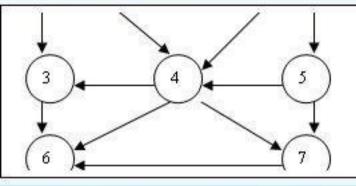
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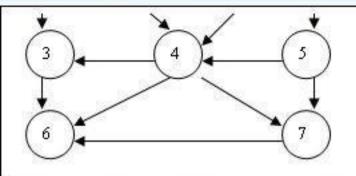
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Answer (Please <u>click here</u> to Add Answer)

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Draw the final **Max-Heap** structure for the following array, 50, 31, 45, 30, 2, 7, 40, 12, 28, 1

You can show the final result (tree) only.

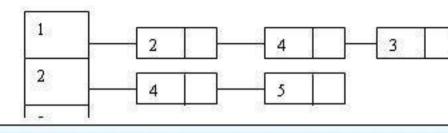
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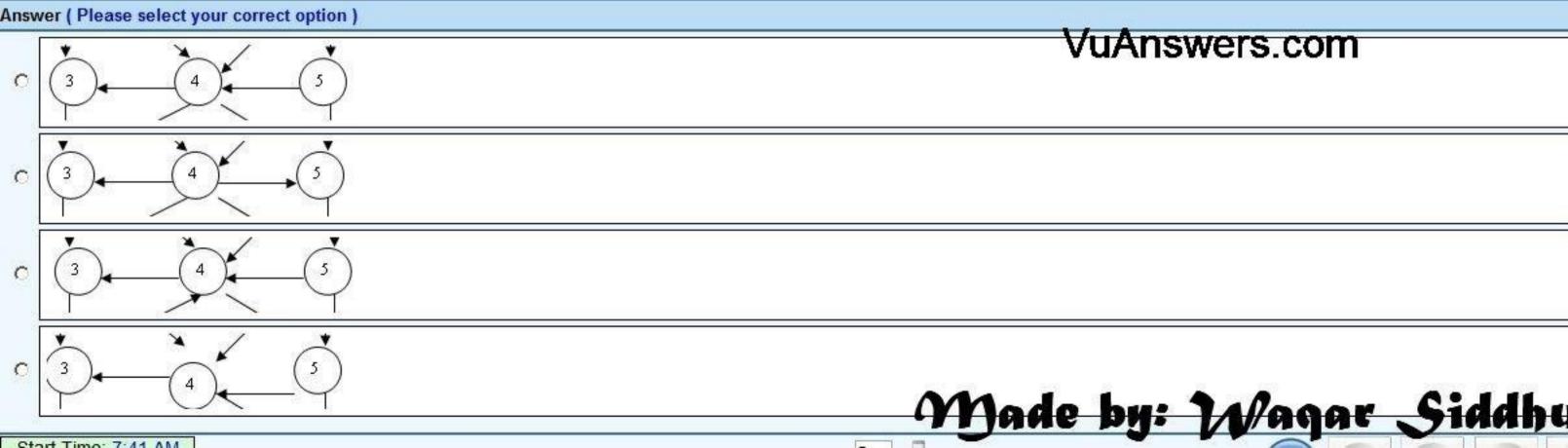
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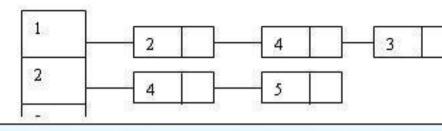


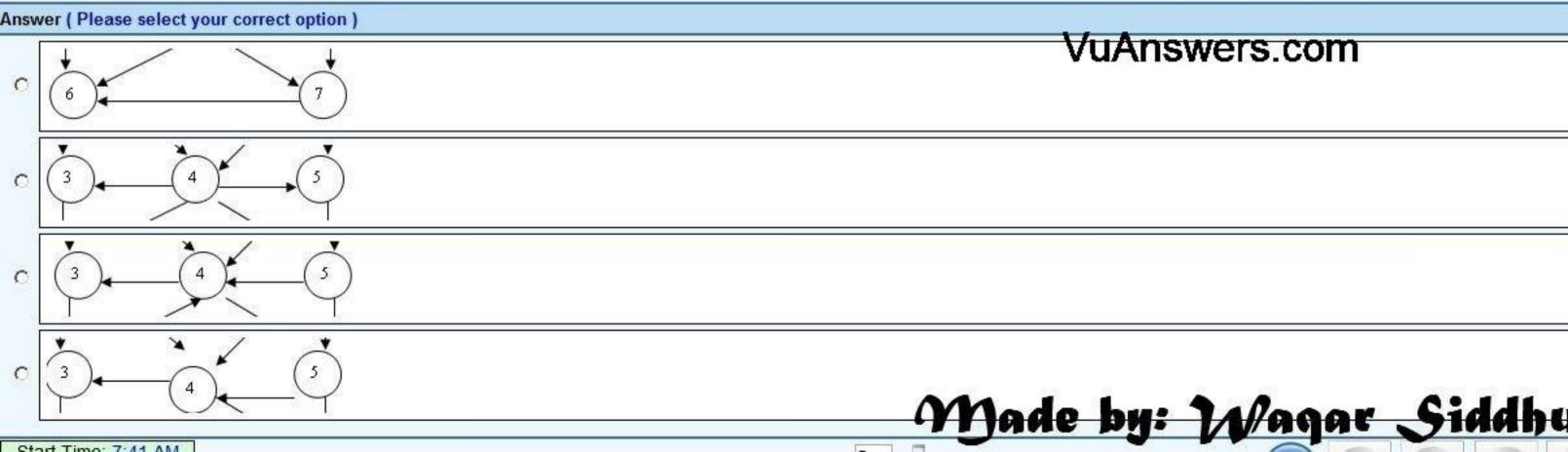
Consider the following adjacency list:



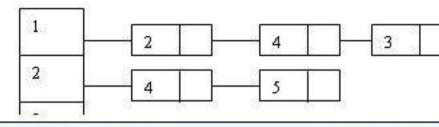


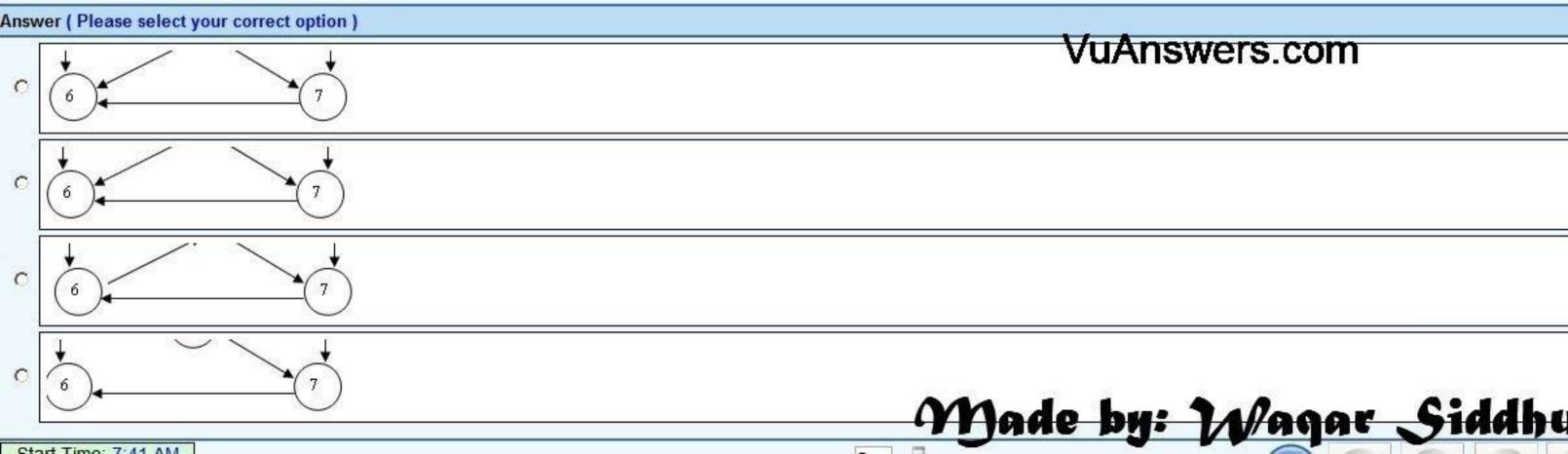
Consider the following adjacency list:





Consider the following adjacency list:





1

In strong components problem what complete refers to?

Answer (Please click here to Add Answer)

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Marks: 2 (Budgeted Time 4 Min)



Question No : 42 of 52

1

What are quadratic series?

Answer (Please <u>click l</u>	here to Add Answer)
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Marks: 2 (Budgeted Time 4 Min)

Question No : 43 of 52

1

What is overall time for Kruskal's algorithm if the graph is sparse?

Answer (Please <u>click here</u> to Add Answer)

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Marks: 2 (Budgeted Time 4 Min)

Question No : 44 of 52

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When a problem is called a decision problem?

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1

Formally describe Minimum Spanning Trees Problem.

Answer (Please <u>click here</u> to Add Answer)

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Marks: 3 (Budgeted Time 6 Min)

Question No : 46 of 52

1

True or false: A sequence of values in a column of the dynamic programming table for an instance of the knapsack problem is always non-decreasing? Give a brief description.

Answer (Please <u>click here</u> to Add Answer)	VuAnsv
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Marks: 3 (Budgeted Time 6 Min)



Question No : 47 of 52

Describe the relation between mutually reachable, equivalence relation, and component digraph.

Answer (Please <u>click here</u> to Add Answer)

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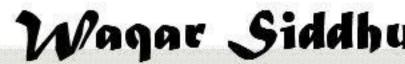
Marks: 3 (Budgeted Time 6 Min)

Question No : 48 of 52

You are given the task of laying down new railway line between Peshawar and Karachi. There are *n* intermediate cities that can be used and you know the cost of laying track between any pair of thes cities. Your goal is to spend the least total amount of track to construct the railway line. How would you determine the least amount of track and the cities to go through? Name the best algorithm whic addresses the above problem.

Answer (Please <u>click here</u> to Add Answer)	VuAns
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Question No : 49 of 52

You are given the task of laying down new railway lines which will connect all *n* cities. Thus for any pair of cities, you will end up with track connecting them. Note that two routes may share the same track; track laid between Lahore and Islamabad can be used to travel in both directions. Your goal is to use the minimum amount of track. How would you achieve the goal now? (Note : consider the scenario carefully and name only the best suited algorithm)

- 1 Dijkstra's algorithm
- 2 Prims Algorithm

1

3 Folloyed Warshal Agorithm

Answer (Please <u>click here</u> to Add Answer)

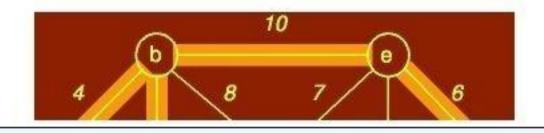
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Marks: 5 (Budgeted Time 10 Min)



Question No : 49 of 52

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- 1 Dijkstra's algorithm
- 2 Prims Algorithm

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- 3 Folloyed Warshal Agorithm
- 4 Bellman Ford Algorithm.

Answer (Please click here to Add Answer)

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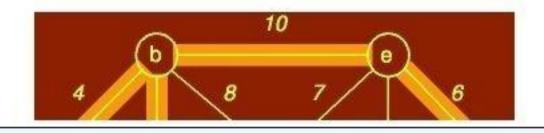
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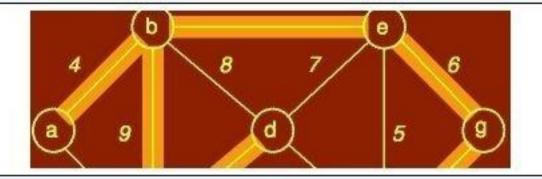
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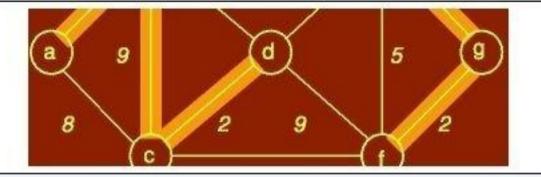
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1

Consider the following recursive search function which returns the index of the array element containing key, if such an element exists. Find out what is the complexity of search and show yo work.

```
int search( int* array, int left, int right, int key){
    int mid = (left + right)/2;
if( left == right )
    return left;
```

Answer (Please click here to Add Answer)

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```
return left;
else if ( array[mid] <= key )</pre>
     return search( array, mid+1, right, key );
else
     return search( array, left, mid, key );
```

Answer (Please click here to Add Answer)

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1

Write pseudo code for the algorithm, if we implement the bag of knapsack by using a stack.

Answer (Please click here to Add Answer)

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