Week 5: PYQs

19 June 2024 10:53

Bellman-Ford:

1. Sep 2023, End Term

Question Label : Multiple Choice Question

The **Bellman-Ford algorithm** cannot be used if a graph has negative cycles. This is because:

Options :

6406532324428. ✖ The algorithm only runs for n iterations, where n is the number of vertices.

6406532324429. ✔ The notion of the shortest path is not well-defined if there are negative cycles.

6406532324430. ✖ Dealing with negative cycles requires examining all paths exhaustively, which takes exponential time.

6406532324431. ✖ To handle negative cycles, we need to compute all-pairs shortest paths.

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Floyd-Warshall:

1. Quiz 2, Jan 24

Question Label : Multiple Choice Question

In the context of the **Floyd-Warshall algorithm**, what does it mean if the distance matrix has a negative value in its diagonal?

Options :

6406532578227. ✔ The graph has a negative-weight cycle.

6406532578228. ✖ The graph has negative-weight on edge but no negative-weight cycle.

6406532578229. ✖ The graph is acyclic.

6406532578230. ✖ The graph has a disconnected component.

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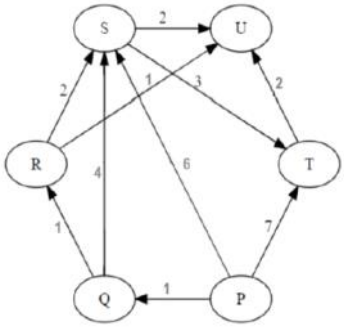
Dijkstra's:

1. Quiz 2, Jan 24

Consider the following graph.



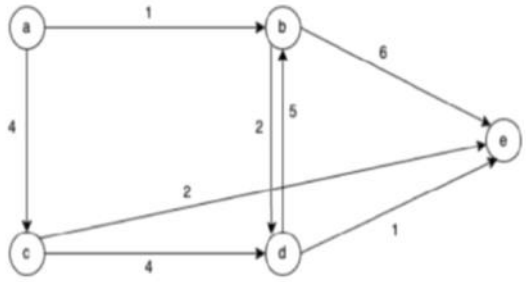
If **Dijkstra's algorithm** is used with **P** as the source vertex then what is the order in which all vertices are visited?

Correct Answer: P,Q,R,U,S,T

2. Quiz 2, Sep 2023

Question Label : Multiple Choice Question

Consider the following directed graph.



If Dijkstra's algorithm is used with **a** as the source vertex, then what is the order in which all vertices are visited?

Note: *Assume that when multiple unvisited nodes have the same minimum distance, Dijkstra's algorithm visits them alphabetically.*

Options :

6406532306604. ✖ a, b, c, d, e

6406532306605. ✖ a, b, c, e, d

6406532306606. ✔ a, b, d, c, e

6406532306607. ✖ a, b, d, e, c

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3. Sep 23, Quiz 2

Which of the following statements is **true** about Dijkstra's algorithm to find the shortest path?

Options :

6406531963668. ✔ Dijkstra's algorithm may fail for graphs with negative weights because it does not reconsider a node once it marks it as visited, even if a shorter path exists than the previous one.

6406531963669. ✖ The shortest path between two vertices *u* and *v* in a graph *G* always remains unaltered when all the edges of *G* are incremented by an equal amount.

6406531963670. ✔ The shortest path between two vertices *u* and *v* in a graph *G* always remains unaltered when all the edges of *G* are multiplied by a positive integer.

6406531963671. ✔ To decide which node to visit next, Dijkstra's algorithm selects the node with the smallest known distance.

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4. End Term, Sep 23

There are N stones, numbered $0, 1, 2, \ldots, N-1$. For each $i (0 \leq i \leq N-1)$, the height of Stone i is h_i .

There is a frog who is initially on Stone 0. He will repeat the following action some number of times to reach Stone N

If the frog is currently on stone i, can jump to Stone $i+1$ or Stone $i+2$. Here, a cost of $| h_i - h_j |$ is incurred, where j is the stone to land on.

Find the minimum possible total cost to reach at stone 5 from stone 0 for the following sequence of heights for 6 stones.

```
30, 10, 60, 10, 60, 50
```

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

[redacted]

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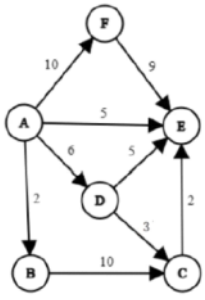
5. May 2023, End Term



If Dijkstra algorithm is used with **A** as the source vertex then what is the order in which all other vertices are visited?

Options :

6406532034105. ✖ A, B, E, D, F, C

6406532034106. ✖ A, B, D, E, C, F

6406532034107. ✔ A, B, E, D, C, F

6406532034108. ✖ A, B, D, E, F, C

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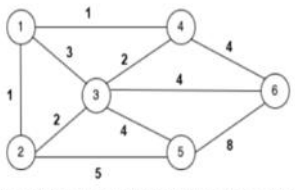
Kruskal's:

1. Sep 2023, End Term, MSQ

Consider the following graph



Which of the following can be the sequence of edges added, in that order, to create a minimum cost spanning tree using **Kruskal's algorithm**?

Options :

[redacted] (1, 2), (1, 4), (2, 3), (3, 5), (4, 6)

[redacted] (1, 2), (1, 4), (3, 4), (3, 5), (3, 6)

[redacted] (1, 2), (2, 3), (3, 4), (3, 5), (4, 6)

[redacted] (1, 2), (1, 4), (1, 3), (3, 6), (3, 5)

6406532324436. ✔ (1, 2), (1, 4), (2, 3), (4, 6), (3, 5)

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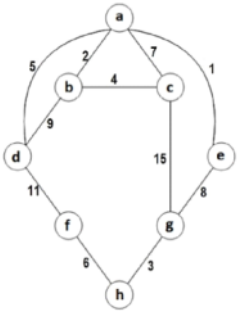
MCST:

1. Quiz 2, Jan 24

Consider the following graph.



If **Prim's algorithm** started with vertex a to construct a Minimum Spanning Tree, then what is the order in which vertices are marked visited?

Options :

6406532578231. ✔ a, e, b, c, d, g, h, f

6406532578232. ✖ a, e, b, c, g, h, d, f

6406532578233. ✖ a, e, b, d, c, h, g, f

6406532578234. ✖ a, e, b, d, c, g, f, h

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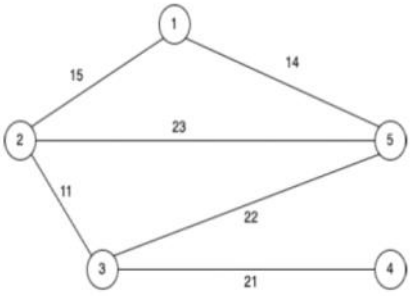
2. Jan 2024, End Term

Consider the given graph below:



Which of the following is the correct sequence of edges added to the minimum spanning tree when **Prim's algorithm** is applied on this graph with **5** as the source vertex?

Options :

[redacted] [(5,1),(3,2),(1,2),(3,4)]

[redacted] [(5,1),(1,2),(2,3),(3,4)]

[redacted] [(5,1),(3,4),(3,2),(2,1)]

[redacted] [(5,1),(3,2),(3,4),(2,1)]

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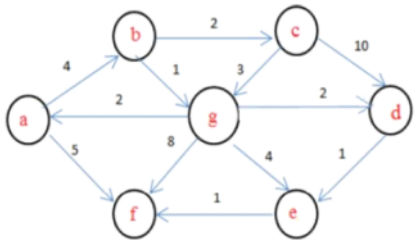
3. Jan 2024, End Term

In the given graph below, what is the minimum cost to reach vertex `f` from vertex `c`?



Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

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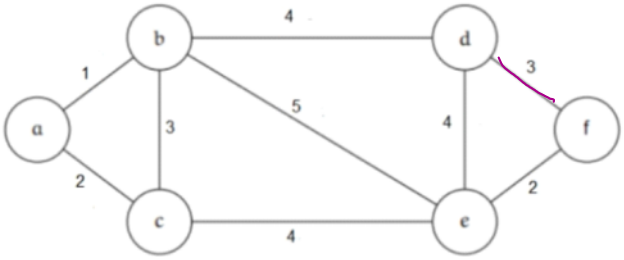
4. Quiz 2, Sep 2023

Consider the graph *G* given below.



The cost of the minimum cost spanning tree for the given graph is _____ .

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

12

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5. Quiz 2, Sep 23

Question Label : Multiple Choice Question

Let G = (V, E) be an undirected graph having distinct positive edge weights. Let V be partitioned into two non-empty sets X and Y. Let e = (s, t) be the minimum cost edge, with s belonging to X and t belonging to Y. Which of the following statement(s) is/are true?

1. The edge e must belong to each path from s to t.
2. The edge e must belong to the minimum cost spanning tree of G.

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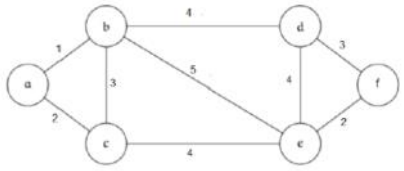
Options:

a. Only 1
b. Only 2 (correct)
c. Both
d. Neither

6. May 2023, End Term

Question Label : Short Answer Question

Consider the graph G given below.



The number of minimum cost spanning tree for the given graph is__.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

2

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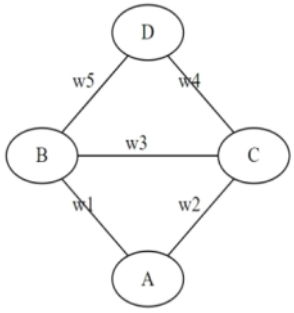
7. Quiz 2, Jan 2024

Consider the following graph where w1, w2, w3, w4, and w5 represent the weights on edges.



Which of the following statement(s) is/are always **true** for the **Minimum Spanning Tree(MST)**?

Options :

6406532578235. ✔ If all given weights are distinct, then only one unique MST is possible.

6406532578236. ✖ If w1 and w2 are the same and largest among all weights and other weights are distinct, then only one unique MST is possible.

6406532578237. ✔ If w1 and w3 are the same and largest among all weights and other weights are distinct, then only one unique MST is possible.

6406532578238. ✔ If w1 and w4 are the same and smallest among all weights and other weights are distinct, then only one unique MST is possible.

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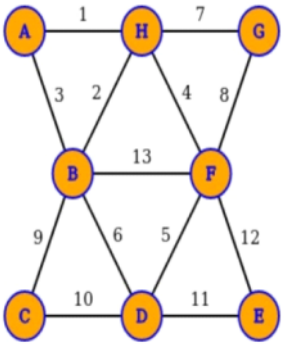
8. Quiz 2, Sep 22

Consider the graph *G* given below.



Let α denote the number of minimum spanning trees of G and β denote the weight of such a minimum spanning tree.
The value of $\alpha + \beta$ is _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

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9. Quiz 2, Sep 22

Correct Marks : 3

Question Label : Multiple Choice Question

Let *G* be a connected graph with at least 5 vertices and all edges in G having distinct weights. Let *T* be a minimum spanning tree of *G*. Consider the following statements:

1. If *e* is the heaviest edge in a cycle in G, then T must exclude *e*.
2. If *e* is the lightest edge in a cycle in G, then T must include *e*.
3. If e_3 and e_4 are the third and fourth smallest edges in G, then T must include at least one of them.

Which of the above statement(s) is/are **correct** regarding G and T?

Options :

6406531484560. ✖ Statement 1 only

6406531484561. ✖ Statement 3 only

6406531484562. ✖ Statements 1 and 2

6406531484563. ✔ Statements 1 and 3

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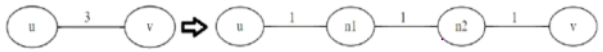
Comparison of Algorithms:

1. **Sep 2023, End Term**

Consider the following strategy to solve the single source shortest path problem with positive integer edge weights from a source vertex `s`:

Replace each edge in the graph with weight `w` by `w` edges of weight 1 connected by new `w-1` intermediate nodes. For example:



Run **BFS(s)** on the modified graph to find the shortest path to each of the original vertices in the graph.

Which of the following statements is true?

Options :

6406532324424. ✖ This strategy will not solve the problem correctly.

6406532324425. ✖ This strategy will only work if the graph is acyclic.

6406532324426. ✖ This strategy will solve the problem correctly and is as efficient as Dijkstra's algorithm.

6406532324427. ✔ This strategy will solve the problem correctly, but is not as efficient as Dijkstra's algorithm.

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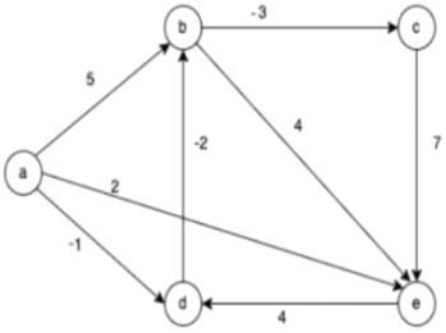
2. **Quiz 2, Sep 2023**

Consider the following graph.



Which of the following statement(s) is/are **true** about computing the shortest path distance from vertex `a` to other vertices in the given graph?

Options :

6406532306608. ✔ Dijkstra's algorithm computes the correct shortest path distance.

6406532306609. ✖ Dijkstra's algorithm does not compute the correct shortest path distance.

6406532306610. ✔ Bellman-Ford algorithm computes the correct shortest path distance.

6406532306611. ✖ Bellman-Ford algorithm does not compute the correct shortest path distance.

6406532306612. ✔ Floyd Warshall algorithm computes the correct shortest path distance.

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3. Quiz 2, May 2023

Correct Marks : 3

Question Label : Multiple Choice Question

Consider the following strategy to solve the single source shortest path problem with positive integer edge weights from a source vertex s:

Replace each edge with weight w by w edges of weight 1 connected by new intermediate nodes. Run BFS(s) on the modified graph to find the shortest path to each of the original vertices in the graph.

Which of the following statement is true?

Options :

6406531963664. ✖ This strategy will not solve the problem correctly.

6406531963665. ✖ This strategy will only work if the graph is acyclic.

6406531963666. ✖ This strategy will solve the problem correctly and is as efficient as Dijkstra's algorithm.

6406531963667. ✔ This strategy will solve the problem correctly, but is not as efficient as Dijkstra's algorithm.

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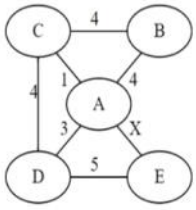
Quiz 2, May 22

Consider the following graph G.



Choose a value for x that will maximize the number of minimum cost spanning trees [MCSTs] for graph G. The number of minimum cost spanning trees [MCSTs] of G for this value of x is_____.

Options :

6406531165962. ✖ 1

6406531165963. ✖ 3

6406531165964. ✔ 4

6406531165965. ✖ 5

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