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**Roll No. L1F18BSCS0311**

**Section - F**

**Try to clear your concepts related to shortest path**

**Question 1**

Draw the graph and apply the single source shortest path algorithm (Dijkstra), A is the source for the shortest path calculation. In the form of table show all the steps

|  |  |
| --- | --- |
| Vertex | Relations |
| A | B(2), D(5) |
| B | E(1), G(8), F(4) |
| C | B(1), E(2) |
| D | C(10), G(2) |
| E | F(2), D(4) |
| F | G(1), C(2) |
| G | B(3), A(5) |



|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **A** | **B** | **C** | **D** | **E** | **F** | **G** |
|  | **0/nil** | Inf/nil | Inf/nil | Inf/nil | Inf/nil | Inf/nil | Inf/nil |
| **A/0** | **X** | **2/A** | Inf/nil | 5/A | Inf/nil | Inf/nil | Inf/nil |
| **B/2** | **X** | **X** | Inf/nil | 5/A | **1/B** | 4/B | 8/B |
| **E/1** | **X** | **X** | Inf/nil | 4/E | **X** | **2/E** | 8/B |
| **F/2** | **X** | **X** | 2/F | 4/E | **X** | **X** | **1/F** |
| **G/1** | **X** | **X** | **2/F** | 4/E | **X** | **X** | **X** |
| **C/2** | **X** | **X** | **X** | **4/E** | **X** | **X** | **X** |
| **E/4** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |

**Question 2**

Draw the graph and apply the single source shortest path algorithm (Bellman Ford), A is the source for the shortest path calculation. You have to show all the updated vertex weights and their parent selection after every complete update of all the edges.

You should consider all the edges in the alphabetical order. Show after every pass update.

|  |  |
| --- | --- |
| Vertex | Relations |
| A | B(2), C(2) |
| B | E(-3), G(8), F(4) |
| C | B(1), E(-2) |
| D | C(10), G(2) |
| E | G(2), D(2) |
| F | E(1), B(2) |
| G | B(-3), A(2) |



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

Pass 1:

|  |  |
| --- | --- |
| Vertex | Weight/Parent |
| A | 0/Nil |
| B | 2/A |
| C | 2/A |
| D | Inf/Nil |
| E | Inf/Nil |
| F | Inf/Nil |
| G | Inf/Nil |

Pass 2:

|  |  |
| --- | --- |
| Vertex | Weight/Parent |
| A | 0/Nil |
| B | 2/A |
| C | 2/A |
| D | Inf/Nil |
| E | -1/B |
| F | 6/B |
| G | 10/B |

Pass 3:

|  |  |
| --- | --- |
| Vertex | Weight/Parent |
| A | 0/Nil |
| B | 2/A |
| C | 2/A |
| D | 1/E |
| E | -1/B |
| F | 6/B |
| G | 1/E |

Pass 4:

|  |  |
| --- | --- |
| Vertex | Weight/Parent |
| A | 0/Nil |
| B | -2/G |
| C | 2/A |
| D | 1/E |
| E | -1/B |
| F | 6/B |
| G | 1/E |

**Question 3**

Given a directed, weighted, connected graph G (V, E) and two vertices u & v, find the shortest path between u & v that passes through a vertex e. **[what it means, you have to find that if there is a shortest path from u to v that should pass through vertex e and this path should be the shortest of all available from u to v through e, if no path available from u to v through e then return -1]**

It is required to write function(s), in pseudo-code, that finds and returns shortest distance between vertices u & v that passes through another vertex e. If there is no such path, the function returns -1.

All the three vertices u, v & e are in a weighted, directed, connected graph G (V, E), with positive weights. **[You should write a generic solution for this problem, in-term of u, v and e vertices]**

**Example: To give the basic understanding that how you have to think to produce your solution**

* The shortest distance path between vertices S & E that passes through vertex D is 9 in the following graph.  
  S – A – D – E (2 + 4 + 6)  
  S – A – D – B – E (2 + 4 + 2 + 5)  
  S – A – D – C – E (2 + 4 + 2 + 1)
* The shortest distance path between vertices S & B that passes through vertex C in the following graph is not possible. Therefore, the function returns -1. As S to B there is a path but it has no option to take any possible route through C



**Pseudo solution needed [first write your ides in points that how you will solve the example]**

**Question 4**In a given directed weighted graph [ positive edge weights], you have applied shortest path algorithm [Dijkstra] and calculated every vertex shortest distance from the given source vertex. You can use question 1 graph and its solution for your understanding that what you have to solve.  
**Question is this**, you have to find that if there is a path between u to v vertex in the given graph, can you find this path in minimum possible steps. Also if the path is not there how you will decide this problem also.  
**Your idea, understanding, solution points, different cases and pseudo solution is needed.**