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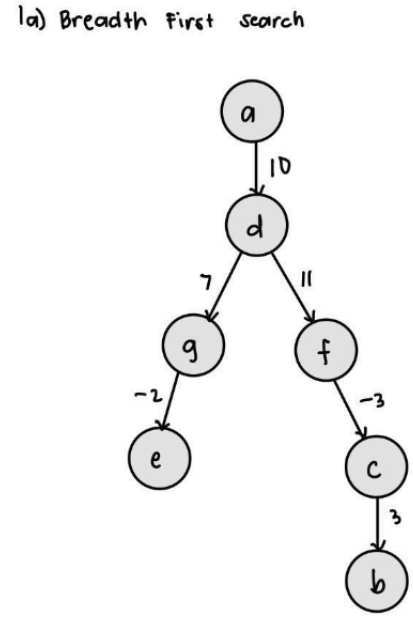
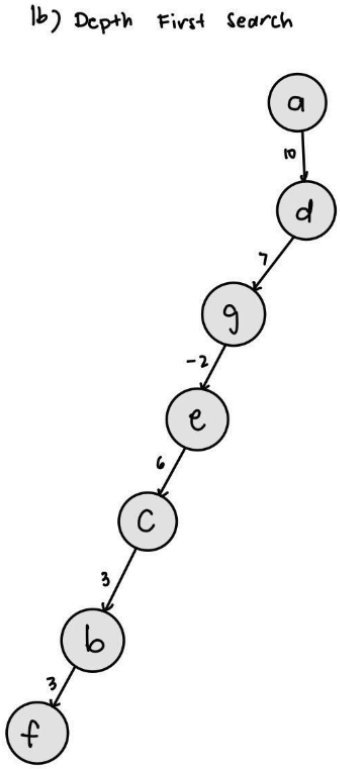
Andrea Laserna

1. **Create a spanning tree. If there are multiple neighbors, select the vertex to traverse first with the lesser weight. Assume that the source vertex is A.**
   a. **BFS Traversal**

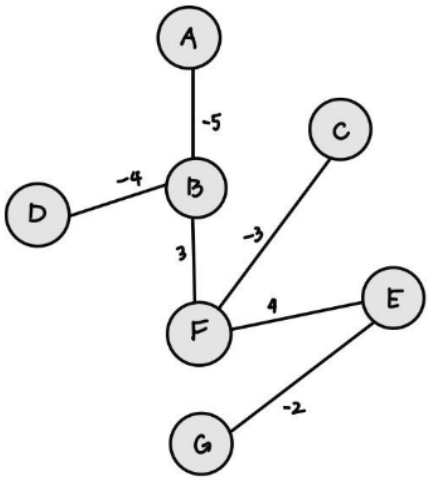


   b. **DFS Traversal**



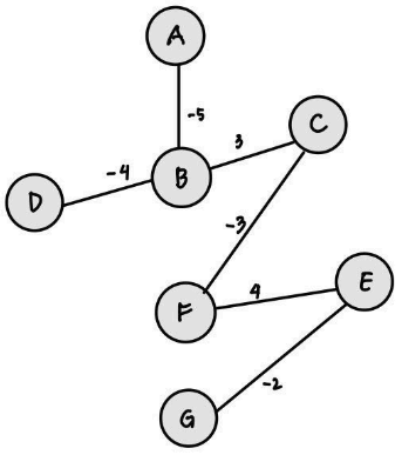
2. **Find the minimum spanning tree of the graph using the following algorithms:**
    a. **Kruskal's Algorithm**

2a) Kruskal's Algorithm



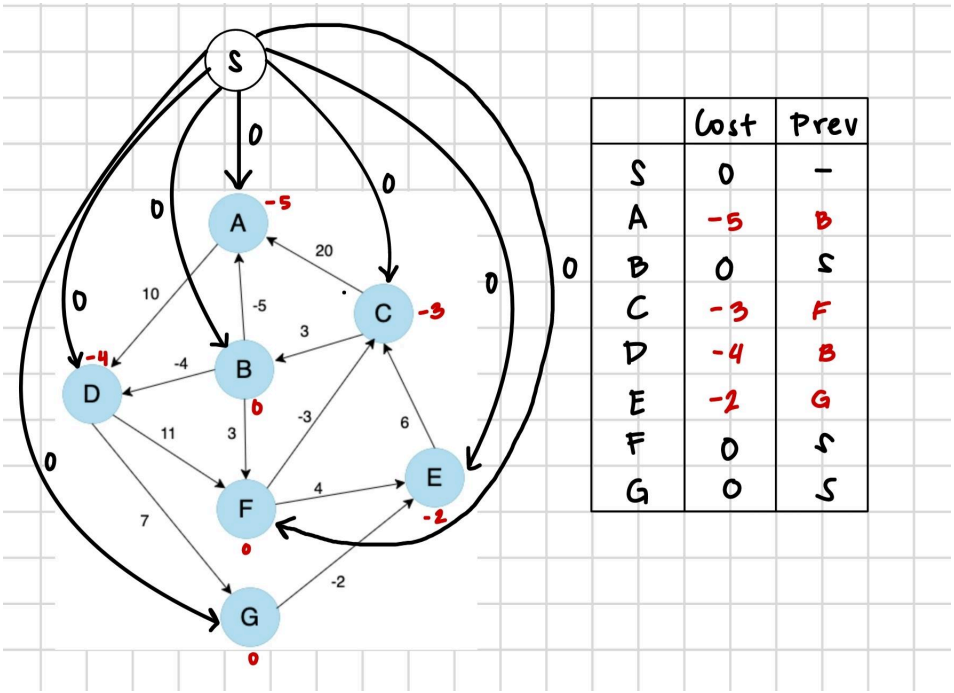
    b. **Prim's Algorithm**

2b) Prim's Algorithm



3. **Find the all-pairs shortest path of the graph using Johnson's Algorithm. Show the following:**
    a. **The shortest paths from the (new) source vertex using Bellman-Ford Algorithm.**
        i. **Specify the number of iterations done**
        The total number of iterations done by the algorithm is 2.

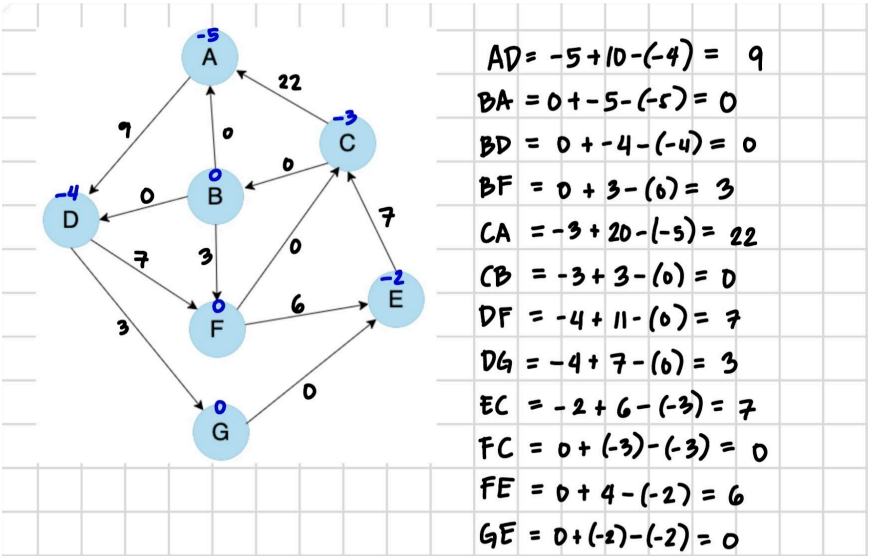
        ii. **You may just show the final table containing the costs / distances from source to each vertex and the previous node**



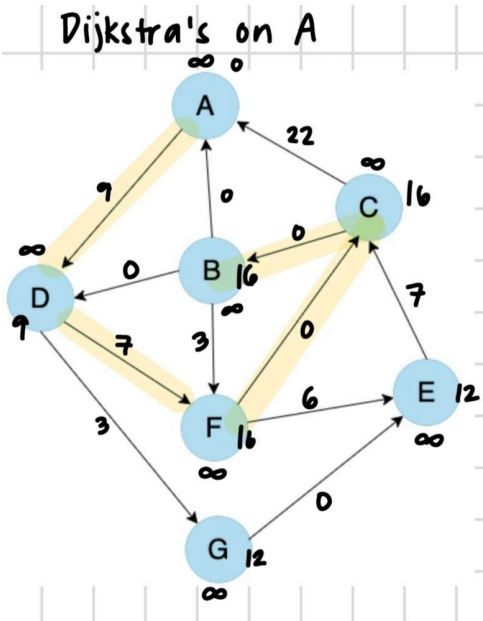
	Cost	Prev
S	0	–
A	-5	B
B	0	S
C	-3	F
D	-4	B
E	-2	G
F	0	S
G	0	S

b. Show the reweighted edges after performing the Bellman-Ford Algorithm c. Perform Dijkstra's algorithm on the following vertices:

Reweighted edges:



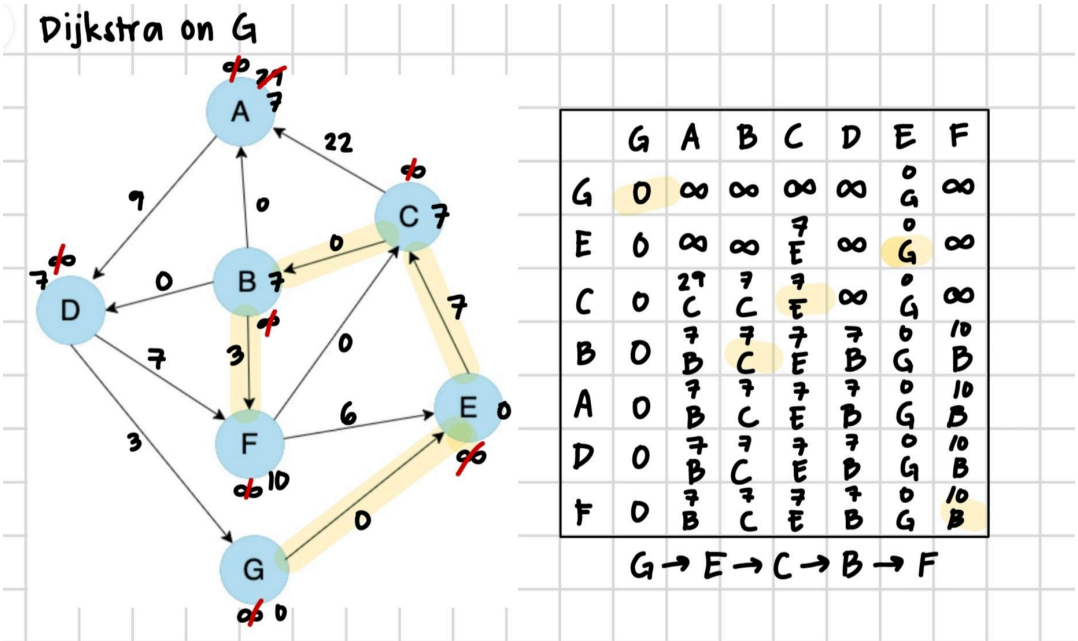
i. A



	A	B	C	D	E	F	G
A	0	∞	∞	9 A	∞	∞	∞
D	0	∞	∞	9 A	∞	16 D	12 D
G	0	∞	∞	9 A	12 G	16 D	12 D
E	0	∞	19 E	9 A	12 G	16 D	12 D
F	0	∞	16 F	9 A	12 G	16 D	12 D
C	0	16 C	16 F	9 A	12 G	16 D	12 D
B	0	16 C	16 F	9 A	12 G	16 D	12 D

A → D → F → C → B

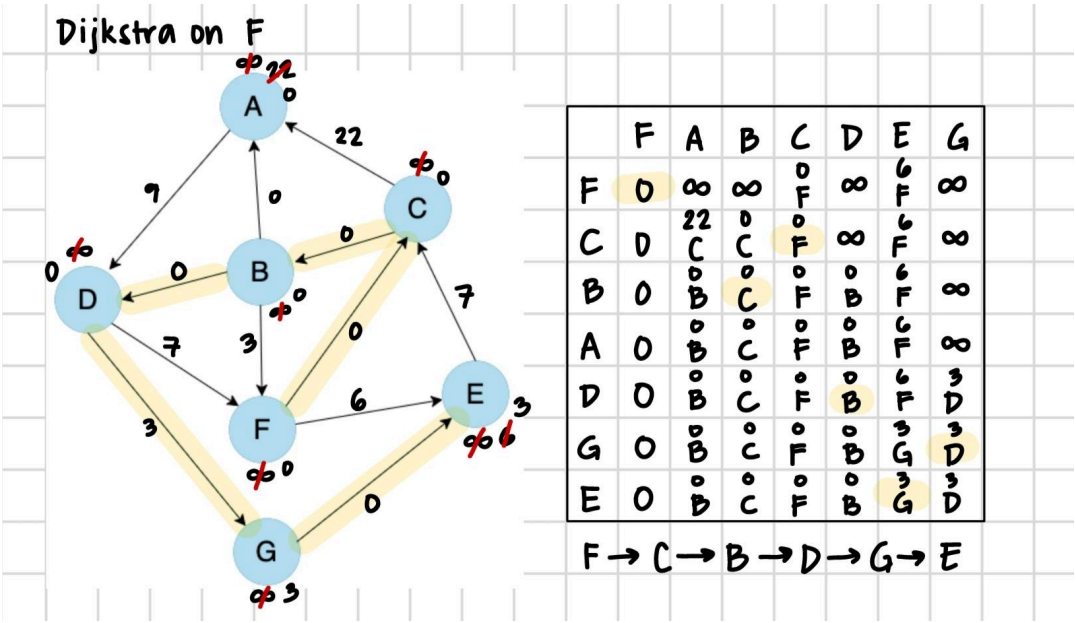
ii. G



	G	A	B	C	D	E	F
G	0	∞	∞	∞	∞	0 G	∞
E	0	∞	∞	7 E	∞	0 G	∞
C	0	29 C	7 C	7 E	∞	0 G	∞
B	0	7 B	7 C	7 E	7 B	0 G	10 B
A	0	7 B	7 C	7 E	7 B	0 G	10 B
D	0	7 B	7 C	7 E	7 B	0 G	10 B
F	0	7 B	7 C	7 E	7 B	0 G	10 B

G → E → C → B → F

iii. F

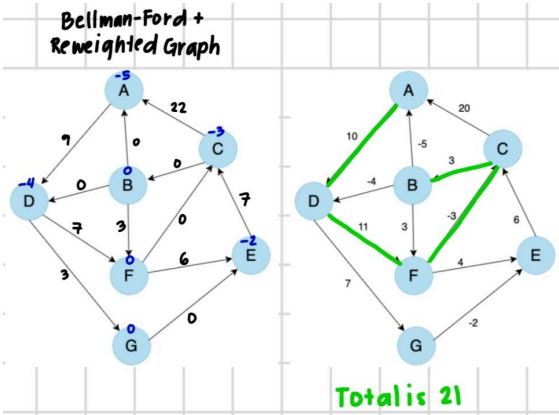


	F	A	B	C	D	E	G
F	0	∞	∞	0 F	∞	6 F	∞
C	D	22 C	0 C	0 F	∞	6 F	∞
B	0	0 B	0 C	0 F	0 B	6 F	∞
A	0	0 B	0 C	0 F	0 B	6 F	∞
D	0	0 B	0 C	0 F	0 B	6 F	3 D
G	0	0 B	0 C	0 F	0 B	3 G	3 D
E	0	0 B	0 C	0 F	0 B	3 G	3 D

F → C → B → D → G → E

c. Reweight and compute the original distances.

Vertex A:



	A	B	C	D	E	F	G
A	0	∞	∞	9 A	∞	∞	∞
D	0	∞	∞	9 A	∞	16 D	12 D
G	0	∞	∞	9 A	12 G	16 D	12 D
E	0	∞	19 E	9 A	12 G	16 D	12 D
F	0	∞	16 F	9 A	12 G	16 D	12 D
C	0	16 C	16 F	9 A	12 G	16 D	12 D
B	0	16 C	16 F	9 A	12 G	16 D	12 D

$d(u,v) = d'(u,v) - h(u) + h(v)$

$d(a,d) = 9 - (-5) + (-4) = 10$

$d(a,b) = 16 - (-5) + 0 = 21$ ✓

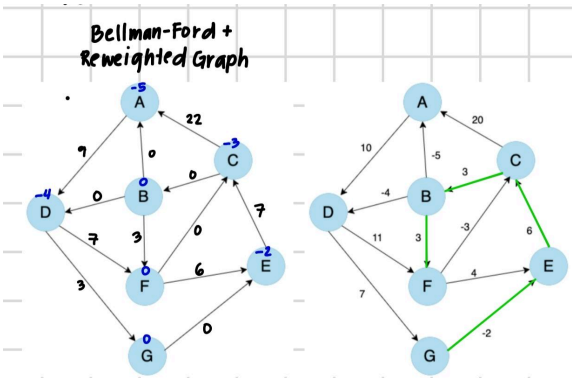
$d(a,c) = 16 - (-5) + (-3) = 18$

$d(a,e) = 12 - (-5) + (-2) = 15$

$d(a,f) = 16 - (-5) + 0 = 21$

$d(a,g) = 12 - (-5) + 0 = 17$

Vertex G:



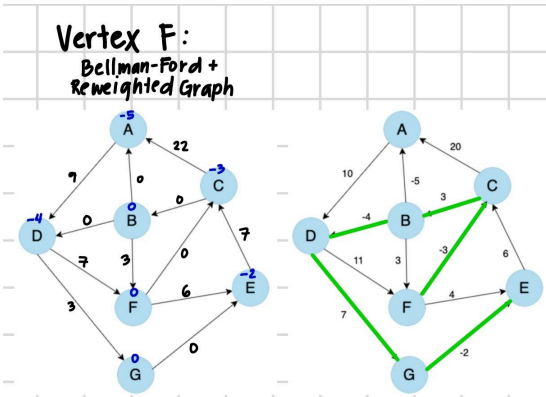
	G	A	B	C	D	E	F
G	0	∞	∞	∞	∞	0 G	∞
E	0	∞	∞	7 E	∞	0 G	∞
C	0	29 C	7 C	7 E	∞	0 G	∞
B	0	7 B	7 C	7 E	7 B	0 G	10 B
A	0	7 B	7 C	7 E	7 B	0 G	10 B
D	0	7 B	7 C	7 E	7 B	0 G	10 B
F	0	7 B	7 C	7 E	7 B	0 G	10 B

$d(g,e) = 0 - 0 + (-2) = -2$ $d(g,b) = 7 - 0 + (0) = 7$

$d(g,f) = 10 - 0 + 0 = 10$ $d(g,c) = 7 - 0 + (-3) = 4$

$d(g,a) = 7 - 0 + (-5) = 2$ $d(g,d) = 7 - 0 + (-4) = 3$

Vertex F:



	F	A	B	C	D	E	G
F	0	∞	∞	0 F	∞	6 F	∞
C	0	22 C	0 C	0 F	∞	6 F	∞
B	0	0 B	0 C	0 F	0 B	6 F	∞
A	0	0 B	0 C	0 F	0 B	6 F	∞
D	0	0 B	0 C	0 F	0 B	6 F	3 D
G	0	0 B	0 C	0 F	0 B	3 G	3 D
E	0	0 B	0 C	0 F	0 B	3 G	3 D

$d(f,c) = 0 - 0 + (-3) = -3$ $d(f,b) = 0 - 0 + (0) = 0$

$d(f,e) = 3 - 0 + (-2) = 1$ $d(f,c) = 0 - 0 + (-3) = -3$

$d(f,a) = 0 - 0 + (-5) = -5$ $d(f,d) = 0 - 0 + (-4) = -4$