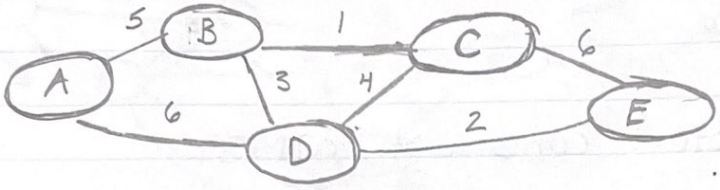
Arjun Koshal

"I pledge my honor that I have abided by the Stevens Honor System" - Arjun Koshal

1. Apply Kruskal's algorithm to find the minimum spanning tree. Show all steps of your work and give the value you obtained for the minimum spanning tree.



Solution:

Step 1: Get weights from graph

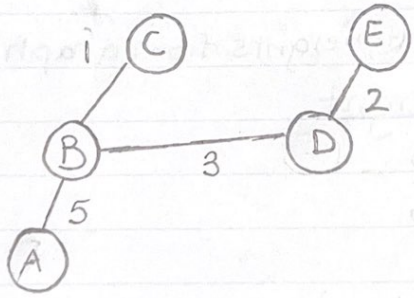
Edge	Weight
AB	5
AD	6
BC	1
BD	3
CD	4
CE	6
DE	2

Step 2: Sort edges by weight

Edge	Weight
BC	1
DE	2
BD	3
CD	4
AB	5
AD	6
CE	6

Step 3: Start constructing MST

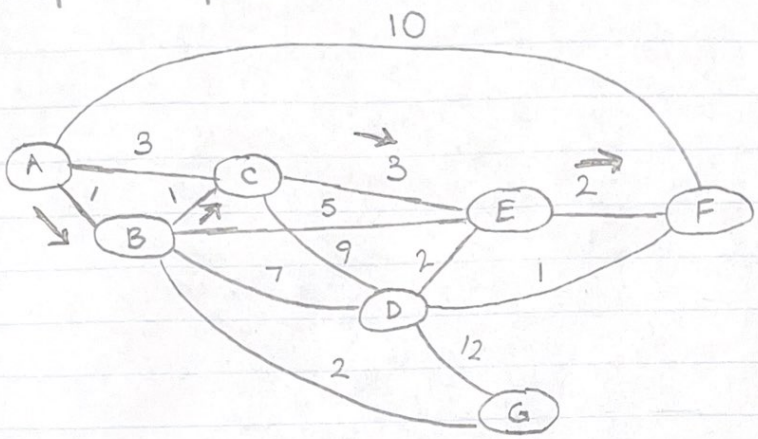
	Edge	Weight
①	BC	1
②	DE	2
③	BD	3
×	CD	4
④	AB	5
×	AD	6
×	CE	6



Insertion of CD, AD, and CE would create cycles.

The value is $1+2+3+5=\boxed{11}$

2. Use Dijkstra's algorithm to Find the Shortest path between nodes A and F. (Start at A and end at F). Show all steps of your work.



Solution:

Q:

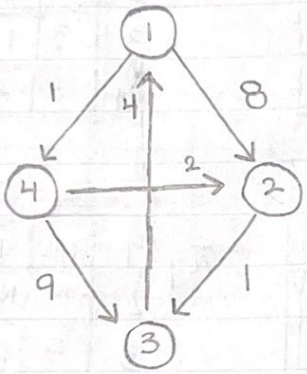
A	B	C	D	E	F	G
0	∞	∞	∞	∞	∞	∞
0	1	3	∞	∞	10	∞
0	1	1	7	5	10	2
0	1	1	7	3	10	2
0	1	1	7	3	2	2

Shortest path is: A → B → C → E → F

0 + 1 + 1 + 3 + 2 = $\boxed{7}$

S = {A, B, C, G, E, D, F}

3. Apply Floyd Warshall Algorithm to find the all-pair shortest path from the following graph. Mention the shortest path for each vertex to every other vertex. Also find the transitive closure of the graph.



Solution:

$D_0 =$

	1	2	3	4
1	0	8	∞	1
2	∞	0	1	∞
3	4	∞	0	∞
4	∞	2	9	0

$\pi_0 =$

	1	2	3	4
1	NIL	1	NIL	1
2	NIL	NIL	2	NIL
3	3	NIL	NIL	NIL
4	NIL	4	4	NIL

$D_1 =$

	1	2	3	4
1	0	8	∞	1
2	∞	0	1	∞
3	4	12	0	5
4	∞	2	9	0

$\pi_1 =$

i \ j	1	2	3	4
1	NIL	1	NIL	1
2	NIL	NIL	2	NIL
3	3	1	NIL	1
4	NIL	4	4	NIL

D_2 =

	1	2	3	4
1	0	8	9	1
2	∞	0	1	∞
3	4	12	0	5
4	∞	2	3	0

π_2 =

	1	2	3	4
1	NIL	1	2	1
2	NIL	NIL	2	NIL
3	3	1	NIL	1
4	NIL	4	2	NIL

D_3 =

	1	2	3	4
1	0	8	9	1
2	5	0	1	6
3	4	12	0	5
4	7	2	3	0

π_3 =

	1	2	3	4
1	NIL	1	2	1
2	3	NIL	2	3
3	3	1	NIL	1
4	3	4	2	NIL

D_4 =

	1	2	3	4
1	0	3	4	1
2	5	0	1	6
3	4	7	0	5
4	7	2	3	0

π_4 =

	1	2	3	4
1	NIL	4	4	1
2	3	NIL	2	3
3	3	4	NIL	1
4	3	4	2	NIL

Shortest Paths of Each Vertex:

Vertex	Path
1 → 2	1 → 4 → 2
1 → 3	1 → 4 → 2 → 3
1 → 4	1 → 4
2 → 1	2 → 3 → 1
2 → 3	2 → 3
2 → 4	2 → 3 → 4
3 → 1	3 → 1
3 → 2	3 → 1 → 4 → 2
3 → 4	3 → 1 → 4

Vertex	Path
4→1	4→2→3→1
4→2	4→2
4→3	4→2→3

$T_0 =$

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

$T_4 =$

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

$T_1 =$

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

$T_2 =$

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

$T_3 =$

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