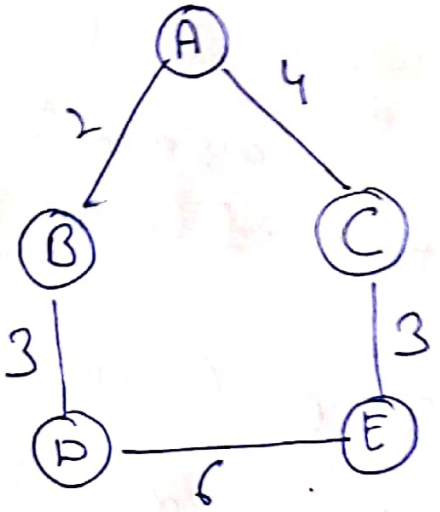
PRIM'S ALGO (G, W, R)

// G → Given graph having vertices and edges
// W → weight assigned to each edge
// R → Root of Graph (starting vertex)

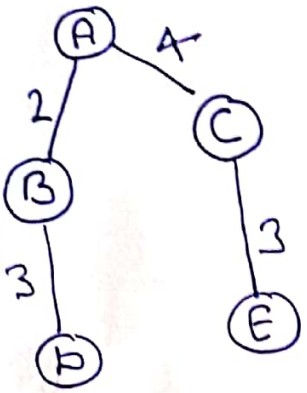
```
{
    for each u ∈ G.V
        u.key = ∞          // Π: Parent node.
        u.Π = NIL
        R.key = 0
        Q = G.V            // Min Heap.

    while (Q ≠ 0)
    {   u = extract_min(Q)  → u
        for each v ∈ G.adj[u] do
        if v ∈ Q and w(u,v) < v.key
            v.Π = u
            v.key = w[u,v]
    }
}
```

PRIM's Algo.

Example 1.



Node	Parent	key
A	Nil	~~∞~~ 0 x
B	~~Nil~~ A	~~∞~~ 2 x
C	~~Nil~~ A	~~∞~~ 4 ✓x
D	~~Nil~~ B	~~∞~~ 3 ✓x
E	~~Nil~~ ~~B~~ ~~D~~ C	~~∞~~ ~~∞~~ 3 x



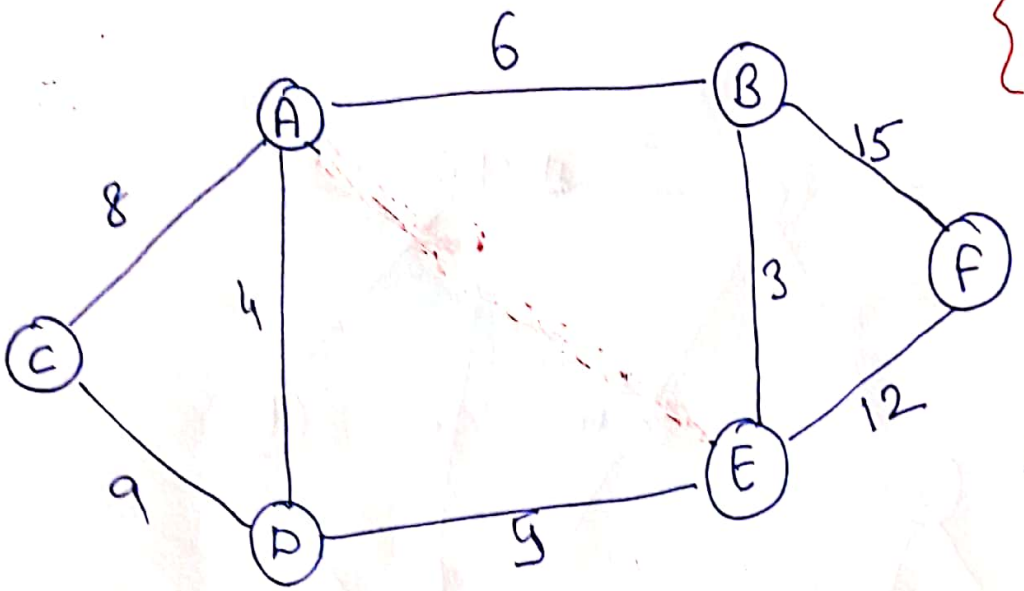
Cost = 2+4+3+3
= 12.

Q:

A	B	C	D	E
x	x	x	x	x

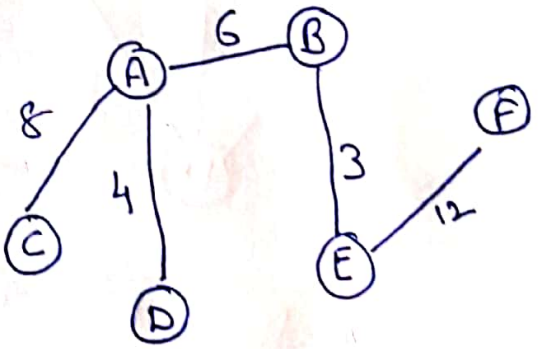
Example 2. PRIM's ALGO

{ In this Graph AE is not an edge }



Starting vertex = A

Node	Parent	Key
A	NiL	~~∞~~ 0 X
B	~~NiL~~ A	~~∞~~ 6 ✓3 X
C	~~NiL~~ A	~~∞~~ 8 ✓5 X
D	~~NiL~~ A	~~∞~~ 4 ✓2 X
E	~~NiL~~ ~~D~~ B	~~∞~~ ~~5~~ 3 ✓1 X
F	~~NiL~~ ~~B~~ E	~~∞~~ ~~15~~ 12 ✓6 X



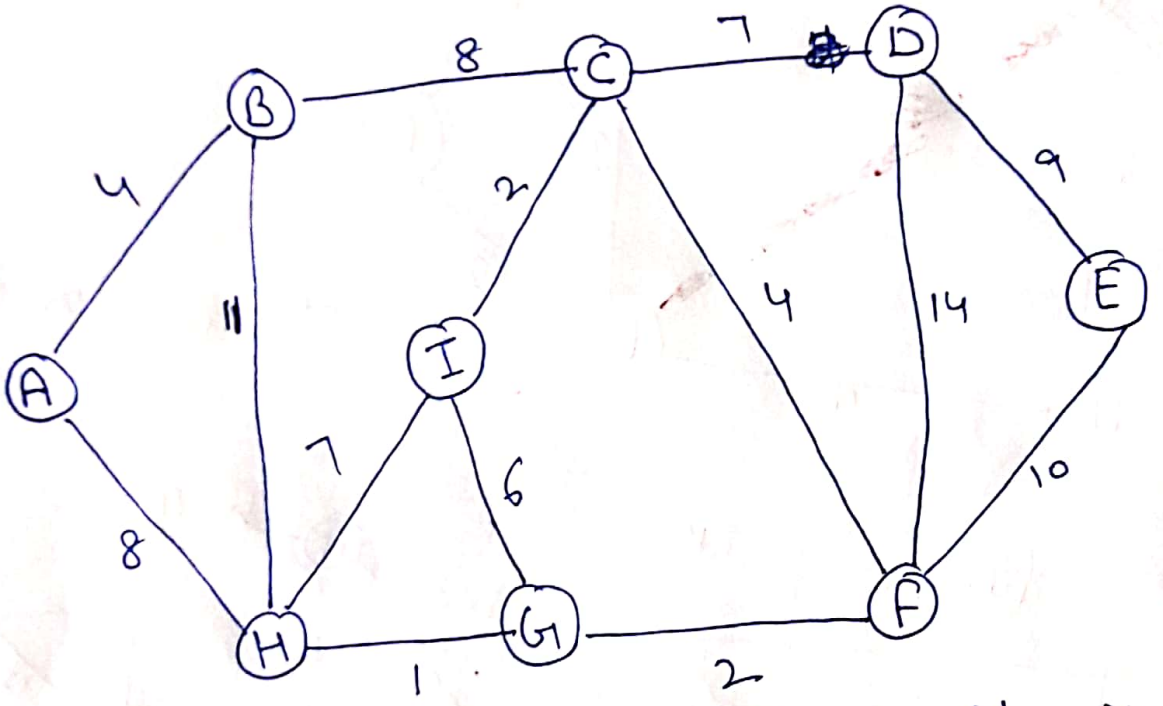
No. of vertices = 6
No. of edges = 5

Cost MST =
8 + 4 + 6 + 3 + 12
= 33

Q :

A	B	C	D	E	F
X	X	X	X	X	Y

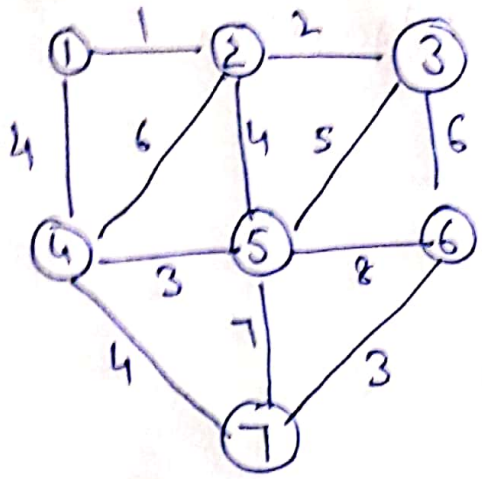
Assignment



Find the MST using Prim's Algorithm.

Pseudo Code for Krushal's Algorithm

```
MST_Krushal (G, w)
1   T ← φ
2.  for every vertex v ∈ V(G)
3.      do makeSet (v)
4.  Sort the edges of E into increasing order by
                weight w.
5.  for each edge (u,v) ∈ E taken in sorted order by wt.
6.      do if find_set (u) ≠ find_Set (v)
7.          then T ← T ∪ {u,v}
8.              Union (u,v)
9.      return T
```



Edge	wt.
1→2	1
2→3	2
4→5	3
6→7	3
1→4	4
2→5	4
4→7	4
3→5	5
2→4	6
3→6	6
5→7	7
5→6	8

Step / Node	Edge Considered	Connected Component
	Initialization	{1}, {2}, {3}, {4}, {5}, {6}, {7}
1	1→2	{1,2}, {3}, {4}, {5}, {6}, {7}
2	2→3	{1,2,3}, {4}, {5}, {6}, {7}
3	4→5	{1,2,3}, {4,5}, {6}, {7}
4	6→7	{1,2,3}, {4,5}, {6,7}
5	1→4	{1,2,3,4,5}, {6,7}
6	2→5	rejected
7	4→7	{1,2,3,4,5,6,7}

for Dense Graph, Prim's Algorithm is used for finding MST.

for Sparse Graph Kruskal's algorithm is used for finding MST.

Assignment

Apply Kruskal's Algorithm