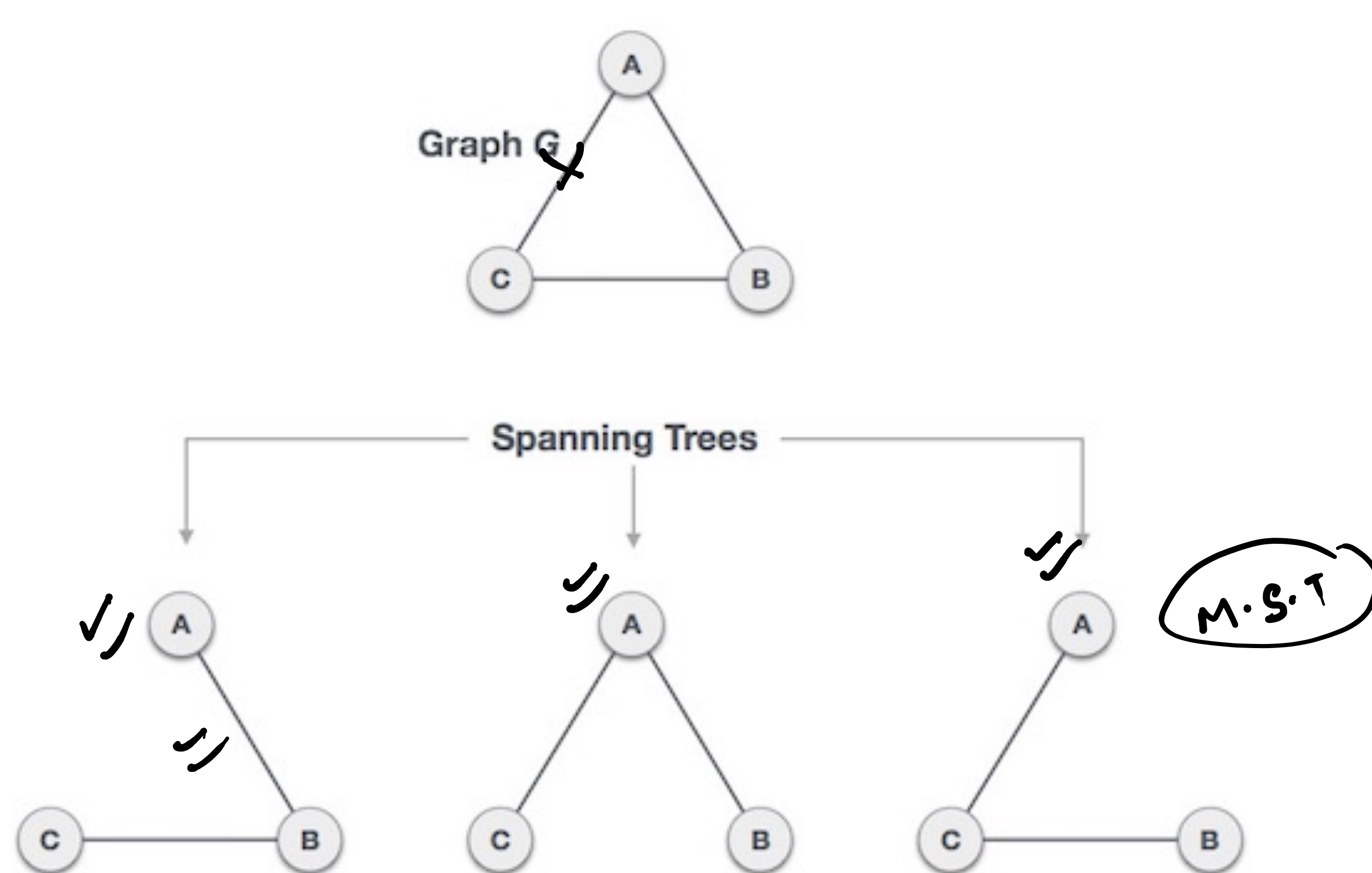


Spanning Tree

A spanning tree is a subset of Graph G, which has all the vertices covered with minimum possible number of edges. Hence, a spanning tree does not have cycles and it cannot be disconnected..



Properties of Spanning Tree

- A Connected graph G can have more than one spanning tree.
- Spanning Tree has $n-1$ edges, where n is the number of Node (Vertices)
- All possible spanning trees of graph G, have the same number of edges and vertices.
- The spanning tree does not have any cycle (loops).
- Removing one edge from the spanning tree will make the graph disconnected, i.e. the spanning tree is minimally connected.
- Adding one edge to the spanning tree will create a circuit or loop, i.e. the spanning tree is maximally acyclic.

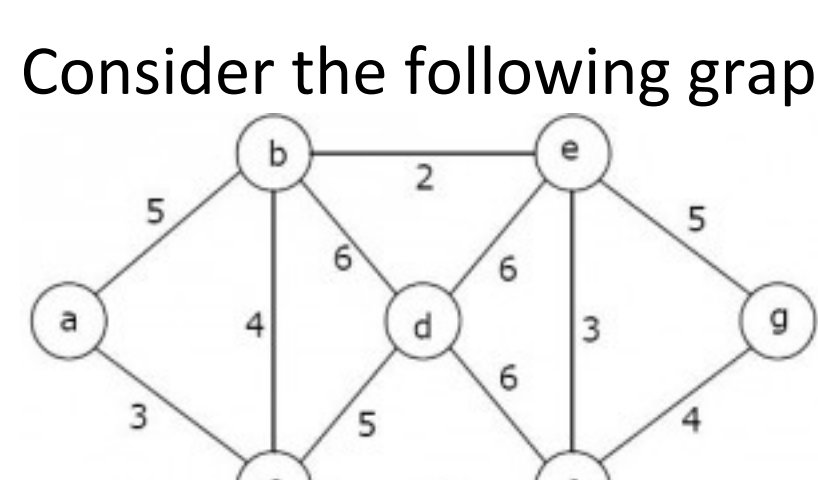
Minimum Spanning Tree (MST)

In a weighted graph, a minimum spanning tree is a spanning tree that has minimum weight than all other spanning trees of the same graph.

- **Kruskal's Algorithm**

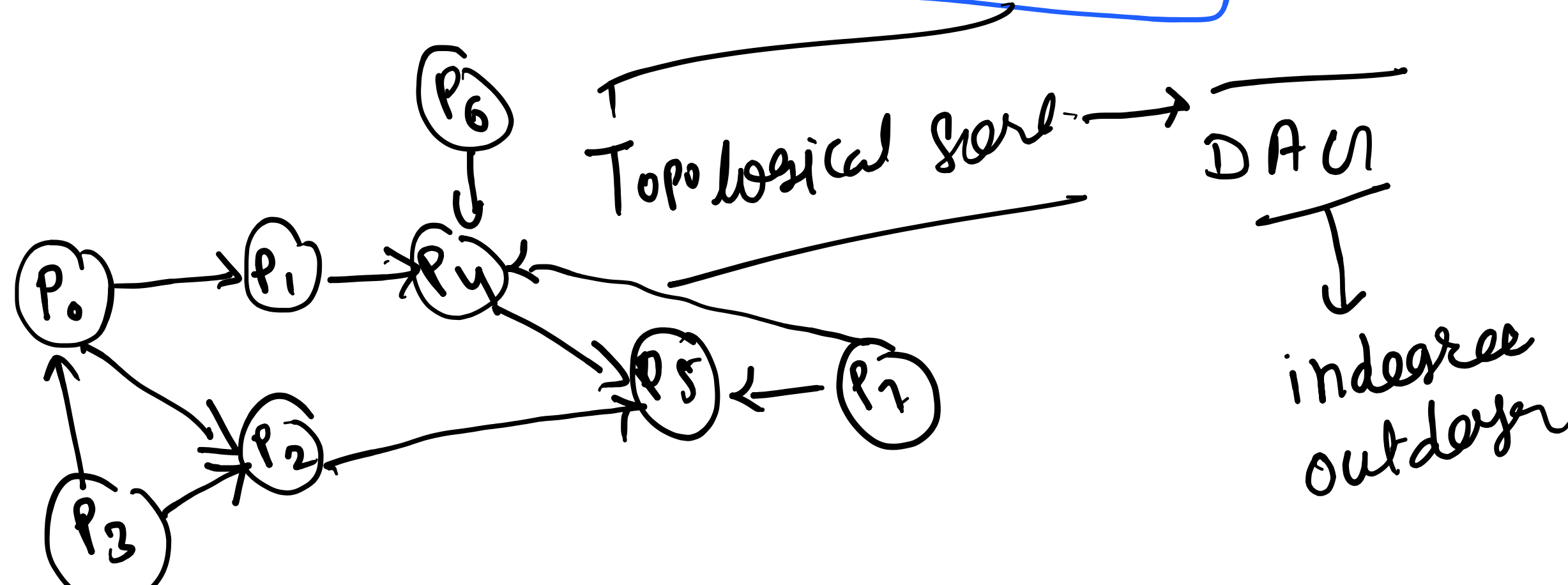
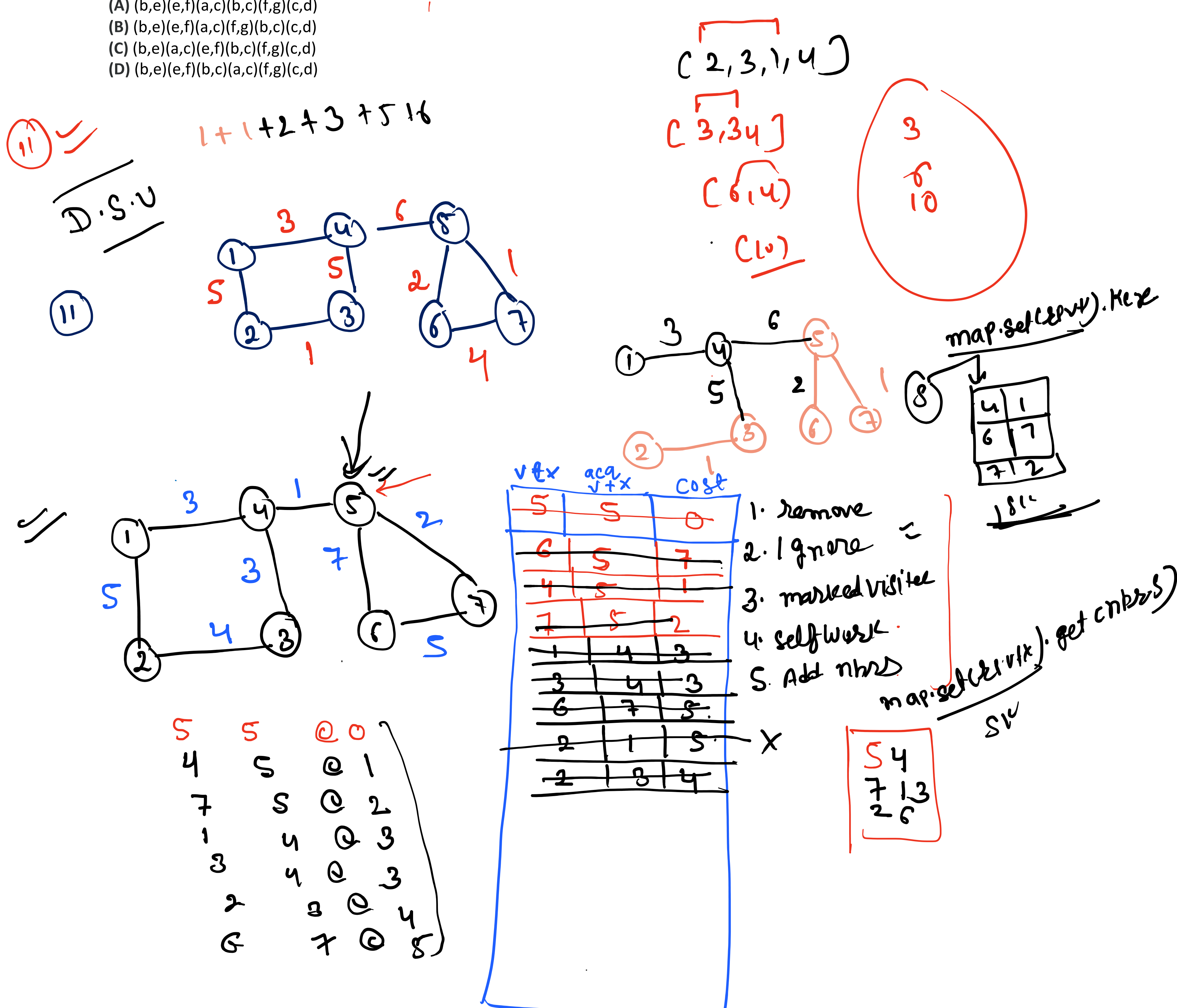
Prim's Algorithm

Both are greedy algorithms.

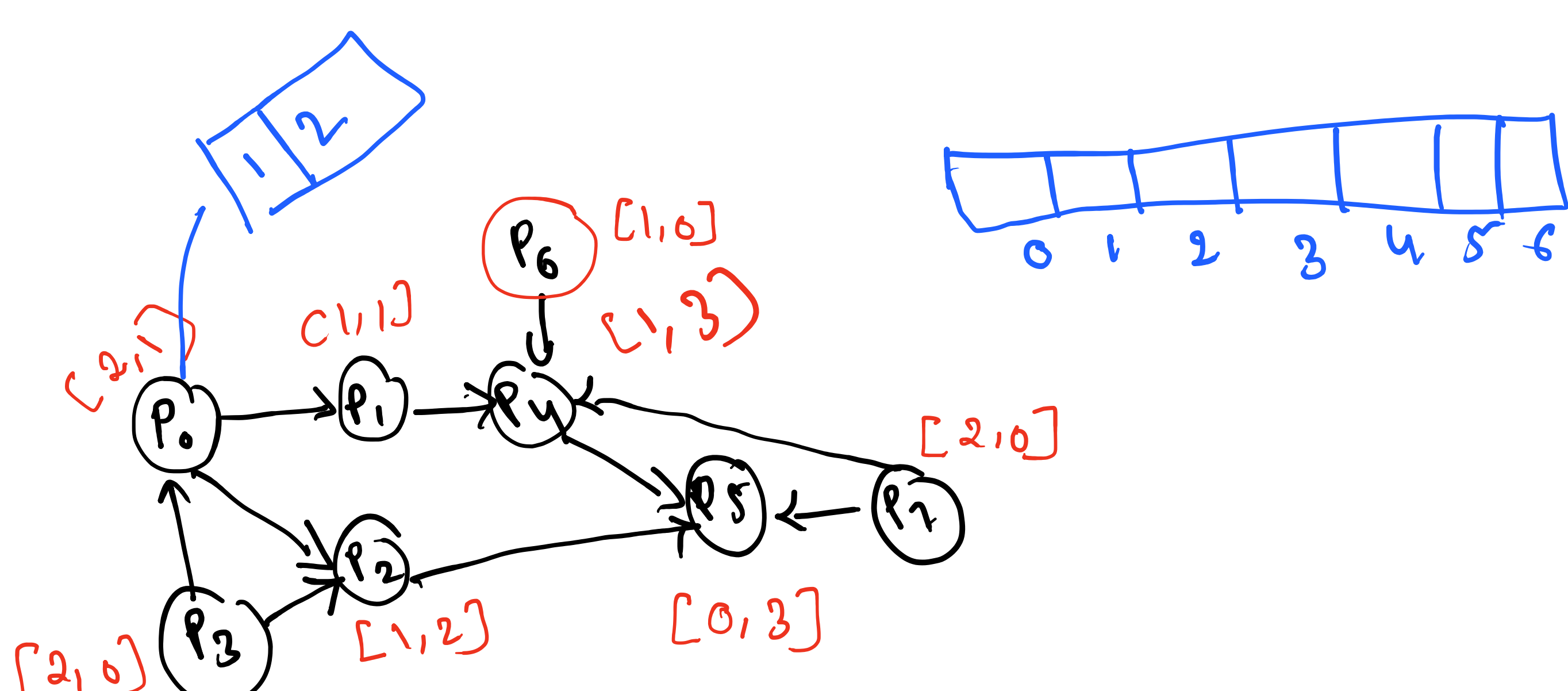
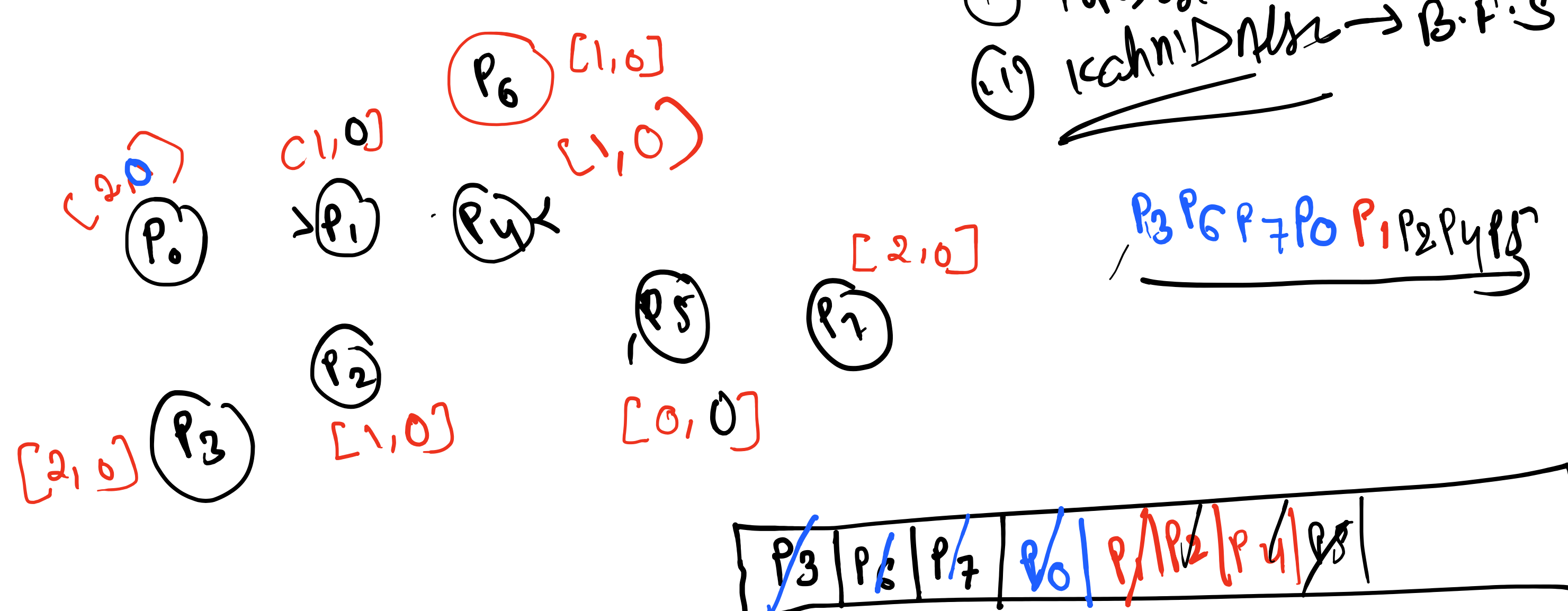


Which one of the following is NOT the sequence of edges added to the minimum spanning tree using Kruskal's algorithm?

- (A) (b,e)(e,f)(a,c)(b,c)(f,g)(c,d)
(B) (b,e)(e,f)(a,c)(f,g)(b,c)(c,d)
(C) (b,e)(a,c)(e,f)(b,c)(f,g)(c,d)
(D) (b,e)(e,f)(b,c)(a,c)(f,g)(c,d)



- ① Topologie \rightarrow D.F.S
② Kahn's Algorithm \rightarrow B.F.S



```
public int[] indegree() {
    int[] in = new int[map.size()];
    for (int v1 : map.keySet()) {
        for (int v2 : map.get(v1)) {
            in[v2]++;
        }
    }
}
```

