204) Given a graph represented by an edge list, implement Kruskal's Algorithm to find the Minimum Spanning Tree (MST) and its total weight.

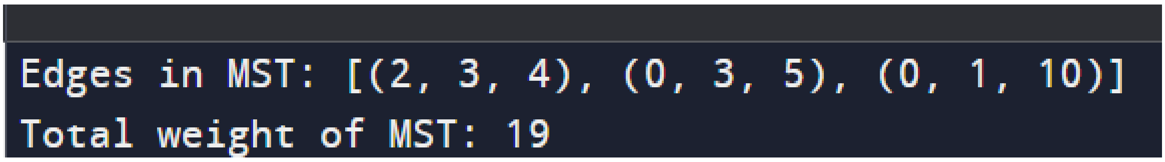
Test Case 1:
Input:
n = 4
m = 5
edges = [(0, 1, 10), (0, 2, 6), (0, 3, 5), (1, 3, 15), (2, 3, 4)]
Output:
Edges in MST: [(2, 3, 4), (0, 3, 5), (0, 1, 10)]
Total weight of MST: 19
Test Case 2:
Input:
n = 5
m = 7
edges = [(0, 1, 2), (0, 3, 6), (1, 2, 3), (1, 3, 8), (1, 4, 5), (2, 4, 7), (3, 4, 9)]
Output:
Edges in MST: [(0, 1, 2), (1, 2, 3), (1, 4, 5), (0, 3, 6)]
Total weight of MST: 16

AIM: To write a python program for the Minimum Spanning Tree (MST) and its total weight.

PROGRAM:

```
class DisjointSet:
    def __init__(self, n):
        self.parent = list(range(n))
        self.rank = [0] * n

    def find(self, u):
        if self.parent[u] != u:
            self.parent[u] = self.find(self.parent[u])
        return self.parent[u]

    def union(self, u, v):
        root_u = self.find(u)
        root_v = self.find(v)
        if root_u != root_v:
            if self.rank[root_u] > self.rank[root_v]:
                self.parent[root_v] = root_u
            elif self.rank[root_u] < self.rank[root_v]:
                self.parent[root_u] = root_v
            else:
                self.parent[root_v] = root_u
                self.rank[root_u] += 1

def kruskal(n, edges):
    edges.sort(key=lambda x: x[2])  # Sort edges by weight
    disjoint_set = DisjointSet(n)

    mst_edges = []
    total_weight = 0

    for u, v, weight in edges:
        if disjoint_set.find(u) != disjoint_set.find(v):
            disjoint_set.union(u, v)
            mst_edges.append((u, v, weight))
            total_weight += weight

    return mst_edges, total_weight

n = 4
m = 5
edges = [ (0, 1, 10), (0, 2, 6), (0, 3, 5), (1, 3, 15), (2, 3, 4) ]
mst_edges, total_weight = kruskal(n, edges)
print("Edges in MST:", mst_edges)
print("Total weight of MST:", total_weight)
```

output:



```
Edges in MST: [(2, 3, 4), (0, 3, 5), (0, 1, 10)]
Total weight of MST: 19
```

TIME COMPLEXITY: O(m log m)