# Graph Beginner Level Question

## Leetcode # 547- Number of Provinces

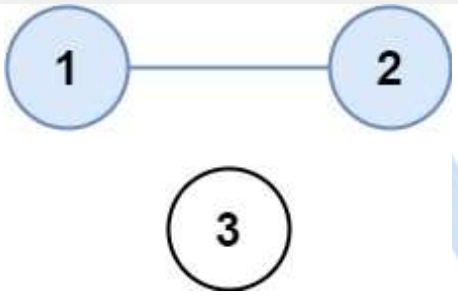
There are n cities. Some of them are connected, while some are not. If city a is connected directly with city b, and city b is connected directly with city c, then city a is connected indirectly with city c.

A province is a group of directly or indirectly connected cities and no other cities outside of the group.

You are given an n x n matrix isConnected where isConnected[i][j] = 1 if the $i_{th}$ city and the $j_{th}$ city are directly connected, and isConnected[i][j] = 0 otherwise.

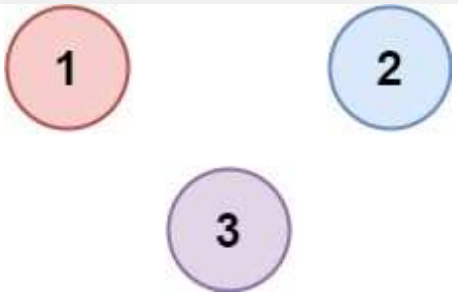
Return *the total number of provinces*.

Example 1:




Input: isConnected = [[1,1,0],[1,1,0],[0,0,1]]
Output: 2

Example 2:



**Input: isConnected = [[1,0,0],[0,1,0],[0,0,1]]**
**Output: 3**

## Leetcode # 997- Find the Town Judge

**In a town, there are n people labeled from 1 to n. There is a rumor that one of these people is secretly the town judge.**

**If the town judge exists, then:**

1. **The town judge trusts nobody.**
2. **Everybody (except for the town judge) trusts the town judge.**
3. **There is exactly one person that satisfies properties 1 and 2.**

**You are given an array trust where trust[i] = [$a_i$, $b_i$] representing that the person labeled $a_i$ trusts the person labeled $b_i$. If a trust relationship does not exist in trust array, then such a trust relationship does not exist.**

**Return *the label of the town judge if the town judge exists and can be identified, or return* -1 *otherwise*.**

**Example 1:**

**Input: n = 2, trust = [[1,2]]**
**Output: 2**

**Example 2:**

**Input: n = 3, trust = [[1,3],[2,3]]**
**Output: 3**

**Example 3:**

**Input: n = 3, trust = [[1,3],[2,3],[3,1]]**
**Output: -1**

## Leetcode # 785- Is Graph Bipartite

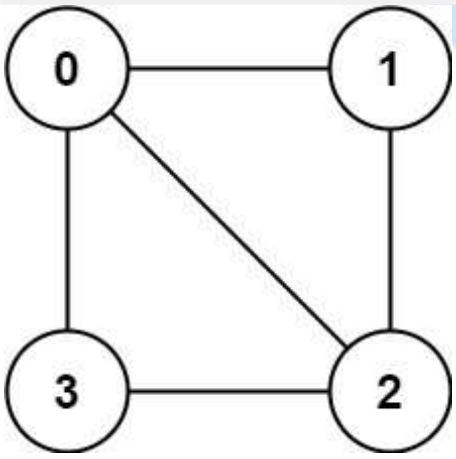
There is an **undirected** graph with n nodes, where each node is numbered between 0 and n - 1. You are given a 2D array graph, where graph[u] is an array of nodes that node u is adjacent to. More formally, for each v in graph[u], there is an undirected edge between node u and node v. The graph has the following properties:

- There are no self-edges (graph[u] does not contain u).
- There are no parallel edges (graph[u] does not contain duplicate values).
- If v is in graph[u], then u is in graph[v] (the graph is undirected).
- The graph may not be connected, meaning there may be two nodes u and v such that there is no path between them.

A graph is **bipartite** if the nodes can be partitioned into two independent sets A and B such that **every** edge in the graph connects a node in set A and a node in set B.

Return true *if and only if it is* ***bipartite***.

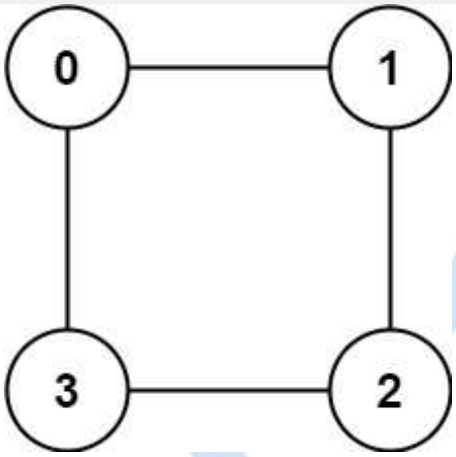
**Example 1:**




**Input:** graph = [[1,2,3],[0,2],[0,1,3],[0,2]]
**Output:** false

**Explanation:** There is no way to partition the nodes into two independent sets such that every edge connects a node in one and a node in the other.

**Example 2:**




**Input:** graph = [[1,3],[0,2],[1,3],[0,2]]
**Output:** true
**Explanation:** We can partition the nodes into two sets: {0, 2} and {1, 3}.

## Leetcode # 690- Employee Importance

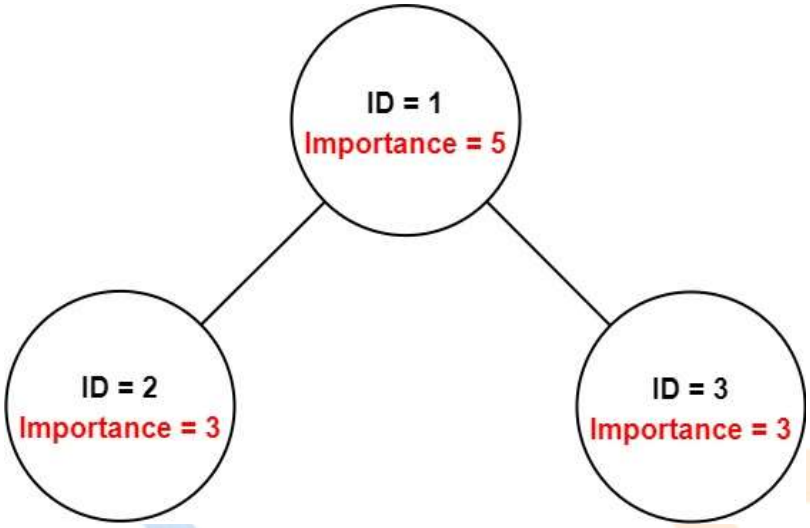
You have a data structure of employee information, including the employee's unique ID, importance value, and direct subordinates' IDs.

You are given an array of employees employees where:

- employees[i].id is the ID of the $i^{th}$ employee.
- employees[i].importance is the importance value of the $i^{th}$ employee.
- employees[i].subordinates is a list of the IDs of the direct subordinates of the $i^{th}$ employee.

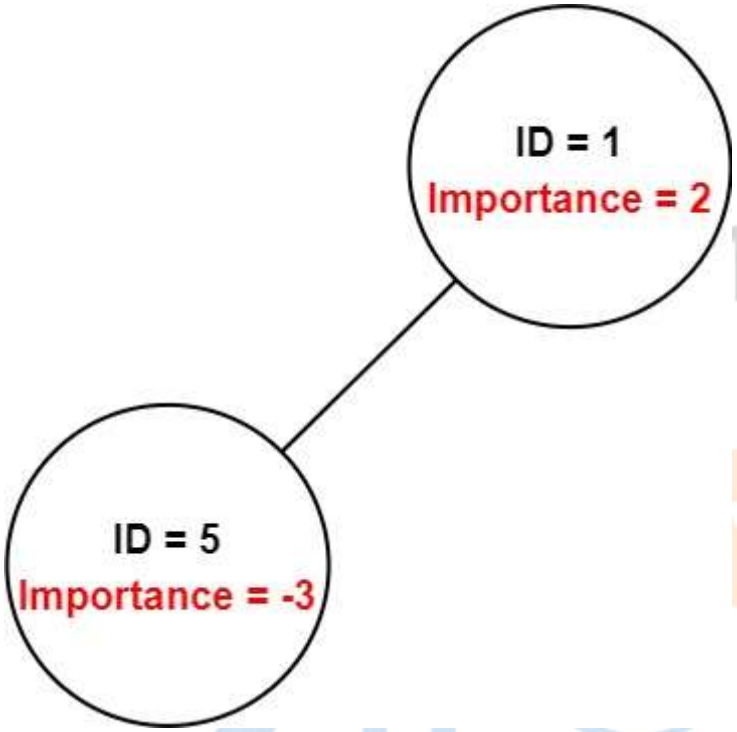
Given an integer id that represents an employee's ID, return *the **total** importance value of this employee and all their direct and indirect subordinates*.

**Example 1:**




**Input:** employees = [[1,5,[2,3]],[2,3,[]],[3,3,[]]], id = 1
**Output:** 11
**Explanation:** Employee 1 has an importance value of 5 and has two direct subordinates: employee 2 and employee 3.
They both have an importance value of 3.
Thus, the total importance value of employee 1 is 5 + 3 + 3 = 11.

**Example 2:**



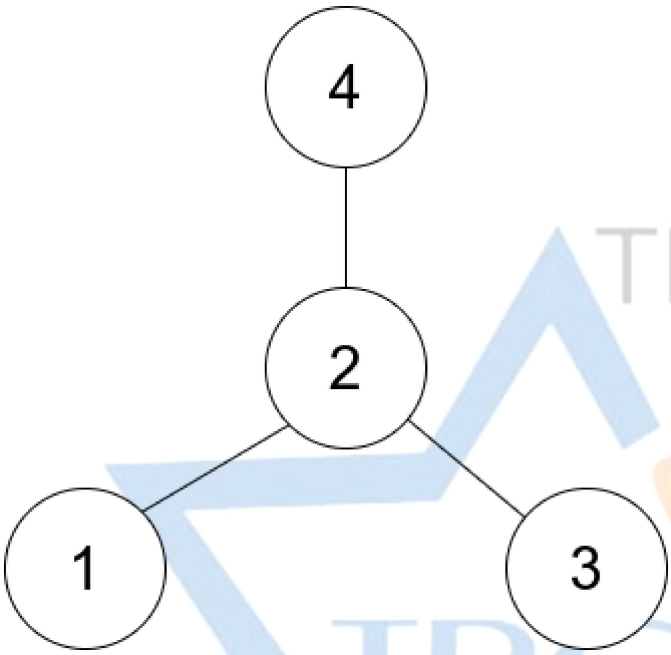

**Input:** employees = [[1,2,[5]],[5,-3,[]]], id = 5
**Output:** -3
**Explanation:** Employee 5 has an importance value of -3 and has no direct subordinates.
Thus, the total importance value of employee 5 is -3.

## Leetcode # 1791- Find Center of Star Graph

There is an undirected **star** graph consisting of n nodes labeled from 1 to n. A star graph is a graph where there is one **center** node and **exactly** n - 1 edges that connect the center node with every other node.

You are given a 2D integer array edges where each edges[i] = [$u_i$, $v_i$] indicates that there is an edge between the nodes $u_i$ and $v_i$. Return the center of the given star graph.

**Example 1:**




**Input:** edges = [[1,2],[2,3],[4,2]]
**Output:** 2
**Explanation:** As shown in the figure above, node 2 is connected to every other node, so 2 is the center.

**Example 2:**

**Input:** edges = [[1,2],[5,1],[1,3],[1,4]]
**Output:** 1