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Breadth First Search: Shortest Reach

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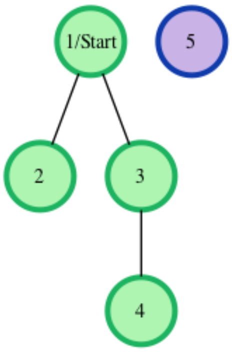
Problem Submissions Leaderboard Discussions

Consider an undirected graph where each edge is the same weight. Each of the nodes is labeled consecutively.

You will be given a number of queries. For each query, you will be given a list of edges describing an undirected graph. After you create a representation of the graph, you must determine and report the shortest distance to each of the other nodes from a given starting position using the *breadth-first search* algorithm (BFS). Distances are to be reported in node number order, ascending. If a node is unreachable, print -1 for that node. Each of the edges weighs 6 units of distance.

For example, given a graph with 5 nodes and 3 edges, $[1, 2]$, $[1, 3]$, $[3, 4]$, a visual representation is:



The start node for the example is node 1. Outputs are calculated for distances to nodes 2 through 5: $[6, 6, 12, -1]$. Each edge is 6 units, and the unreachable node 5 has the required return distance of -1.

Function Description

Complete the *bfs* function in the editor below. It must return an array of integers representing distances from the start node to each other node in node ascending order. If a node is unreachable, its distance is -1.

bfs has the following parameter(s):

- *n*: the integer number of nodes
- *m*: the integer number of edges
- *edges*: a 2D array of start and end nodes for edges
- *s*: the node to start traversals from

Input Format

The first line contains an integer q, the number of queries. Each of the following q sets of lines has the following format:

- The first line contains two space-separated integers n and m, the number of nodes and edges in the graph.
- Each line i of the m subsequent lines contains two space-separated integers, u and v, describing an edge connecting node u to node v.

- The last line contains a single integer, s, denoting the index of the starting node.

Constraints

- $1 \leq q \leq 10$
- $2 \leq n \leq 1000$
- $1 \leq m \leq \frac{n \cdot (n-1)}{2}$
- $1 \leq u, v, s \leq n$

Output Format

For each of the q queries, print a single line of $n-1$ space-separated integers denoting the shortest distances to each of the $n-1$ other nodes from starting position s. These distances should be listed sequentially by node number (i.e., $1, 2, \ldots, n$), but *should not* include node s. If some node is unreachable from s, print -1 as the distance to that node.

Sample Input

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

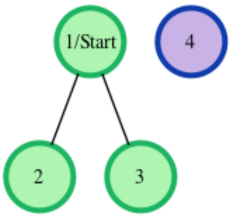
Sample Output

```
6 6 -1
-1 6
```

Explanation

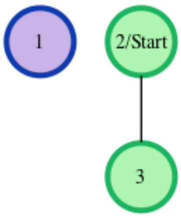
We perform the following two queries:

1. The given graph can be represented as:



   where our *start* node, s, is node 1. The shortest distances from s to the other nodes are one edge to node 2, one edge to node 3, and an infinite distance to node 4 (which it's not connected to). We then print node 1's distance to nodes 2, 3, and 4 (respectively) as a single line of space-separated integers: `6, 6, -1`.

2. The given graph can be represented as:



   where our *start* node, s, is node 2. There is only one edge here, so node 1 is unreachable from node 2 and node 3 has one edge connecting it to node 2. We then print node 2's distance to nodes 1 and 3 (respectively) as a single line of space-separated integers: `-1 6`.

Note: Recall that the actual length of each edge is 6, and we print -1 as the distance to any node that's unreachable from s.

Submissions: 141

Max Score: 10

Difficulty: Medium

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