Problem 2714: Find Shortest Path with K Hops

Problem Information

Difficulty: Hard
Acceptance Rate: 68.65%
Paid Only: Yes
Tags: Graph, Heap (Priority Queue), Shortest Path

Problem Description

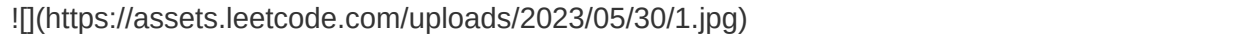
You are given a positive integer `n` which is the number of nodes of a **0-indexed undirected weighted connected** graph and a **0-indexed** **2D array** `edges` where `edges[i] = [ui, vi, wi]` indicates that there is an edge between nodes `ui` and `vi` with weight `wi`.

You are also given two nodes `s` and `d`, and a positive integer `k`, your task is to find the **shortest** path from `s` to `d`, but you can hop over **at most** `k` edges. In other words, make the weight of **at most** `k` edges `0` and then find the **shortest** path from `s` to `d`.

Return _the length of the**shortest** path from _`s` _to_`d` _with the given condition_.

Example 1:

Input: n = 4, edges = [[0,1,4],[0,2,2],[2,3,6]], s = 1, d = 3, k = 2 **Output:** 2
Explanation: In this example there is only one path from node 1 (the green node) to node 3 (the red node), which is (1->0->2->3) and the length of it is 4 + 2 + 6 = 12. Now we can make weight of two edges 0, we make weight of the blue edges 0, then we have 0 + 2 + 0 = 2. It can be shown that 2 is the minimum length of a path we can achieve with the given condition.



Example 2:

Input: n = 7, edges = [[3,1,9],[3,2,4],[4,0,9],[0,5,6],[3,6,2],[6,0,4],[1,2,4]], s = 4, d = 1, k = 2
Output: 6 **Explanation:** In this example there are 2 paths from node 4 (the green node) to node 1 (the red node), which are (4->0->6->3->2->1) and (4->0->6->3->1). The first one has the length 9 + 4 + 2 + 4 + 4 = 23, and the second one has the length 9 + 4 + 2 + 9 = 24.

Now if we make weight of the blue edges 0, we get the shortest path with the length 0 + 4 + 2 + 0 = 6. It can be shown that 6 is the minimum length of a path we can achieve with the given condition.

Example 3:

Input: n = 5, edges = [[0,4,2],[0,1,3],[0,2,1],[2,1,4],[1,3,4],[3,4,7]], s = 2, d = 3, k = 1 **Output:** 3 **Explanation:** In this example there are 4 paths from node 2 (the green node) to node 3 (the red node), which are (2->1->3), (2->0->1->3), (2->1->0->4->3) and (2->0->4->3). The first two have the length 4 + 4 = 1 + 3 + 4 = 8, the third one has the length 4 + 3 + 2 + 7 = 16 and the last one has the length 1 + 2 + 7 = 10. Now if we make weight of the blue edge 0, we get the shortest path with the length 1 + 2 + 0 = 3. It can be shown that 3 is the minimum length of a path we can achieve with the given condition.

Constraints:

* `2 <= n <= 500` * `n - 1 <= edges.length <= min(104, n * (n - 1) / 2)` * `edges[i].length = 3` * `0 <= edges[i][0], edges[i][1] <= n - 1` * `1 <= edges[i][2] <= 106` * `0 <= s, d, k <= n - 1` * `s != d` * The input is generated such that the graph is **connected** and has **no** **repeated edges** or **self-loops**

Code Snippets

C++:

```
class Solution {
public:
int shortestPathWithHops(int n, vector<vector<int>>& edges, int s, int d, int
k) {

}
};
```

Java:

```
class Solution {
public int shortestPathWithHops(int n, int[][] edges, int s, int d, int k) {

}
}
```

Python3:

```
class Solution:
def shortestPathWithHops(self, n: int, edges: List[List[int]], s: int, d:
int, k: int) -> int:
```