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# LAB-4

## Answer-3

For problem 1,

Since, the graph is stored as an adjacency list and priority queue Q is used as a binary min heap,
the inner loop (the for loop inside while loop) takes $O(V+E)$ as all vertices of the graph can be traversed in $O(V+E)$ time using BFS. The time complexity of operations like extract-min and adding v to Q with priority value dist[v] is $O(\log V)$ as min heap is used.
So overall time complexity is $O(E+V) * O(\log V)$
which is $O((E+V) * \log V)$. In worst case, $E >> V$
Hence, Time Complexity is $O(E \log V)$

for problem 2,
Same Time Complexity = $O(E \log V)$ as same algorithm is used with few modification. A 'prev' list is used to keep track of the parent nodes which is then used to find a path using a loop that does not affect the overall time complexity.

If the number of titans in each road is exactly 1, we will have to find just the shortest part regardless of the weight (no. of titans in this case). Simply using BFS will give us the shortest path from source to all other nodes. And in the shortest path, Eren will face the minimum number of titans.

∴ BFS (graph, source).

In this problem, the source is 1.