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Task-3

1. It takes $O(|V|)$ time to construct the initial priority queue of $|V|$ vertices. We are using binary heap.
2. With adjacency list representation, all vertices of the graph can be traversed using BFS. Therefore, iterating over all vertices' neighbours and updating their 'dist' values over the course of a run of the algo takes $O(|E|)$ time.
3. The time taken for each iteration of the is $O(|V|)$. as one vertex is removed 'Q' per loop.
4. The binary-heap data structure allows us to extract-min and update an element in $O(\log |V|)$ time.
5. Therefore, the time complexity becomes $O(|V|) + O(|E| \times \log |V|) + O(|V| \times \log |V|)$.

and it is equivalent to $O((|E|+|V|)+\log|V|)$

$V = N$

$E = M$

Therefore for our problem 1 and 2 the timeComplexity would be $O((N+M)\log M)$.

(*) If all the weight is 1 then it is an unweighted graph meaning that we can find the shortest path between vertices using BFS. Also, BFS's time complexity is $O(N+M)$.