We add a new node v' to the graph G and connect each $v \in T$ to v' and denote this new graph as G'. Then we run Ford-Fulkerson Algorithm in graph G' using h as source and v' as sink. We assign the capacity of edges connected to sink in the Graph as the values w_v and all other capacities as 1. Denote the residual graph of G' with max flow f as G'_f. Then starting at h, we run BFS to find out the set of nodes that are reachable from h and denote such a set as R. We let E' be the edges in G' that are from a node in R to a node in $V - R$. We remove edges in E' that are from any $v \in T$ to v' and denote the remaining edges as F. Then F is the objective set that maximizing $q(F) - |F|$

Proof of Correctness:

After we have found the min cut in G', we can divide E' into F and E''. Given that nodes in $V - R$ are not reachable from h in G'_f, $q(f)$ will be the set of nodes in $V - R$ after we find the min cut. Then there are $|T| - q(f)$ terminal nodes in R. Since we know there is no augmenting path in G'_f (min cut), edges from $|T| - q(f)$ nodes in R to v' have to be saturated. Hence, $|E''| = |T| - q(f)$. **Because the min cut in $\mathbf{G'}$ is the cut that minimizes the number of edges, it aims to minimize $|\mathbf{F}| - \mathbf{q(f)}$, which is exactly the same as maximizing $\mathbf{q(f)} - |\mathbf{F}|$.** Since edges in E'' are not actually existed in E, they must be removed from E'. However, removing E'' from E' will not change $q(f) - |F|$ since every edge in E'' corresponds a v which is reachable from h.

Time Complexity Analysis::

Denote number of nodes as n and number of edges as m. Using Ford-Fulkerson would cost $O(n^3)$ to find the max flow. Running BFS would use $O(m) = O(n^2)$. Removing edges in F takes $O(n)$ since there as at most $n - 1$ terminal nodes. Hence, the total time complexity is $O(n^3) + O(n^2) + O(n) = O(n^3)$