3. Suppose we are given a flow network G = (V, E) in which every edge has capacity 1. Describe and analyze an algorithm to identify one edge in G such that after deleting that edge, the value of the maximum (s, t)-flow in the remaining graph decreases by one.

Solution:
Run any algorithm to find the max flow of the flow network (let's say you run the Shortest Augmented Path algorithm), use BFS to find the min-cut, lets call that cut C. We know that the capacity of the min-cut = the value of the max flow. Since C is put min cut if you remove one edge that crosses the cut (from the source side to the sink side) then we will be decreasing the min-cut value by 1 and essentially decreasing the max-flow by 1 as well.
The capacity of the algorithm is O(max-flow algorithm) + O(BFS) = O(mn^2) + O($m+n$) = O(mn^2) the running time will probably change with other max-flow algorithms.