

The Program basically uses a BFS to find the sink. The worst-case scenario of a BFS is $O(n^2)$. After the program computes all the visited nodes it stores the path in a queue. After it, the program has the path it computes the max flow linearly by pushing flow as much as it can before it reaches a narrow pipe then it pushes less flow. The Big O of the FLOW computation is $O(n)$