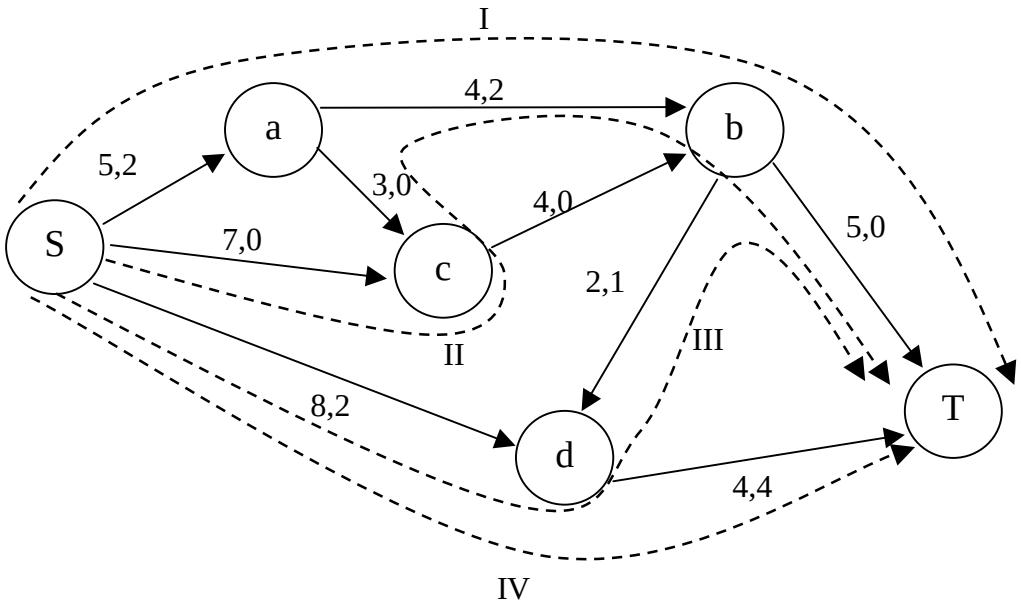
Flow Problem

Consider a water pipe system as shown in following figure.



Each edge represents a pipe and numbers beside every edge (c, f) give capacity(c) and present flow (f) in the pipe. E.g. pipe Sd have capacity of 8 and present flow is 2. Present flow is always between 0 and c i.e. $0 \leq f \leq c$. There is exactly one node each without incoming edges (source) and without outgoing edges (sink). Nodes S and T in above figure represents source and sink, respectively.

The flow-augmenting path is a path from source to sink along which flow can be increased. A flow-augmenting path can have both forward and backward edges. (Backward edge is an edge where water can flow in the opposite direction of the path). If there is a forward edge in a path having flow equal to its capacity, then the path is not a flow-augmenting path. If there is a backward edge in the path having flow equal to zero, then the path is not a flow-augmenting path. In figure, Path II & III are example of paths having backward edges. Path I & III are flow-augmenting paths, whereas path II and IV are not flow-augmenting paths.

The flow in a forward edge can be increased by an amount equal to the difference between its capacity and the present flow. The flow in a backward edge can be increased by an amount equal to its present flow i.e. the flow can be reduced to zero (the increase is in the direction of the path). The flow in a path can be increased by an amount equal to the minimum of possible flow increases in all the edges along the path. The possible flow increase in flow augmenting path will always be greater than 0.

Possible flow increase in path I = min (max possible increase in Sa, ab, bT)
= min (3, 2, 5)
= 2
Possible flow increase in path III = min (max possible increase in Sd, db, bT)
= min (6, 1, 5)
= 1

Given such a system you are required to find all possible flow augmenting paths with possible increment in flow along them and print them in the descending order of possible increment. You can assume that no two flow-augmenting path will have the same possible increase in flow. Note that a path will always be composed of unique nodes.

Input Specification
The first line will have an integer V, giving number of nodes in the system followed by V characters in the following line, each being name of a node. First node will be the source and last will be the sink. Next line will have an integer E, giving number of edges in the system. Next E lines will of following format: V1 V2 c f, which represents an edge from node V1 to V2, having capacity c and present flow f.

Output Specification
Each line in the output will contain a flow-augmenting path with possible increase. Each node in the path and the possible flow increase should be separated by a blank space. The paths should be printed in the descending order of possible increase in flow.

Sample Input
6
S a b c d T
9
S a 5 2
S c 7 0
S d 8 2
a b 4 2
a c 3 0
b d 2 1
c b 4 0
b T 5 0
d T 4 4

Sample output
S c b T 4
S a c b T 3
S a b T 2
S d b T 1