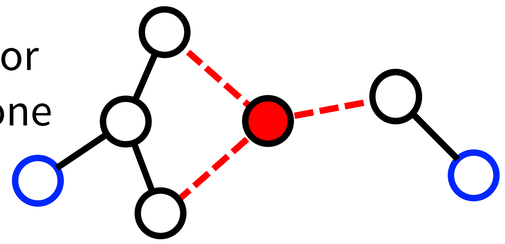
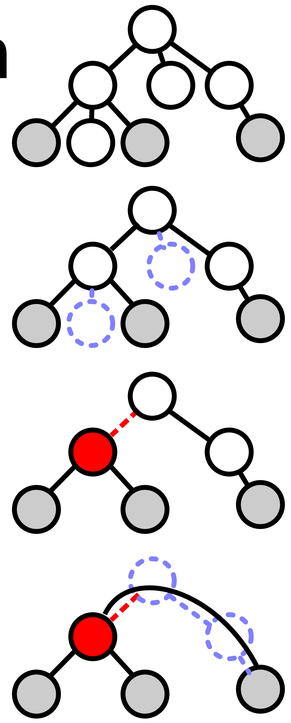
Easy

Can A Reach B?



Use breadth-first search or depth-first search from one of the terminals.
Return true if the other terminal is reached.

Medium



Monitor a Tree

Opportunistically repeat:

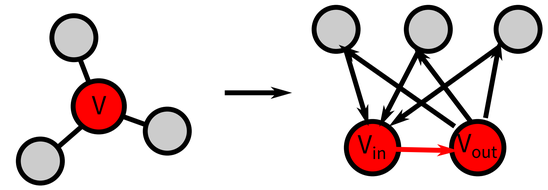
- Discard leaves that don't need monitoring
- Monitor nodes for which *all* direct children need monitoring — then mark them unreachable
- Compress paths (remove straight nodes)

Hard

Minimum Vertex Cut

This is a minimum cut problem, applied to vertices instead of edges.

We will reduce it to a minimum edge cover problem, using the vertex transformation to the right.

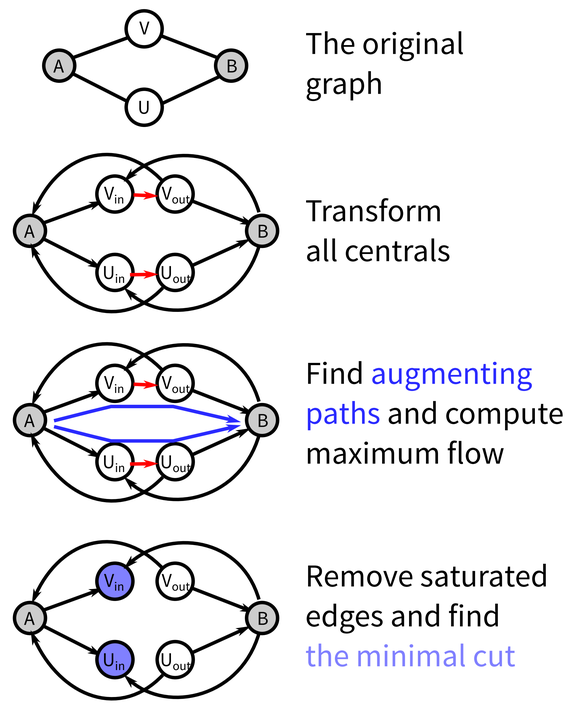


Each node V is transformed into two nodes, V_{in} and V_{out}, connected by a directed edge with capacity 1.

Solve this problem using the Ford-Fulkerson algorithm. It computes the maximum flow through the network.

To construct the solution: Remove all saturated edges. A vertex V is part of the solution if either V_{in} or V_{out} are reachable from the source, but not both.

Example



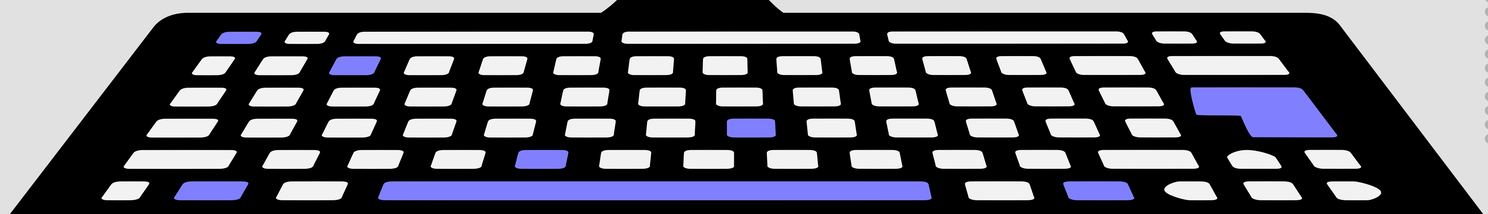
The original graph

Transform all centrals

Find augmenting paths and compute maximum flow

Remove saturated edges and find the minimal cut

Surveillance



AdNovum

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