

## **Complexity of finding maximum region disjoint paths in a directed graph**

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In INFOCOM 2006, Region Based Connectivity was introduced as a metric for determining network robustness. Just like node connectivity determines the ability of a network to withstand node faults and still be functional, Region Based Connectivity deals with how many physical regions can be faulty before the network is disconnected.

In this work, I show that the problem of determining if there are at least  $k$ -region disjoint paths between any two nodes reduces to the problem of finding max-cliques. Given a network with its physical coordinates and the radius of 'destruction' around each node, the program finds all nodes and edges in each region centered on a node, and all paths between two given nodes. The question if there are  $k$  region disjoint paths is NP complete.

This work was implemented in a Java program and was used to analyze some real networks in civilian and military domain to test for their robustness.

Keywords: Region Based Connectivity, Max Clique, NP-Complete