9101 Assignment 4

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Q1

1. There are N computers in a network, labelled $\{1, 2, 3, \ldots, N\}$. There are M one-directional links which connect pairs of computers. Computer 1 is trying to send a virus to computer N. This can happen as long as there is a path of links from computer 1 to computer N. To prevent this, you've decided to remove some of the links from the network so that the two computers are no longer connected. For each link, you've calculated the cost of removing it. What is the minimum total cost to disconnect the computers as required, and which edges should be removed to achieve this minimum cost? (25 pts)

Solution,

1) Create the flow network as a directed graph:
   a) Source (S): Computer 1
   b) Sink (T): Computer N
   c) All computers represent the vertices of graph
   d) Each edge is the one-directional link between any two computers
   e) Each of capacity $ci = the\ cost\ of\ removing\ link$
2) By the algorithm of the maximum (the Preflow-Push algorithm) flow can get the minimum cut.
3) Removing all the links obtained through the minimum cut can completely prevent the virus from reaching computer N, and it is also the smallest cost.
4) The complexity is $O(V^3) = O(N^3)$