COMP523 Tutorial 7

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Problem 1

A. Let A be a totally unimodular matrix. Prove that the matrix $A' = [A, -A, I, -I]^T$ is totally unimodular, where I is the identity matrix.

B. Prove that the incidence matrix of any directed graph is totally unimodular.

Problem 2

Recall the 0/1-Knapsack problem: There is a set N of n items with weights w_i and values v_i and a knapsack with capacity W. The goal is to select a subset $S \subseteq N$ of the n items to put into the knapsack, such that $\sum_{i \in S} w_i \leq W$ holds, and $\sum_{i \in S} v_i$ is maximised.

Design a polynomial time approximation algorithm for the 0/1-Knapsack problem, which achieves an approximation ratio of 2.