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Problem Set 9

409 - Discrete Optimization

Winter 2019

The following problems will not be collected or graded.

Exercise 1

Let $G = (V, E)$ be an undirected graph. An *edge cover* in G is a collection of edges $C \subseteq E$ such that every $v \in V$ is incident to at least one edge in C.

1. Model the minimum cardinality edge cover problem in G as an integer program and write it in matrix notation.
2. Prove that when G is bipartite, the minimum cardinality edge cover problem can be solved by its LP relaxation.
3. Write down the dual of the LP relaxation in part 1.
4. If you required the variables to be integral in part 3, which combinatorial optimization does this IP model?
5. What combinatorial statement can you conclude from the pair of primal and dual LPs that you have created?

Exercise 2

Use the dynamic programming algorithm to solve the following knapsack problem for $W = 10$.

items	1	2	3	4
w_i	5	4	6	3
c_i	10	40	30	50

Exercise 3

Use the max flow min cut algorithm to find the max matching and min vertex cover in the following graph.