Finding a 2-factor

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Definition (2-factor). A *2-factor* of a graph $G = (V, E)$ is a spanning subgraph of G for which all vertices have degree two.

We will give a linear program for finding 2-factors in bipartite graphs.

Let $G = (V, E)$ be our graph, $|V| = n$, and $|E| = m$. Our objective is the following:

$$\begin{aligned} \text{maximize} \quad & \sum_{(u,v)\in E} x_{(u,v)} \\ \text{subject to} \quad & \sum_{v\in E(u)} x_{(u,v)} \leq 2 \\ & 0 \leq x_{(u,v)} \leq 1. \end{aligned}$$