

Übungstest – Discrete Mathematics - WS 2016 (Gruppe Probetest)

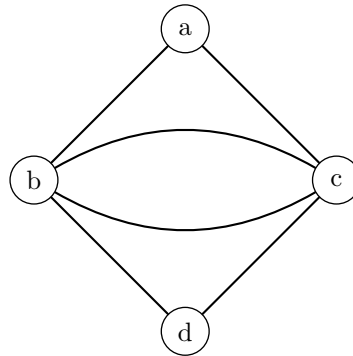
1. (a) State the handshaking lemma for graphs.
 - (b) Show that a connected graph that has no induced path with three vertices must be a complete graph.
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2. (a) Let (E, I) be a matroid, and A and B are in I with $|B| = |A| + 1$. What do we then know about $B \setminus A$?
- (b) Let $G = (V_1 \cup V_2, E)$ be a bipartite graph. Let Show that the pair (E, I) with

$$I = \{M \subseteq E : M \text{ is a matching of } G\}$$

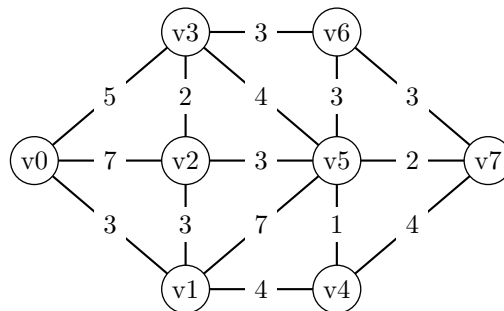
is, in general, not a matroid. Hint: it is sufficient to provide very small counterexample, eg. with four vertices and three edges.

3. Let G be the graph



- (a) What is the adjacency matrix of G ?
 - (b) Compute the number of spanning trees of the graph using the matrix tree theorem.
 - (c) Compute the number of walks of length two between all pairs of vertices of G .
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4. Let G be the following graph:



- (a) Use Dijkstra's algorithm to compute a distance tree from v_0 to the other vertices in G .
 - (b) Use Kruskal's algorithm to compute a minimum spanning tree of G .
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