MATH 634, Spring 2013
Practice Problems
in preparation for Exam 2 on Monday, May 13, 2013.

The exam covers:

- *Pearls in Graph Theory*, Sections 3.1, 7.2, 8.1–8.3, 9.1, 9.2, and 10.3.
- Additional topics that are included in the course notes since the first exam, including and not limited to: knight's tours, de Bruijn graphs, stable marriage algorithm, Ford-Fulkerson and related algorithms.

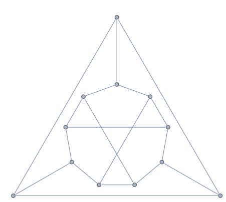
Below are some questions that practice concepts from the class.

– Book questions: 3.1.11, 8.1.8, 9.1.8, 9.2.2, 9.2.4 (using a theorem from Chapter 3.1)

Q1. Let T be a tree and e be any edge of T. Prove that T/e (T contract e) is a tree.

Q2. Show that the planar dual of the octohedron is the cube and vice versa.

Q3. Show that the Petersen graph is a minor of this graph:



Q4. When embedding K_6 into the torus, show that the generalization of Euler's formula holds ($p - q + r = 2 - 2g$).

Q5. Prove that the Gale-Shapley algorithm is female-pessimal when run with the men proposing. (Hard!)

Q6. The market for kumquats is booming! Five markets (I through V) each have put orders into the five large kumquat distributors (A through E).

- A has 5 kumquats and can deliver to I, II, and III.
- B has 4 kumquats and can deliver to I, III, and IV.
- C has 2 kumquats and can deliver to II and III.
- D has 5 kumquats and can deliver to III and V.
- E has 4 kumquats and can deliver to IV and V.

Market I desires 5 kumquats, II desires 2, III desires 4, IV desires 6, and V desires 3. Is it possible for all the markets to receive their desired quantity of kumquats for the distributors? If so, give a valid transshipment. If not, explain why not.