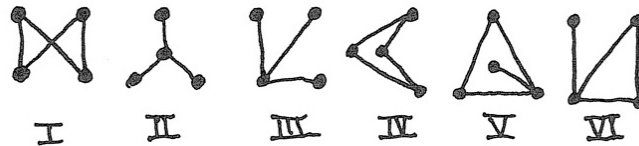


Math 113 homework due 2/20

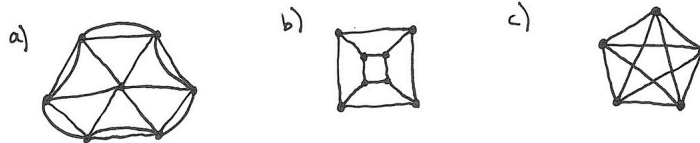
Thus you see, most noble Sir, how this type of solution [to the Königsberg bridge problem] bears little relationship to mathematics, and I do not understand why you expect a mathematician to produce it, rather than anyone else, for the solution is based on reason alone, and its discovery does not depend on any mathematical principle...

– Leonhard Euler (mathematician) in a letter to Carl Ehler (mayor of Danzig), 1736

- (1) Read sections 14.1 - 14.3 in the textbook.
- (2) Which of the following graphs are isomorphic? (hint: every graph is isomorphic to at least one other)



- (3) In each graph, find an Eulerian circuit or explain why it is impossible to do so:

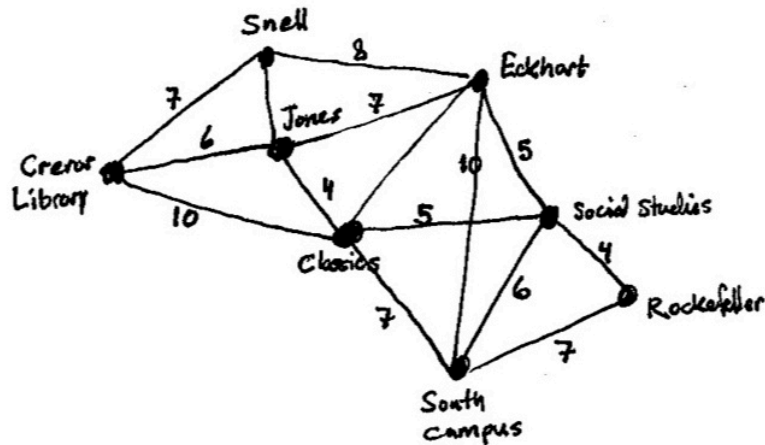


- (4) a) How many non-isomorphic graphs with 4 vertices are there? Draw them all or explain how to get all of them
 b) Which of these are planar graphs? Show they are planar, and that the other ones are not.
- (5) Copying the proof we did in class for $K(3, 3)$ (the utility graph), show that the pentagram (graph c in question 3) is not planar.
 [Remark: at this point, you can answer our question from class: what is the minimum number of vertices of a non-planar graph?]
- (6) Show that the pentagram can be drawn on a coffee mug without crossings.
- (7) (Bonus, will not be graded) Can *every* non-planar graph be drawn on a coffee mug without crossings?

[See back of sheet!]

The next questions use material from Friday's class:

- (8) Draw the complement of each graph from question 3.
- (9) You're putting up posters on campus to advertise your intramural quidditch championship game. You need to visit each of the locations on campus depicted below. Distances (in 100 ft increments) are shown on the sketch of a map.



- a) Suppose you start at Jones lab. What distance do you travel and what route do you take if you use the greedy algorithm?
- b) Can you find a shorter route (starting from Jones again) that visits every location? What do you think is the shortest route?