

Math 442 Midterm Review

The midterm will cover all material discussed in lecture up to and including polyhedra. Below are some practice problems to help review the material discussed in lecture.

1. Prove by induction that if $r > 0$ is a real number, then $\sum_{k=0}^n r^k = \frac{1-r^{n+1}}{1-r}$.
2. Is the octahedral graph Eulerian? Prove that your answer is correct.
3. Give an example of a connected (simple) graph that is not Hamiltonian. Prove that your example is correct.
4. Prove that any drawing of $K_{n,n}$ must have at least $n^4/128$ edge crossings.
5. Given a planar embedding \tilde{G} of a graph G , the *dual* of G , denoted G^* , is the graph whose vertices are in one-to-one correspondence with the *faces* of \tilde{G} . Two vertices in G^* are adjacent if and only if the corresponding faces in \tilde{G} share an edge, and an edge is generated between 2 vertices in G^* for every edge the corresponding faces share in \tilde{G} . Find the dual of the polyhedral graph for each of the platonic solids.
6. For the following problems, you do not need to prove that your answer is correct.
 - (a) Let \mathcal{A} be the set of all connected graphs. Is \mathcal{A} minor closed?
 - (b) Let \mathcal{B} be the set of all Eulerian graphs. Is \mathcal{B} minor closed?
 - (c) Let \mathcal{C} be the set of all graphs with crossing number at most 10. Is \mathcal{C} minor closed?
 - (d) Let \mathcal{D} be the set of all graphs with crossing number at least 10. Is \mathcal{D} minor closed?
 - (e) Let \mathcal{E} be the set of all graphs that are bipartite. Is \mathcal{E} minor closed?