Advice for students in Math 412

Math 412 is a course in graph theory, but it also emphasizes careful expression of logical arguments. Mathematics is a language; understanding and communicating it requires expressing it in words. Homework problems require clear and concise explanations, as do most test questions. Keep in mind some simple principles: Use *complete sentences*, say what you mean, and mean what you say.

Mean what you say: Be honest. Don't claim the conclusion when you haven't completed a proof or don't understand how the conclusion follows. Don't give an example where the conclusion holds and claim that this is a proof. Statements with a number or a graph as a parameter must be proved for all possible instances.

Say what you mean: Use sentences that accurately state your ideas. Omitting words can produce fragments that mean something else. Don't introduce terminology without defining it. Don't use the same notation or terminology to mean more than one thing. Understand the structure of logical statements, including quantifiers, converse vs. contrapositive, proof by contradiction, and the need to prove both directions of an equivalence.

Many employers hire mathematics graduates because of their experience in logical thinking. Part of understanding mathematics is being able to communicate it. We will offer collaborative study sessions. Here students can ask questions about the course material and discuss the ideas in the homework problems. Explaining a proof orally to other people may illuminate a better way to write it or expose flaws in the reasoning.

Start homework early! If the statement of an exercise or what is needed to complete it is unclear, trying it early allows time to ask for clarification, by email or in person. Discussions in study sessions will be more valuable if you have thought about the problems in advance. Study sessions usually involve discussion of homework problems, but all students must write up their own complete solutions; grades reflect the written presentation.

Most students need to improve their writing. When you first write a proof it seems clear, because the ideas are fresh in your mind. Revising later is the only way to be confident that you expressed what you meant. As you use the revision process to discover habits of unclear writing, your first drafts will improve. To benefit from this technique, don't wait to solve all the problems before writing them up. Write solutions as you go. At the end, you have had a chance to forget the ones written first. If you now find them unconvincing or hard to follow, the grader will find it even harder! Revise the exposition so it clearly communicates what you had in mind. *The revision process is greatly aided by editing your draft on a computer, whether you use TEX or not.*

Examples can help you find the idea for a proof, but proofs must apply for all possible examples. Proof can be viewed as translating your understanding of why particular examples work into an explanation of why all possible examples work. Include enough detail so that you would find the explanation convincing if you hadn't thought about it before.

This course requires effort. The instructors will explain ideas, guide your efforts, and provide feedback. We ask you to make a commitment to intellectual honesty and to learning to express yourself clearly. Seize the opportunity, and you will gain a lot of personal satisfaction from this course.

—Douglas B. West