Honors Discrete Mathematics - Spring 2016

The Course: M325K-H

1. When & Where: $9:00-9:50$ MWF in RLM 7.112

Instructor: Professor Michael Starbird

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3. Office Hours: MWF 10:00-11:00 and by appointment in RLM 11.122

Required Texts: Brian P. Katz and Michael Starbird, *Distilling Ideas: An introduction to mathematical thinking* and Edward B. Burger and Michael Starbird, *The 5 Elements of Effective Thinking*, Princeton University Press, 2012.

Instructional strategy:
This course will be taught using an **Inquiry Based Learning** method of instruction, meaning that you, the student, will be responsible for doing the exercises and proving the theorems we discuss in this course. During class, you will present proofs that you have written, and see proofs that your classmates have written. In order to get the most out of this course, you must be willing to put in a sustained effort from the beginning of the semester to the end.

Grading and expectations:
Your grade in this course will be determined by the following:

- Homework – 15%
- Presentations and participation – 10%
- Small group meetings – 15%
- Two midterm exams – 20% each
- Final presentation–20%

All UT courses use a plus/minus system of grading.

Your homework notebook:
In this class, you will keep a "homework notebook" that (together with the problem sets and notes we give you) will create your textbook for the course. For this purpose, we recommend that you buy a durable three-ring binder. Each week, we will assign problems for you to work on; please write up or TeX your answers and proofs and put them in your notebook. From time to time we will ask to see the whole notebook.

Written homework will be due each week. Not every problem will be graded. There is a difference between the scratch work required to find an answer and a well written solution. The

clarity and structure of your solution is also part of the goal.

We will grade your exercises and proofs according to how complete and correct they are. However, we also want this notebook to be a resource for you as you continue your mathematical studies. Therefore, we want you to make this notebook beautiful, organize it well, and make it your own! If your work is sloppy or disorganized, your grade may suffer and you will not learn as much. It is likely that you will make some mistakes the first time you try to write a proof; this reality is why we want you to use a binder rather than a spiral notebook, so that you can add and remove pages as necessary. If a proof or exercise is ugly, rewrite it and try to make it beautiful!

Presentations and participation:
On most class days, we will ask you to present proofs of theorems or answers to exercises that you have been working on. Please come to class each day prepared to present the exercises and theorems scheduled for that day; you won't be called upon to do so every day, but we want you to be ready in case you are. If you proved one theorem that you thought was particularly interesting or difficult, you should let us know so we all can see your proof!

Keep in mind that talking to others about a proof you have done is a bit different from writing a proof. The act of talking about a proof gives you the opportunity to show people how the ideas of the proof fit together, and what issues you had to deal with when working on the problem. One thing we want you to develop in this course, besides your mathematical skills, is your ability to communicate mathematics to others.

You will meet with Tom at a regularly scheduled time for half an hour every week in small groups. This allows for more personal feedback on your presentation skills at a time when you are not in front of the whole class. Also, there are too many people in the class for everyone to present each week, so meeting outside of class time will let you practice presenting more frequently.

When your classmates are presenting, it is your responsibility to follow their line of reasoning. We also want you to interact actively with the other student presenters, whether it is asking questions to clarify, offering suggestions at impasses, or more generally contributing to discussion. Keep in mind that their argument may be different from yours; alternative proofs are common. If you see something in a proof that you don't understand, please ask about it. If you see a possible mistake, please ask about it. If there is something about the proof that you thought was interesting or clever, feel free to comment on it! In each case, please be considerate of the person at the front of the room, and treat him/her the way you'd like to be treated when it's your turn to present.

Rules of the game:
Most of the theorems that we will prove in this course can be readily found in textbooks or on the internet. This semester, we are going to ask you **not** to use these sources. We want you to have the experience of proving theorems on your own, because figuring things out on your own is the best way to learn mathematical ideas and techniques if you want to be able

to use them a year / five years / ten years from now. You can quickly find out how to do a problem by looking it up in a book or on the internet, but we want you to experience the joy of figuring things out and being a producer, rather than a consumer, of mathematics. One of the major goals of this course is for you to become skillful at creating mathematical ideas and proofs on your own. Therefore, for purposes of this class, turning in a solution to a homework problem that you obtained from an outside source is considered plagiarism, just like writing a report that consists entirely of quotes from other books or papers would be considered plagiarism in another course. We know that since you are not allowed to look to outside sources for help, you may get stuck from time to time and not be able to complete all of the problems we assign. This is okay, and we will take this into account when determining your homework grade.

We **do** encourage you to work with your classmates when working on homework for this class, but please use the following method in doing so. First work on the problem on your own. If you get stuck, one source for help is to ask Tom or Dr. Starbird for a hint. Alternatively, you may work with other students who have not solved the problem. If you ask a student in the class who has solved the problem, that is OK; however, the student who knows the answer should not simply tell the answer. Instead, the person who knows should give helpful guidance so that you can solve the problem on your own. As a general rule, everything you turn in for this class should represent your own work; it should not be something that somebody else gave you without any work on your part, and it should, of course, never be copied from someone else's paper. If you do learn a substantial part of the idea of a problem from someone else, then please note that fact on your paper.

Students with disabilities:
The University of Texas provides, upon request, appropriate academic accommodations for qualified students with disabilities. For more information, contact the office of the Dean of Students at 471-6259, TTY 471-4641.

One more thing...
We are committed to doing everything we can to help you make the most of this course. If you have questions, comments, or suggestions regarding our class, please do not hesitate to contact us.

Exams:
We will have two midterm exams in class on February 19 and April 13, although the dates may change depending on how the class is going. Each will be announced at least one week in advance. There will be four major types of questions on these tests, and thinking about how we will assess your knowledge/skills can help you know what we expect of you on a daily basis. There will be problems that ask you to apply your understanding to examples, usually computationally or through counterexamples. There will be problems that ask you to describe an outline of the proof of a fact and explain its usefulness or importance. There will be problems that ask you to prove one of the facts that comes directly from the packet. And there will be problems that ask you to prove new facts; this last type will (necessarily) be simpler than the average fact from the packet. Parts of some of these exams may be take-home.

Topics: We will consider three topics during the semester: graph theory, group theory, and epsilon-delta calculus. Roughly speaking the graph theory topic will take us through mid February, the group theory topic will take us to roughly the beginning of April, and the final topic will take the rest of the semester.