Math 251: Foundations of Advanced Mathematics
Spring 2013
Course Procedures

Professor: Josh Laison
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Office Hours:
Tuesday 2:30–3:30
Wednesday 10:00–11:30 at the Bistro
Thursday 2:30–3:30
or anytime by appointment or by catching me in my office. You can see my schedule and available times at http://www.willamette.edu/~jlaison

Class Meetings: Ford 201, 9:40-11:10 Tuesday Thursday
Course Web Page: http://www.willamette.edu/~jlaison/foundations.html

Grading:

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<tr>
<td>Reading problems (around 18)</td>
<td>25%</td>
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<tr>
<td>Homework problems (around 8)</td>
<td>30%</td>
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<td>Quizzes (around 6)</td>
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<td>Oral problems (around 6) and class participation</td>
<td>20%</td>
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<td><strong>Total</strong></td>
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Course Goals:

- Learn to write mathematical proofs.
- Learn mathematical writing and typesetting.
- Learn to communicate mathematics verbally, in conversations and in formal presentations.
- Learn a core set of mathematical tools that appear in most pure mathematics.
- Get an introduction to some of the most important fields of pure mathematics.
- Have fun.

Topics Covered:
We will spend the first few weeks of class on logic and proof techniques (Chapters 1 and 2), and then use these techniques to prove theorems in set theory (Chapter 3), number theory (5.2, 8.2, 8.3), real analysis (Chapter 4, 7.8), abstract algebra (7.1, 7.2), combinatorics (7.6, 7.7), and possibly other fields of mathematics.
Ways in Which This Course Is Different From Previous Math Courses:

1. In previous math courses, you could solve a problem set of 10 problems in a couple hours. In Foundations, 10 problems might take closer to 20 hours to solve, and you will have 2 weeks or more to work on them.

2. In previous math courses, most of the problems were very similar to others that were already been solved for you. You might have identified examples in the section that were similar to the ones on the assignment and mimicked them in your work. In Foundations, you will use templates provided in the text and in class, but you will need to think more creatively about how to fit the ideas together to prove a theorem. Not all problems will be solvable using the same technique.

3. In previous math classes, you mostly sat and listened while the instructor talked. In Foundations, you will mostly talk while the instructor sits and listens.

4. Foundations is much more fun than your previous math classes!

Reading and Reading Problems: Since you will be spending a lot of class time working with classmates, it is important that you read and start thinking about the relevant sections of the textbook before class. This will also help you become a better reader of mathematics, a skill that takes a long time to learn. I will assign a few problems to help you think about the reading each day, and we will discuss these problems in class.

Homework Problems: The homework problems will be due every one or two weeks. You may work together on these problems; in fact, you may have the opportunity to work on them in class. However, please write your solutions to these problems in your own words. In addition, all of your solutions to these problems should be written in the \LaTeX\ word-processing application. We will talk more about this in class.

Part of the goal of this course is for you to learn to speak and write mathematics well. Therefore it is not enough to submit a written solution which includes the key ideas, or the final “answer.” The clarity and form of your solution are just as important, and will count for half of your grade.

To further this goal, you will have a chance to rewrite and resubmit some of your homework problems, within the two weeks after you get them back, for an improved grade. Editing is part of the process of learning to be a better mathematical writer, and I strongly suggest you take advantage of this opportunity. I may grade these problems more harshly for the first few assignments to help this process along.

Please talk to me in my office about homework if you are confused, and I’ll help you out. The problems are challenging enough that you probably won’t be able to do all of them by yourself without some assistance. Banging your head against the wall in your dorm room is not a productive way to spend your time.

Oral Problems: I will frequently ask members of the class to prepare solutions to problems to present in class. Sometimes the whole class will be asked to work on the same set of problems; sometimes they will be divided up by groups or by individual. You will be graded
on the quality and clarity of your presentation. You will also be graded on your responses, feedback, and support of other students’ presentations.

You will probably find that, although giving an oral presentation on a problem seems easier than writing up the solution, you will have to think just as carefully about these problems as you do about the written ones. In fact, it would probably help to write out your argument beforehand, so you have things straight in your mind.

**Quizzes:** We will have an in-class quiz about once every two weeks. They should each take about half an hour to 45 minutes of class time. The quizzes will test your understanding of the fundamental ideas of the course, emphasizing conceptual ideas over calculation.

**Attendance and Class Participation:** Since in-class activities will be such a large component of the course, the portion of your grade for attendance and class participation is correspondingly high. The class will cease to function if many people are absent or disengaged. Please support your classmates by coming to class every day prepared, thinking about other students’ oral problems so that you can follow their presentations, and designing your own oral presentations so as to benefit your classmates.

During a classmates’ presentation, you are not off the hook. Your classmate is relying on you to help them if they have difficulty. You should ask questions if you are confused, make helpful suggestions, and learn from their presentation. Above all, treat the presenter with respect. Listen to what they have to say, and do not make disparaging comments. “I don’t quite understand what you did in that step,” is appropriate, “You didn’t explain that well,” or “You’re wrong” are not.

**Attendance at the Math Department Colloquium:** According to math department policy, since you are enrolled in a 200-level mathematics course, you are required to attend at least 2 mathematics department colloquium talks. The goal of this requirement is to expose you to a wider range of mathematics, and to make you want to go to more than 2 talks! I hope you will decide by the end of the semester, as I have, that math talks are a lot of fun. If you miss this requirement, points will be deducted from your final grade.

**Disabilities:** If you have a documented disability for which accommodations may be required in this class, please contact me to discuss your needs. Additionally, you will need to register with Disability and Learning Services in the Bishop Wellness Center within the first two weeks of class. All such discussions will be confidential.

**Academic Honesty:** Cheating and plagiarism are serious offenses and will be treated severely, in accordance with college policy. In addition, I am personally insulted by such behavior. So please don’t do it. These are the practices I expect you to follow in each of the components of the course:

- **on the reading, homework, and oral problems:** You may, and are encouraged to, discuss the homework with anyone, get help from your textbook, notes, computer algebra systems, etc. However, your submitted written work should be your own.

- **on the quizzes:** You may not receive aid from any source other than me. Copying others’ work, or providing your work to be copied by other students, is cheating.