Math 251: Foundations of Advanced Mathematics
Spring 15
Course Procedures

Professor: Josh Laison
Ford 215, x6689, jlaison@willamette.edu

Office Hours:
Monday and Wednesday 3:00-4:00, in my office
Tuesday and Thursday 10:00-11:30, at the Bistro
Anytime by appointment or by catching me in my office.
My available times are on my webpage http://www.willamette.edu/~jlaison

Class Meetings:
Section 1: Ford 222, 12:40-1:40, Monday, Wednesday, Friday
Section 2: Ford 222, 1:50-2:50, Monday, Wednesday, Friday

Textbook:
Proofs and Fundamentals: A First Course in Abstract Mathematics,
1st or 2nd edition, Ethan Bloch
Course Web Page: http://www.willamette.edu/~jlaisonFOUNDATIONS.html
Course WISE Site: https://wise.willamette.edu/portal/site/MATH-251W-0102-15_SP

Grading:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Reading problems (around 20)</td>
<td>15%</td>
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<tr>
<td>Written problems (around 5)</td>
<td>30%</td>
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<tr>
<td>Quizzes (around 4)</td>
<td>20%</td>
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<tr>
<td>Class Presentations (5 to 10)</td>
<td>10%</td>
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<tr>
<td>Peer Reviews (around 5)</td>
<td>10%</td>
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<tr>
<td>Final exam</td>
<td>15%</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>100%</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 all theoretical mathematics courses.
- Get an introduction to some of the most important fields of theoretical mathematics.
- Have fun.
**Topics Covered:**
We will spend the first several 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 or less. In Foundations, a problem set might only have three or four problems, but might take around 10 hours to finish, and you will have a week or two to work on it.

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 frequently talk while the instructor sits and listens.

4. Foundations is more fun!

**Reading and Reading Problems:** The reading problems are a chance for you to start thinking about the relevant sections of the textbook before class. They will also help you become a better reader of mathematics, a skill that takes a long time to learn. We will discuss these problems in class, but you will be graded on your answers before the class discussion. If you have questions about the reading problems, talk to me or your classmates before class.

**Written Problems:** The written 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 formal mathematical style of your solution is just as important as the content, and will count for half of your grade.

To further this goal, you will have a chance to rewrite and resubmit these problems, in the week 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.

**In-class presentations:** I will frequently ask members of the class to prepare solutions to problems to present in class. For each scheduled oral presentation day, you’ll submit a list of the problems you are ready to present through the course WISE site. This list will count towards your presentation grade, and also help us determine who will present which problems in class. You will get additional credit for being prepared to present particularly challenging problems, or problems that a small number of students are prepared to present. You will also write up one problem you have presented on each written assignment, so you will need to present regularly.

Although the quality of your presentations is part of your grade, keep in mind that these presentations are practice, both for the presenter and the rest of the class, in getting better at communicating mathematics. Just as important as your own presentations are your thoughtful responses, feedback, and support of other students’ presentations.

Please support your classmates by coming to class every day prepared, thinking about as many of the presentation problems ahead of time as you can so that you can learn from your classmates’ presentations and provide feedback, and designing your own oral presentations so as to benefit your classmates.

**Peer-reviewed problems:** On every written problem assignment, you will have one peer-reviewed problem. This problem must be one that you have presented in class. You will write your solution to the problem in \LaTeX, and then a classmate will write a peer review of this solution. Peer reviews should not re-solve the problem themselves, but should provide as many suggestions as possible for improvement, both general and specific. Your peer review of your classmates’ problem should be turned into both your classmate and me, and will be used by your classmate to edit and resubmit her work.

**Quizzes:** We will have an in-class quiz about once every three weeks. They should each take about 30 minutes of class time. The quizzes will test your understanding of the fundamental ideas of the course, emphasizing conceptual ideas over calculation.

**Final Exam:** Your final exam in this course will be an oral exam. Each student will schedule their exam individually, and take it in my office. The exam should last around 30 minutes.

**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.
Collaboration: Working with others is an important part of many academic endeavors. Too little collaboration can make the learning experience more frustrating and less productive. Too much collaboration could be interpreted by your professor as cheating and incur severe penalties (see Academic Honesty below). Part of becoming a good college student is learning the level of collaboration appropriate for each assignment. Here are two important things to keep in mind as you seek that appropriate level:

1. Your professors may have a different socially accepted idea than your fellow students of what constitutes too much collaboration. Use your professors’ standard, not your peers’.

2. Do not assume that you should work alone unless you encounter difficulty in the course material. Working with classmates, even when you’re both doing well in the course, is often helpful, a normal part of college life, and not a sign of weakness!

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 and homework: You may, and are encouraged to, discuss the homework with fellow students, and get help from your professor, textbook, notes, or calculator. However, your submitted written work should be your own. Copy/pasting sections of another assignment, or providing your assignment to be copied by others, is cheating.

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 others, is cheating.