LING 160: Mathematical methods is linguistics

Syllabus: Fall 2017  www.cs.brandeis.edu/~ling160

This is an undergraduate and introductory-graduate course presenting the key mathematical concepts which belong to the basic repertoire of linguistic methods. The course is recommended for students considering research in linguistics or cognitive science, or intending to continue on to graduate programs in linguistics, computational linguistics, and related fields. It is an approved elective for the undergraduate major and minor, as well as for the MA in Computational Linguistics. In addition, the course fulfills the University Quantitative Reasoning requirement.

The course has two goals: first, to strengthen the students’ math background in the areas most widely relevant to linguistic theorizing and computational linguistics, and second, to provide a broad overview of linguistic applications for various mathematical tools that would be of interest to students in linguistics, computation, philosophy, and the cognitive and social sciences.

The course has no pre-requisites.

**Time:** T, Th 2pm – 3:20 PM

**Textbook:** Kenneth H. Rosen "Discrete Mathematics and Its Applications", 7th edition ONLY.

**Reader:** Additional readings will be distributed through LATTE. Please check LATTE often, as all changes in schedule, assignments, deadlines, and materials will be broadcast through LATTE.

**Professor:** Sophia A. Malamud  Email: smalamud AT brandeis DOT edu  Office: Volen 215

**Requirements:**

Success in this four-credit course is based on the expectation that students will spend a minimum of 9 hours of study time per week in preparation for class (readings, papers, preparation for quizzes, etc.).

Students are required to complete three types of assignments: homework problem sets, midterm quizzes, and the final exam. In addition, students must attend, and are expected to come prepared to fully participate in discussion and in-class “workshops”. Details of these requirements are below:

- Problem sets will be generally assigned on a Thursday, and will be due the following Thursday at the beginning of class.
  - They will be graded on a 10 point scale and the lowest grade will be dropped.
  - You’re encouraged to discuss the problems with your colleagues and work together, provided you indicate the name(s) of the person(s) you’re working with. However, after you are done talking to your group, you should go away and write up the answers on your own, and in your own words.
  - Homework on multiple pieces of paper needs to be stapled together! Write neatly. Think about what it must be like to read your own writing!
- Two mid-term quizzes and final exam will be cumulative. All quizzes and exams will be take-home. You’re not supposed to discuss the exams with anyone other than me and the TA. It always shows, and we will know.
- Some class sessions will be dedicated to discussion of the material and its application to various areas of linguistics. I will assign practice problems and discussion questions beforehand, and you should come to class with written attempted solutions to the problems and written thoughts on discussion questions. While you won’t be penalised for being quiet in class, I hope that you will feel welcome to ask questions, and that you will want to participate in class discussions.
• You can skip any three classes for any reason. Any further skipped classes will incur a penalty of half a point from the final course grade, up to a total of the 10% attendance/participation grade.
• Being on time and communicating with me is part of your grade for all of the above requirements.
  o Late problem sets will incur a 10% penalty for every day late
    ▪ Assignments submitted on the due date but after the beginning of class will be considered one day late.
    ▪ I cannot accept problem sets after the graded assignments are returned or after answers are posted.
  o If you feel that you are failing to make a deadline, you should communicate with me immediately, and ask for an extension before the assignment is due.
    ▪ I'm usually generous with extensions, but other than late problem sets (see above) I cannot accept an assignment if you just skip a deadline without prior communication with me
  o If a family or medical emergency intervenes, you should communicate with me as soon as you can.

Grading:
   Attendance & participation 10% - - obligatory to qualify for a grade
   (including communication with me, completion of practice problems, and discussion)
   Homework 56%
   Midterm quizzes 20% (10% each)
   Final exam 14%

Honour code: Although collaboration is encouraged, collaboration should not be confused with writing up the results of a classmate's work - this is unacceptable. If you work as a part of a group, you should indicate this at the top of your assignment when you submit it. Of course, you're encouraged to talk to me and the TAs about all assignments. Cheating is a very serious business and will not be tolerated at all. We will make every attempt to be reasonable about assignments, due dates, etc., but infractions of the honour code will be dealt with severely.

Additional information:
Throughout the semester, deadlines, assignments, etc. will be announced on LATTE, so please check it often. The LATTE page for this course that you can access by logging in [here](#). You must be officially registered for the course in order to access the LATTE page. Talk to me if you’re shopping the class and would like to be added to the LATTE in the meantime.

If you are a student with a documented disability on record at Brandeis University and wish to have a reasonable accommodation made for you in this class, please see the professor immediately. Retroactive accommodation cannot be provided.

Preliminary schedule:
• Schedule is subject to change, so check LATTE
• All chapter references are for our textbook, Rosen “Discrete Mathematics”, 7th edition.

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<thead>
<tr>
<th>Week/day</th>
<th>Topic</th>
<th>Readings, assignments</th>
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<tbody>
<tr>
<td>Week 0, 1: Aug 31, Sep 5,7</td>
<td>Sets</td>
<td>Chapter 2 HW1 due Sep 14 2pm</td>
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<td>Week 2: Sep 12, 14</td>
<td>Functions, relations</td>
<td>Chapters 2 &amp; 9</td>
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<td>Week 3 - 4 : Sep 19, 26, 28</td>
<td>Properties of relations, orders, equivalences</td>
<td>Chapter 9 HW2 due Sep 28 2pm</td>
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<td>Note: no class Sep 21</td>
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<td>Week 5 - 7: Oct. 3, 10, 11</td>
<td>Graphs, paths, trees, isomorphism</td>
<td>Chapters 10 &amp; 11</td>
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<td>Note: no class Oct 5, 12</td>
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<td>Take-home Quiz 1 due Oct 11 2pm</td>
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<td><strong>Thursday schedule Oct 11</strong></td>
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| Week 8 - 9: Oct. 17, 19, 24 | Counting | Chapters 6 & 8  
*HW3 due Oct 26 2pm* |
| Weeks 10-12: Oct. 26, 31 Nov 2, 7, 9, 14 | Discrete probability | Chapter 7  
*HW4 due Nov 9 2pm* |
| Weeks 13-14: Nov. 16, 21, 28, 30 | Linear algebra | Bits of chapter 2, Strang 1.3, Strang 6.1, Anton 3.1-3.2  
*Take-home Quiz 2 due Nov 21 2pm* |
| Week 15: Dec. 5, 7 | Statistical decision theory, information theory | Raiffa chapter 2  
*HW5 due Dec 7 2pm* |

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*Final exam will be distributed Dec 7 in class, and due Dec 14 at 2pm*

*The above schedule is very ambitious, so we shall see how we do*