LING 527 MATHEMATICAL LINGUISTICS – FALL 2024 SYLLABUS

Instructor:	Stanley Dubinsky	Office:	HOB 218 / Teams
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Class time/place:	T/Th 1:15 – 2:30 p.m. / HRH B119	Office hours/location:	By appt.

COURSE DESCRIPTION

This course will introduce its participants to the mathematical and formal mechanisms that play a prominent role in the formulation and formalization of theories of syntax and semantics. The topics covered in this course include: set theory, logic, English as a formal language, and languages & grammars. The course is not straightforwardly a linguistics course, per se (in that it doesn't really cover a particular sub-discipline in the field). Rather, it is a course that teaches basic formalisms, and shows how these can be applied to an understanding of the working parts of human language. It is, in a way, a little like a course in learning how to use tools, rather than a course in how to make anything with those tools.

LEARNING OUTCOMES

Upon successful completion of the course, students will be able to:
- Utilize mathematical methods and formal systems having application to the analysis of human language.
- Calculate the meaning of expressions using these methods.
- Analyze language grammars formally.
- Correlate subjective meaning with formal expressions of that meaning.
- For a linguistics or philosophy student, this course will be a window into basic formal languages and representations, which will teach them that formalisms are not ad hoc, but are rather precise ways of stating things about language. This will be a help to them regardless of what sort of analysis and formalizations they might ultimately wind up using.
- For the mathematics or computer science student, the formalisms may be rudimentary. What they will take away from this are ways of applying these formalisms to natural language. Given that math and computer science students don't necessary or automatically think of human language in this way, the course is likely to open up doors for them, as they approach the universe of human language/expression.

Prerequisites: There are no prerequisites for this course.

REQUIRED TEXT AND OTHER MATERIALS

- Barbara Partee, Alice ter Meulen, and Robert Wall [PTW]. 1990. *Mathematical Methods in Linguistics.* Springer. DOI: 10.1007/978-94-009-2213-6 [Chapters 1-7, 13-18]
  https://ebookcentral.proquest.com/lib/southcarolina/reader.action?docID=3102357
- **Additional readings to be distributed electronically:**
  Chomsky, Noam. 1956. Three models for the description of language. *IRE Transactions on Information Theory* 2(3): 113-124. [DOI:10.1109/TIT.1956.1056813]
  Chomsky, Noam, and George A. Miller. 1963. Introduction to the formal analysis of natural languages. In R. Duncan Lace, Robert R. Buch, and Eugene Galanter (eds.), *Handbook of Mathematical Psychology*, Volume II, 269-321. New York: John Wiley & Sons. [https://archive.org/details/handbookofmathem017893mbp/page/n279]
  Dowty, David. 1979. Aspectual classes of verbs. *Word meaning and Montague Grammar*. Chapter 2, 50-132. Springer.
  Dowty, David. 1991. Thematic proto-roles and argument selection. *Language* 67(3): 547-619.
  Fitch, Tecumseh, and Marc Hauser. 2004. Computational constraints on syntactic processing in a nonhuman primate. *Science* 303 (Jan 2004): 377-380. [DOI:10.1126/science.1089401]
  Gibson, Edward, Richard Fultrell, Steven Piandadosi, Isabelle Dautriche, Kyle Mahowald, Leon Bergen, and Roger Levy. 2019. How efficiency shapes human language. *Trends in Cognitive Sciences.* Elsevier. [https://doi.org/10.1016/j.tics.2019.02.003]

Grice, H.P. 1975. Logic and conversation. In Peter Cole and Jerry Morgan, *Speech acts. Syntax and Semantics 3*. Academic Press.

Hauser, Marc, Noam Chomsky, and Tecumseh Fitch. 2002. The faculty of language: What is it, who has it, and how did it evolve? *Science* 298 (Nov 2002): 1569=1579. [DOI:10.1126/science.298.5598.1569]

Jackendoff, Ray. 1972. *Semantic interpretation in generative grammar.* Chapter 2: Grammatical relations and functional structure, 25-46. Cambridge, MA: MIT Press.

Pelletier, Jeffrey. 2005. Introduction to intensional logic (lecture slides). Simon Fraser University. [http://www.sfu.ca/~jeffpell/Ling406/Ch5a.pdf]

Pullum, Geoffrey K. (2011) On the mathematical foundations of *Syntactic Structures*. *Journal of Logic, Language and Information* 20: 277–296. [http://ling.ed.ac.uk/~gpullum/onSyntacticStructures.pdf]

Studdert-Kennedy, Michael, and Louis Goldstein 2003. Launching language: The gestural origin of discrete infinity. In Morten H. Christiansen and Simon Kirby, *Language evolution*. Oxford: Oxford University Press.

Tattersall, Ian. 2019. The Minimalist Program and the origin of language: A view from paleoanthropology. *Frontiers in Psychology* 10.677. [https://doi.org/10.3389/fpsyg.2019.00677]

Zabbal, Youri. 2008. The semantics of predicate logic (handout). Boston University. [http://www.bu.edu/linguistics/UG/course/lx502/_docs/lx502-predicate%20logic%202.pdf]

Zabbal, Youri. 2008. The syntax of predicate logic (handout). Boston University. [http://www.bu.edu/linguistics/UG/course/lx502/_docs/lx502-predicate%20logic%201.pdf]

Zaenen, Annie. 2011. Monotonicity (lecture slides). Stanford University. [https://web.stanford.edu/~azaenen/LING-7800-019/LSABoulder1b.pdf]

- **Possible/parallel worlds resources** (**related to PTW chapter 16, Intensionality**)**:**

  Asimov, Isaac. 1972. *The gods themselves*. New York: Doubleday. ISBN:0-385-02701-X [https://en.wikipedia.org/wiki/The_Gods_Themselves]

  Gamow, George. 2012 (1940). *Mr Tompkins in paperback*. Cambridge: Cambridge University Press. [ISBN-10:1107604680, https://en.wikipedia.org/wiki/Mr_Tompkins] [https://www.asc.ohio-state.edu/durkin.2/phys1201/MrTompkinshort.pdf]

  Pullman, Philip. 1995/1997/2000. *His dark materials [trilogy]: The golden compass, The subtle knife, The amber spyglass*. NewYork: Scholastic. [https://en.wikipedia.org/wiki/His_Dark_Materials]
  Miller, David L. 2016. *Video lectures: His dark Materials* 12 mini-lectures. [https://www.youtube.com/playlist?list=PLCAy1o7SnXEDmF1BHhIRiMtjVL3nhAlj0]

HONORS AND GRADUATE STUDENT COURSE REQUIREMENTS

Reading responses (each class) – 1% each	25%
Homework assignments: 10% for exercises presented, 35% for additional exercises submitted	45%
Class notes	10%
Midterm event	20%

***Reading responses*:**
Students are required to submit responses to the readings prior to each lecture (150 words minimum).
- Responses must be, each time, at least **200 words**. Submissions of fewer than 150 words (i.e., 149 or fewer) will receive ½ credit.
- Responses must be received by **9:00 pm on the evening before the lecture (e.g., reading responses for Tuesday are due by 9:00 pm on Monday)**. Responses received within 12 hours after the deadline (by 9:00 am the next morning) will receive ½ credit, and no credit afterwards.
- E-mail your responses with a subject line "LING 527 comments" to dubinsky@sc.edu with your comments in the body or as a Word attachment. Do not send links to shared documents.
- Your responses will be distributed to the whole class. So, don't send anything you would not want publicly posted.

Homework exercises and presentation of these:
Students will present their solutions for assigned exercises on a rotating basis, those students not presenting exercises on a given day will submit them electronically. Exercises will be presented using PowerPoint. Following each presentation, students are expected to correct their slide deck based on comments and corrections received in the class discussion and email the corrected slides to dubinsky@sc.edu with a subject line "LING 527 exercises". Students not presenting should submit their assignments as Word documents, pdf files, or as jpegs of a notebook page. E-mail these as attachments with a subject line "LING 527 exercises" to dubinsky@sc.edu. Do not send links to shared documents.

***Posting of class notes*:**
Students will prepare and submit class notes for the benefit of the whole class on a rotating basis. These notes can be submitted as Word documents, pdf files, or as jpegs of a notebook page. E-mail your notes as attachments with a subject line "LING 527 notes" to dubinsky@sc.edu. Do not send links to shared documents.

Midterm "event":
The midterm "event" will consist of the presentation of questions that test students' knowledge of concepts introduced in the first seven weeks, and answers to these. For the mid-semester review, students will submit questions appropriate for a midterm exam and which would fairly test what has been learned. Selecting from and editing the questions submitted, I will assign students the task of framing and presenting an answer to one or two of them. These presentations will be done in class using a PowerPoint presentation. Following their presentation, students will correct their slide deck based on comments and corrections received in class and email the corrected slides to dubinsky@sc.edu with a subject line "LING 527 midterm".

Graduate student teaching presentations:
Graduate students will present part of a class lecture, two times during the semester. Undergraduate students will also have this opportunity if they choose it, but for extra credit.

GRADING SCALE

A	= 92.0-100.0	= excellent, extraordinary, exceptional, exemplary
B+	= 88.0-91.9	= very good, admirable, praiseworthy
B	= 82.0-87.9	= good, acceptable, commendable
C+	= 78.0-81.9	= adequate, passable
C	= 72.0-77.9	= marginal
D+	= 68.0-71.9	= unsatisfactory
D	= 62.0-67.9	= more unsatisfactory
F	< 62	= über unsatisfactory

Attendance and punctuality — Attendance is a requirement. It is also very important that you come to class **on time**. Failure to do so is disruptive and impacts negatively on the rest of the class. **Unexcused absences will count as much as a missed reading response (i.e., 1% grade penalty). Arriving late, unexcused, to class two times will count as one unexcused absence (i.e., 1% grade penalty).**

Excused absences — Legitimate absences from class are sometimes unavoidable (**it is up to the instructor to determine what is and is not legitimate**). In such cases and with **a legitimate excuse communicated to the instructor BEFORE the class**, an opportunity to attend virtually will be offered. If virtual attendance is also impossible, arrangements can be made to have the class recorded. In all these cases (virtual attendance and recorded lecture viewing), a student missing an in-person class will submit (within 2 days of the missed in-person class) a 500-word (minimum) summation of all the topics covered and the in-class discussion. Failure to submit the required summary will result in an unexcused absence penalty. The only exceptions are cases in which one is required to miss class by Student Health Services (e.g., following a positive Covid test).

Electronic devices — This class is a device-free class. Laptops and cellphones are not to be used during the class. They are a distraction to the instructor and to others attending the class. You will be provided with access to a PowerPoint presentation for each lecture, and this should be sufficient for your purposes. Anyone using laptops, electronic notebooks, notepads, or cell phones will be asked to refrain from using them. Cell phones should be put into "Airplane Mode" at the start of each lecture and remain so until the end of the lecture. Failure to do so will result in a grade penalty. A 1% grade penalty will be levied each time an electronic device is used in class (for example, 5 occurrences will lower your final course grade by one letter grade).

Grading of homework assignments — Grading criteria vary according to the assignment, though you should always aim for originality, clarity, sound reasoning, and attention to detail. It is your responsibility to be aware of due dates and times for assignments ("It's in the syllabus"). **Grades for late assignments (when accepted) will be lowered by 10% for each day late (including weekend days) and regardless of the reason**.

No incompletes will be given for this course.

<u>ACADEMIC HONESTY AND COLLABORATION</u>

You are expected to do your own work and acknowledge the use of anyone else's work or ideas. Academic dishonesty includes: (a) copying another student's work or letting another student copy your work and (b) copying passages or ideas directly from another source and passing them off as your own; that is, without properly referencing them. Honor Code violations will be reported to the Office of Academic Integrity. (http://www.sc.edu/academicintegrity/honorcode.html)

<u>DISABILITY STATEMENT AND SUPPORT RESOURCES:</u>

Students with disabilities should contact the **Student Disability Resource Center** at:
 1523 Greene Street, LeConte Room 112A Columbia, SC 29208
 Phone: 803.777.6142
 Fax: 803.777.6741
 Email: sasds@mailbox.sc.edu
 Web: https://sc.edu/about/offices_and_divisions/student_disability_resource_center/index.php
These services provide assistance with accessibility and other issues to help those with disabilities be more successful. Additionally, students with disabilities should review the information on the Disabilities Services website and communicate with the professor during the first week of class. Other academic support resources may help students be more successful in the course as well.
 Library Services (http://www.sc.edu/study/libraries_and_collections)
 Writing Center (http://www.cas.sc.edu/write)
 Carolina Tech Zone (http://www.sc.edu/technology/techstudents.html)

Syllabus: Class by Class Schedule

Week	Date	Topics/Assignments	Readings
1	8/20	**Course Overview**	
	8/22	**Unit 1: Set Theory** Concepts of set theory	PTW, chapter 1
2	8/27	Relations and functions	PTW, chapter 2
	8/29	Properties of relations	PTW, chapter 3
3	9/3	Infinities	PTW, chapter 4
	9/5	Infinities Language: The Gestural Origin of Discrete Infinity	PTW, chapter 4 **Studdert-Kennedy & Goldstein 2003**
4	9/10	**Unit 2: Logic** Concepts of logic, Statement logic	PTW, chapter 5, chapter 6.1-2
	9/12	Statement logic: Natural deduction	PTW, chapter 6.3-5
5	9/17	Logic and conversation	**Grice 1975**
	9/19	Predicate logic	PTW, chapter 7.1-3
6	9/24	Predicate logic: Natural deduction	PTW, chapter 7.4
	9/26	Grammatical relations and functional structure	**Jackendoff 1972**
7	10/1	Thematic proto-roles and argument selection - I	**Dowty 1991 – pp. 547-575 (s. 1-7)**
	10/3	Thematic proto-roles and argument selection – II	**Dowty 1991 – pp. 576-614 (s. 8-13)**
8	10/8	Aspectual classes of verbs	**Dowty 1979, 50-71**
	10/10	**Mid-semester review:** Semantics of predicate logic	**Zabbal 2008, handout 1-handout 2**
9	10/15	**Midterm event**	

	10/17	FALL BREAK	
10	10/22	**UNIT 3: ENGLISH AS A FORMAL LANGUAGE** Compositionality	PTW, chapter 13.1
	10/24	Compositionality/Lambda-abstraction	PTW, chapter 13.1/13.2
11	10/29	Lambda-abstraction	PTW, chapter 13.2
	10/31	Generalized quantifiers	PTW, chapter 14
12	11/5	ELECTION DAY	
	11/7	Generalized quantifiers	PTW, chapter 14
13	11/12	Intensionality	PTW, chapter 15
	11/14	Intensionality	PTW, chapter 15 **Dowty 1979, 71-132**
14	11/19	**UNIT 4: LANGUAGES, GRAMMARS, AUTOMATA** Grammars and trees	PTW, chapter 16.1-3
	11/21	Languages, (finite) automata, and the Chomsky Hierarchy	PTW, chapter 16.4-6 and 17.1 **Tattersall 2019**
15	11/26	THANKSGIVING BREAK	
	11/28	THANKSGIVING BREAK	
16	12/3	The faculty of language and syntactic processing	**Chomsky 1956** **Hauser, Chomsky, & Fitch 2002** **Fitch & Hauser 2004**
	12/4	Regular languages & Type 3 grammars Pushdown automata, context-free grammars & languages	PTW, chapter 17.2-3 PTW, chapter 18
17	12/10 12:30 -3:00	**FINAL EXAM DAY: SEMESTER END** [virtual meeting] Mathematical foundations of *Syntactic Structures* How efficiency shapes human language	**Pullum 2011** **Chomsky & Miller 1963** **Gibson et al. 2019**