80-210 Logic & Proofs

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Logic & Proofs (L&P) is a web-based course which introduces students to modern symbolic logic. It focuses primarily on strategies for constructing and refuting arguments. In service of this primary focus, L&P offers a wealth of online instructional materials which will help students develop an understanding of:

i. the logical form of statements;
ii. syntactic inference rules that allow the construction of logically correct arguments;
iii. strategies for crafting arguments that use these rules;
iv. semantic techniques that facilitate the development of counterexamples to arguments (showing them to be logically incorrect).

By the end of this course, students will find themselves introduced to and familiar with the following (this is not an exhaustive list):

- Logical interpretation of statements and arguments.
- The structure and validity (or invalidity) of arguments.
- The syntax of sentential and predicate (quantificational) logic.
- The semantics of sentential and predicate logic.
- **Counterexamples**.
- Finally: **inference rules**, **proofs**, and **strategies for arguments**.

How does Logic & Proofs Work?

As stated above, L&P is a web-based course. There are weekly discussion sections that you are required to attend. However, much of your intellectual experience will take place *online*. L&P is significantly more than an online textbook! It's a bundle of Interactive Learning Environments (ILEs) which work together to enable active student learning. Most of your time will be spent *interacting* with the L&P software—it is through the use of the ILEs that you develop and sharpen your understanding of logic.

The most sophisticated ILEs are the ProofLab and the TruthLab. The former supports - via dynamic intelligent Tutoring - the most difficult task you are going to face: proof construction.

The weekly discussion sections I lead are a complementary experience where you interact mostly with your peers. Each week, *students* give a brief presentation or demonstration of key topics. We then review the assigned chapter and use the remaining time to address open-ended questions.

How Do Lab Activities Work?

Lab activities are found throughout the course material. There are three types:

- *In-chapter problem sets*, as you read through the material. E.g., "**Learn By Doing**" activities,
- *Practice problem sets*, in each **Chapter Review** section,
- Chapter *lab assignments*, in each **Assignments** section.

The in-chapter activities should be completed as you encounter them while you read through the material. They are always directly related to what you have just read, allowing you to assess your own understanding and practice any new techniques presented. Completing the in-chapter activities will "unlock" the practice problems for the chapter.

The practice problems should be completed once you have finished reading the chapter material. Completing the practice problems will "unlock" the lab assignment for the chapter.

It is generally the case that completing a single problem from an in-chapter or practice problem set is all it takes to complete the problem set (any exceptions will be clearly indicated). In other words, you **don't** need to do *all* the problems, though you are perfectly welcome (and encouraged) to do so, if you wish to get additional practice.

The lab will indicate if there are any problem sets required to unlock an activity that have not yet been completed. You can also check your scores on the OLI "My Scores" page to see if a problem set is or is not complete. If you cannot access an activity, but believe you should be able to do so, please let us know!

IMPORTANT!

To give yourself adequate time for the lab itself, we recommend that you do the in-chapter activities immediately as you read through the text, and that you complete the practice problem sets for the current chapter by Wednesday night, the same time as the quiz is due.

How are grades calculated?

Chapter Quizzes ..... 15% of final grade

12 quizzes, top 10 scores @ 1.5% each
Due the Wednesday before class, by 11:59pm

Chapter Lab Assignments ..... 30% of final grade

12 labs, top 10 scores @ 3% each
Due the Saturday after class, by 11:59pm

For full credit, assignments must be completed by the deadlines specified in this syllabus. If you miss a deadline, you may **request** an extension after the deadline has passed, but be aware that there is a *10% per day* **penalty** for late work.

If you know *in advance* that you will need extra time for a given assignment (e.g., because you will be participating in or traveling to or from a University recognized activity such as a school sporting event or academic competition on or before the day that the assignment is due), **requesting** an extension *at least a day before the deadline* will get you a day's extension with no late penalty. Of course, extensions will also be granted for illnesses and emergencies, just let us know by e-mail what's going on, and we'll work things out with you.

If you know you will have trouble meeting a deadline in advance, make an appointment with me! I will help you with whatever issues you are having.

Please note that you must **request** the extension (with or without penalty), and not just do the work after the deadline! Grades for work done after the deadline without an extension do not show up in the same place in the OLI gradebook as grades for work done before the deadline, so we will not see that you have done work after the deadline (and you will not get credit for it) unless you let us know about it.

Please note also that you can choose to leave out two assignments - you will get zero points, but those deliberately missed assignments will not impact your score, as we are taking only the ten best into account! However, be cautious with this possibility and, please, let us know if you have chosen to take it.

Midterm Exams ..... 30% of final grade

3 midterms @ 10% each

Final Exam ..... 15% of final grade

There will be three midterms and a final, all of which will be conducted online and graded for the most part automatically (like the homework quizzes).

Some questions on the exams may require instructor/TA attention; these will generally be graded within a few days of the exam deadline. Until the exams are reviewed, your score may appear unexpectedly low due to questions for which human grading is required. Please *do not panic* about these questions. Once your exam score appears on Canvas and you still have questions about your scores on an exam, let us know.

Attendance and Participation ..... 10% of final grade

All work on homework (both quizzes and labs) and exams must be your own original and independent work. Collaboration on understanding the text and ILEs, but also on solving practice problems of a chapter is strongly encouraged. However, collaboration, sharing answers, etc. on the actual homeworks are considered to be cheating.

See

https://www.cmu.edu/policies/student-and-student-life/academic-integrity.html

for further details.

SCHEDULE (ASSIGNMENTS AND READINGS)

The normal week for L&P will look like this (but there are a few deviations from this pattern to keep in mind):

- Wednesdays night the quiz is due,
- Friday is recitation,
- Saturday night the lab is due.

Week	Date	Reading/Topic	Wednesday *quiz due by midnight*	Saturday *labs due by midnight*
1	Jan. 17	Chapter 1 Introduction: Statements and Arguments		Ch. 1 Quiz and Ch. 1 Lab
2	Jan. 24	Chapter 2 Sentential Logic: Syntax	Ch. 2 Quiz	Ch. 2 Lab
3	Jan. 31	Chapter 3 Sentential Logic: Semantics	Ch. 3 Quiz	Ch. 3 Lab
4	Feb. 7	Chapter 4 Sentential Logic: Derivations	Ch. 4 Quiz Midterm 1 Opens	Ch. 4 Lab Midterm 1 Closes
5	Feb. 14	Chapter 5 Sentential Logic: Indirect Rules	Ch. 5 Quiz	Ch. 5 Lab
6	Feb. 21	Chapter 6 Sentential Logic: Derived Rules	Ch. 6 Quiz	Ch. 6 Lab
7	Feb. 28	*Mid-semester break on Friday* *- no class this week!*	Ch. 7 Quiz	*nothing due (no class this week)*
–	Mar. 7	*Spring Break!* *- no class this week!*	*nothing due (no class this week)*	*nothing due (no class this week)*

8	Mar. 14	Chapter 7 Sentential Logic: Elementary Metamathematics	Ch. 7 Lab	Midterm 2 Opens
9	Mar. 21	Chapter 8 Predicate Logic: Syntax and Semantics I	Ch. 8 Quiz Midterm 2 Closes	Ch. 8 Lab
10	Mar. 28	Chapter 9 Predicate Logic: Syntax and Semantics II	Ch. 9 Quiz	Ch. 9 Lab
11	Apr. 4	*Carnival* *- no class this week!*	Midterm 3 Opens *(no class this week)*	Midterm 3 Closes *(no class this week)*
12	Apr. 11	Chapter 10 Predicate Logic: Derivations	Ch. 10 Quiz	Ch. 10 Lab
13	Apr. 18	Chapter 11 Predicate Logic: Derived Rules	Ch. 11 Quiz	Ch. 11 Lab
14	Apr. 25	Chapter 12 Predicate Logic: Identity	Ch. 12 Quiz	Ch. 12 Lab
Exams	May 2–9	During exam period—date and time TBD	Final Exam	