Constructive Logic (15-317/657)

Karl Crary

Fall 2021

This undergraduate course provides an introduction to constructive logics, such as intuitionistic and linear logic, with an emphasis on their application in computer science. This includes basic means for defining logics (for example, natural deduction and sequent calculus), establishing properties of logics (for example, cut elimination), and for investigating their computational interpretations (for example, via proof reduction or proof search).

Prerequisites: 15-317 is an introductory undergraduate course with a minimum grade of C in 15-150 as prerequisite. For the cross-listed graduate version, 15-657, some experience with functional programming is recommended.

Instructors

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Sessions

Lecture	MW	11:50 AM–1:10 PM	Posner 152
Section A	T	9:05 AM–9:55 AM	3SC 265
Section B	T	10:10 AM–11:00 AM	DH 2122
Section C	T	11:15 AM–12:05 PM	DH 2122
Section D	T	5:45 PM–6:35 PM	DH 2122

Online resources

The course web page is located at:

$$\texttt{cs.cmu.edu/\~crary/317-f21}$$

It gives a tentative schedule of topics, often with lecture notes. We will also distribute assignments through the web page. In addition, we will use a Piazza forum for announcements, questions, and discussion.

It is best to view the lecture notes as the textbook for the course. Do not view them as a substitute for lecture! The notes are generally very good, but they do not cover all the topics of the course, and those that it does cover, it does not always cover the same way. This is particularly true in the second half of the course.

Homework and grading

Homework will be assigned weekly and collected using Gradescope. You will have five late days to use as you see fit, with at most three late days on any single assignment. These late days are intended to address all normal circumstances that obstruct getting work done, include mild illness and interviews. You can earn additional late days by handing in homeworks at least two days early, at a rate of one late day for each early assignment. (Extra late days earned do not affect the maximum of three late days on any particular assignment.)

All students who were registered for the course on August 25 should be in the Gradescope system already. Other students should contact an instructor.

Students are permitted two pages of notes (*i.e.,* one sheet, front and back) during exams. Exams are closed internet.

Attendance in lectures is required. The weighting in assigning grades will be 48% homework, 19% midterms, 29% final, 4% attendance.

Software

For much of the course, we will be using an automated proof checker called Prooftree. Prooftree runs on Gradescope, but its interface is an SML library that we provide. You can compile the interface wherever you run SML, which will allow you to check locally that your submission is free of syntax errors.

An auxiliary tool to help you get used to Prooftree is at:

```
proof-tree-generator.web.app
```

In the middle part of the course, we will be writing programs in Prolog. Two good, free Prolog interpreters are GNU-Prolog and SWI-Prolog.

Covid-related course policies

The course is being delivered in-person. Lectures and recitations are not being livestreamed or recorded. Thus, if you miss lecture, you will need to obtain notes from another student who attended. Exams will be conducted in-person in the traditional manner.

As the class opens, the university is requiring face coverings for indoor activities, which includes lecture and recitation. Students are required to wear face coverings in class. If the university chooses to lift the mask requirement, mask-wearing in class will be optional.

We have not yet determined by what means we will be offering office hours. Once we know, they will be announced in class and on Piazza.

Academic integrity

All assignments in the course are individual assignments. All work you hand in on assignments must be your own work. You should not copy any part of any other person's solution, nor look at any solution before preparing your own. You must not make your solutions, in whole or in part, available to any other student, and it is your responsibility to ensure that others cannot read your files.

It is permissible to discuss assignment problems or other course material in general terms, but such discussions must stop short of discussing solutions to assignment problems.

Exam work must be exclusively your own. You are not to discuss any exam problem with anyone other than course staff until you turn in your exam. Thereafter, you may discuss exam problems with others, provided you take care, proactively, to ensure you are not overheard by any student who, for whatever reason, might not yet have finished his or her exam. This includes when you are in a location other than where the exam took place.

Note taking

Research has shown that taking notes, by hand, using a pen or pencil is a vital part of learning for most students. Taking notes on a laptop is a poor substitute. In fact, research has shown that you are better off taking notes by hand and then throwing those notes away, than taking notes on a laptop. It seems that the act of processing material into handwritten notes involves the parts of the brain responsible for learning, while the act of transcribing class material on a laptop largely bypasses those parts.

You can learn about this research, which some people find counterintuitive, here:

  www.scientificamerican.com/article/a-learning-secret-don-t-take-notes-with-a-laptop/

It does seem reasonable that taking notes on a laptop or tablet using a stylus probably is similar to taking notes with pencil, although I am not aware of any research that actually confirms this intuition. Conversely, it seems reasonable that simply taking screenshots of the lecture is probably even worse than taking notes on a laptop.

Accommodations for students with disabilities

If you have a disability and have an accommodations letter from the Disability Resources office, I encourage you to discuss your accommodations and needs with me as early in the semester as possible. I will work with you to ensure that accommodations are provided as appropriate. If you suspect that you may have a disability and would benefit from accommodations but are not yet registered with the Office of Disability Resources, I encourage you to contact them at `access@andrew.cmu.edu`. Note that we cannot provide any special accommodations without a Disability Resources letter.

Support for students' health and well-being

This semester is unlike any other. We are all under a lot of stress and uncertainty at this time. Attending Zoom classes all day can take its toll on our mental health. Make sure to move regularly, eat well, and reach out to your support system or me if you need to. We can all benefit from support in times of stress, and this semester is no exception.

There are many helpful resources available on campus and an important part of the college experience is learning how to ask for help. Asking for support sooner rather than later is almost always helpful. If you or anyone you know experiences any academic stress, difficult life events, or feelings like anxiety or depression, we strongly encourage you to seek support. Counseling and Psychological Services (CaPS) is here to help: call 412-268-2922 and visit their website at `http://www.cmu.edu/counseling/`. Consider reaching out to a friend, faculty or family member you trust for help getting connected to the support that can help.

Diversity

We must treat every individual with respect. We are diverse in many ways, and this diversity is fundamental to building and maintaining an equitable and inclusive campus community. Diversity can refer to multiple ways that we identify ourselves, including but not limited to race, color, national origin, language, sex, disability, age, sexual orientation, gender identity, religion, creed, ancestry, belief, veteran status, or genetic information. Each of these diverse identities, along with many others not mentioned here, shape the perspectives our students, faculty, and staff bring to our campus. We, at CMU, will work to promote diversity, equity and inclusion not only because diversity fuels excellence and innovation, but because we want to pursue justice. We acknowledge our imperfections while we also fully commit to the work, inside and outside of our classrooms, of building and sustaining a campus community that increasingly embraces these core values.

Each of us is responsible for creating a safer, more inclusive environment.

Unfortunately, incidents of bias or discrimination do occur, whether intentional or unintentional. They contribute to creating an unwelcoming environment for individuals and groups at the university. Therefore, the university encourages anyone who experiences or observes unfair or hostile treatment on the basis of identity to speak out for justice and support, within the moment of the incident or after the incident has passed. Anyone can share these experiences using the following resources:

- Center for Student Diversity and Inclusion: `csdi@andrew.cmu.edu`, (412) 268-2150

- Report-It online anonymous reporting platform: `reportit.net` username: `tartans` password: `plaid`

All reports will be documented and deliberated to determine if there should be any following actions. Regardless of incident type, the university will use all shared experiences to transform our campus climate to be more equitable and just.