Intermediate Logic 1

We will study three topics. *Computability*: we will study which mathematical tasks can be accomplished by a "mechanical procedure". *Metalogic*: we will prove things about logical systems, such as "a statement of propositional logic is a tautology if and only if it is derivable", and "there is no mechanical procedure for deciding whether an arbitrary sentence of predicate logic is true in all models". *Metamathematics*: we will prove things about mathematical systems, such as Gödel's startling incompleteness theorem: there is no way to write down axioms from which all true statements of arithmetic can be derived as theorems.

Prerequisite

Intro logic (Philosophy 201 or 202). Note: this course is difficult (much, much harder than—and very different from—intro logic). You need to be comfortable with abstract mathematical reasoning. Please see me if you're unsure whether this class is appropriate for you.

Readings

The required text is *Computability and Logic*, by Boolos, Burgess, and Jeffrey, 3rd edition. (Note: this is not the current edition of the book.) My class notes are in some cases more explicit than the textbook, and will be available on Sakai.

Requirements

Two exams (70%), plus periodic homework assignments (30%). The first exam will be in-class on **October 24**. The second exam, which will cover only the second half of the course, will be during finals week, at **8am on December 17**, in our regular classroom. Homework assignments will be posted on the Sakai site:

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https://sakai.rutgers.edu/x/jClHxB
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You must do your homework on your own; no working in groups, no consulting outside sources (e.g., other books, the internet). Some homework problems will be difficult; I don't expect everyone to be able to solve them all. Just do the best you can. Homework must be produced electronically (not hand-written) and turned in at the Sakai site. You are also responsible for insuring that your homework is successfully uploaded. **Late homework will be penalized 10%; after 3 days it will not be accepted.**

Learning goals

The goals of this course are to learn the rudiments of recursive function theory, the main metalogical theorems, and the main limitative theorems of metamathematics; and also, to develop students' ability to carry out abstract mathematical reasoning, as applied to symbolic languages, on their own.

Schedule

1. Mathematical background: chapters 1, 2; notes, part I.
2. Computability: skim pp. 19–23, 52–7; then chapter 7 (you need only skim the material on pp. 78–81 and 83–84 about abacus machines); notes, part II
3. Metalogic: chapter 9; skim pp. 112–3; then chapters 11–12; notes, part III
4. Metamathematics: chapters 14–15; notes, part IV