COURSE ANNOUNCEMENT – FALL 2009

MATH 445 – ELEMENTARY MATHEMATICAL LOGIC

MWF 1:00-1:50

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DESCRIPTION: This course is an introduction to mathematical logic aimed at a broad audience. Mathematical logic studies reasoning as used in mathematics.

In mathematics we try to show that various statements are *true* of some specific mathematical structure — for example, the integers under $+$, $-$, $\cdot$ and $<$ — or some class of structures — for example, the class of abelian groups. We do this by constructing *proofs*, that is, arguments following certain specified rules. The obvious question is: do proofs enable us to derive *all* statements true of the structure or structures involved?

Gödel gave two contrasting answers to this question, for statements which can be written in first order logic. In his Completeness Theorem he showed that a statement is trus in all models of a set of axioms if and only if it has a proof from those axioms. In his Incompleteness Theorem he showed that no axiomatic proof system is adequate to derive all the true statements about any structure rich enough to contain arithmetic on the integers.

Our goal in this course is to explain and prove these two theorems.

PREREQUISITES: MATH 141.

TOPICS:

Sentential Logic

Sentences and truth tables
Proofs
Completeness of the proof system

First Order Logic

Formulas and structures
Proofs
Completeness of the proof system

Incompleteness

Computable functions
The Incompleteness Theorem

TEXT: (recommended) J.N. Crossley et al, What is Mathematical Logic? Dover, 1990.
In addition, notes will be supplied by the instructor.

COURSE WORK: Homework, two midterm exams, final exam.