This is an introductory course on mathematical logic. In principle it is self-contained, but a student should have background experience in precise mathematical reasoning. Lecture notes will be distributed. There are three main topics.

**Natural Deduction** Since the work of Gentzen there has been a science of mathematical proof. A proof is supposed to show that the hypotheses inevitably lead to the conclusion. Every proof may be accomplished by repeated use of a relatively small number of standard templates. Furthermore, such proofs are simply a more detailed version of the kind of proofs that mathematicians find quite natural. The presentation of this deductive scheme is the initial and most practical part of the course.

**Proof Theory** There is a procedure for constructing proofs with the following property. If there is a proof that the hypotheses lead to the conclusion, then this proof is finite, and the procedure finds it. If there is no proof, then the procedure constructs a counterexample. This is a constructive version of the Gödel completeness theorem. It might seem that this should make mathematics very easy—just apply the procedure. However mathematics deals with infinite objects, and the construction of the counterexample can be an infinite process. While attempting to produce a proof, one is never sure whether one is merely part way along toward success or in a futile process of producing an infinite counterexample.

**Model Theory** Say that one wants to characterize some infinite mathematical object and its properties. It would be nice to have a complete theory of this object, a theory that can answer all questions posed in the appropriate language. For instance, it is easy to construct a complete theory that answers all questions that one can pose about the order structure of the natural numbers. The Gödel completeness theorem implies that if the mathematical system is infinite, then, even if the theory is complete, there are models of the theory other than the intended one. These are the non-standard models. Such models are illustrated in simple examples, so one can see exactly how they work.