LGIC 320 / MATH 571: Logic II
Preliminary Outline

1. Propositional intuitionistic logic (Int)
    - Foundations and motivations. BHK semantics
    - Hilbert-style axiomatization
    - Kripke semantics, completeness theorem
    - Disjunctive property; double-negation translation (CL $\to$ Int)
    - Finite-valued logics; Int is not finite-valued
    - Topological semantics; completeness theorem
2. Lambda calculus
    - Untyped lambda calculus as a universal computational model
    - The Church – Rosser (diamond) property
    - Simply typed lambda calculus
    - Strong normalization [proof optional]
    - Set-theoretic models for lambda-calculus, completeness theorem
    - Natural deduction for Int; the Curry – Howard correspondence
    - Combinators and the Hilbert-style calculus for Int
3. First-order intuitionistic logic (FO-Int)
    - Hilbert-style axiomatization
    - Kripke semantics, completeness theorem
    - Double-negation translation (FO-CL $\to$ FO-Int)
    - Disjunctive property; constructivity of the existential quantifier
    - The constant domain principle
    - Curry – Howard for FO-Int; calculus of inductive constructions (CIC)
    - Application: the Coq proof assistant
4. Sequent (Gentzen-style) calculi
    - Sequent calculi for FO-CL and FO-Int
    - Cut elimination: semantic and syntactic approaches
    - Disjunctive property, constructivity of the existential quantifier, and Herbrand's theorem syntactically
    - Substructural logics, linear logic and its variants
    - Semi-Thue systems; undecidability of propositional linear logic
    - Application: non-commutative linear logic in linguistics (the Lambek calculus)
5. Modal logic
    - Kripke semantics for modal logic, complete and incomplete logics
    - Canonical model, canonicity
    - Sahlqvist formulae, Sahlqvist's completeness theorem [proof optional]
    - Completeness and finite model property of GL (Gödel-Löb logic)
    - Topological semantics for S4 and GL
    - Arithmetical interpretation of GL, Solovay's theorem [proof optional]
    - Sequent calculi for modal logics; infinite and cyclic proofs for GL