Third Indian School on Logic and its Applications

Course Outline: Model Theory of Modal Logic

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This course outline is tentative. Depending on the background of the audience, I may speed up and add more material, or slow down and leave out some topics.

Day 1: 90 min

- Introduction: syntax and Kripke semantics of modal logic.
- Standard translation of modal logic to FO_2.
- Modal theories and modal definability of classes of Kripke frames and models.

Day 2: 60 min

- Bisimulations and modal invariance.
- Classical truth-preserving constructions.
- Proving modal non-definability.

Day 3: 60 min

- Bisimulation games.
- Finite bisimulations, characteristic formulae, and modal equivalence.
- Finite vs full bisimulations.

Day 4: 60 min

- Modal logic as a fragment of first order logic.
- van Benthem's characterisation theorem.
- Basics of correspondence theory: modal definability and FO definability.

Day 5: 60 min

- Canonicity. Sahlqvist theorem and extensions.
- Algorithmic correspondence and completeness in modal logic. The algorithm SQEMA.

Course readings:

1. Valentin Goranko and Martin Otto: Model Theory of Modal Logic, Chapter in: Handbook of Modal Logic, P. Blackburn, J. van Benthem, F. Wolter (eds.), Kluwer, 2007, pp. 249-329.

2. (for Day 5 only) Willem Conradie, Valentin Goranko and Dimiter Vakarelov: Algorithmic correspondence and completeness in modal logic. I. The core algorithm SQEMA, Logical Methods in Computer Science, vol. 2 (1:5) 2006, pp.1-26.