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MATH43051

Model Theory

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| Unit code: | MATH43051 |
| Credit Rating: | 15 |
| Unit level: | Level 4 |
| Teaching period(s): | Semester 1 |
| Offered by | School of Mathematics |
| Available as a free choice unit?: | N |

Requisites

None

Aims

- To present the basic notions and results of model theory.
- To illustrate these in a variety of kinds of examples.
- To show some applications of realising types in elementary extensions.

Overview

Model theory deals with those properties of mathematical structures which can be expressed using formulae of the predicate calculus. One theme is the investigation of the class of those structures which are the models of a set of sentences from predicate calculus. Another theme is the analysis of definability in individual structures and the use of elementary extensions to produce non-standard elements (such as infinitesimals in extensions of the set of real numbers).

Assessment methods

- Other - 20%

- Written exam - 80%

Assessment Further Information

- Mid-semester coursework: two take home tests weighting 20%
- End of semester examination: two and a half hours weighting 80%

Learning outcomes

On successful completion of this course unit students will be able to

- understand the relation between structure and syntax, definable sets and types, in the context of predicate logic;
- be able to analyse examples from a model-theoretic perspective;
- understand the fundamental results on the class of models of a theory in predicate logic;
- be able to use the technique of realising types.

Future topics requiring this course unit

None.

Syllabus

1. Review of predicate logic: languages, structures, theories, compactness theorem. [6 lectures]
2. Comparing structures: embeddings, elementary embeddings, diagrams. [4 lectures]
3. Lowenheim-Skolem theorems; elementary chains. [2 lectures]
4. Definable sets; the space of types; saturation. [4 lectures]
5. Elimination of quantifiers and model completeness, basic examples. [4 lectures]
6. Aleph-0 Categoricity. [6 lectures]
7. Preservation Theorems. [4 lectures]

Recommended reading

- Marker, David Model theory. An introduction. Graduate Texts in Mathematics, 217. Springer-Verlag, New York, 2002. viii+342 pp.
- Hodges, Wilfrid Model theory. Encyclopedia of Mathematics and its Applications, 42. Cambridge University Press, Cambridge, 1993. xiv+772 pp

Feedback methods

Tutorials will provide an opportunity for students' work to be discussed and provide feedback on their understanding.

Study hours

- Lectures - 22 hours
- Tutorials - 11 hours
- Independent study hours - 117 hours

Teaching staff

Alex Wilkie - Unit coordinator