

Lógica Matemática

Objetivos

Presentar los conocimientos básicos de Lógica Matemática para poder trabajar en Programación Lógica, en Inteligencia Artificial y, en general, en Ciencias de la Computación.

Descripción

En este curso se pretende revisar las ideas principales de la Lógica Matemática con miras a su aplicación. Esto incluye un tratamiento del cálculo de proposiciones, de la lógica de primer orden, de una introducción a ciertas lógicas modales y polivalentes y al uso de PROLOG.

El curso es asimismo una introducción a PROLOG. Las nociones del lenguaje serán introducidas a lo largo del curso. PROLOG es pues el lenguaje para la realización de prácticas.

Contenido

1.- Preliminaries

1. Logic Formulas
2. Semantics of Formulas
3. Models and Logical Consequence,
4. Logical Inference
5. Substitutions

2.- Definite

- a. Logic Programs
- b. Definite Clauses,
- c. Definite Programs and Goals
- d. The Least Herbrand Model
- e. Construction of Least Herbrand Models

3.-SLD-Resolution:

1. Informal Introduction
2. Unification
3. SLD-Resolution
4. Soundness of SLD-resolution
5. Completeness of SLD-resolution
6. Proof Trees

4.-Negation in Logic Programming:

- a. Negative Knowledge
- b. The Completed Program

- c. SLDNF-resolution for Definite Programs
- d. General Logic Programs
- e. SLDNF-resolution for General Programs
- f. Three-valued Completion
- g. Well-founded Semantics

5.-Towards Prolog:

1. Cut and Arithmetic: Cut: Pruning the SLD-tree
2. Built-in Arithmetic

6.-Logic and Databases:

- a. Relational Databases,
- b. Deductive Databases,
- c. Relational Algebra vs. Logic Programs,
- d. Logic as a Query-language
- e. Special Relations,
- f. Databases with Compound Terms
- g. Programming with Recursive Data Structures: Recursive Data Structures,
- h. Lists,
- i. Difference Lists

7.-Amalgamating Object- and Meta-language:

- a. What is a Meta-language?,
- b. Ground Representation,
- c. Nonground Representation,
- d. The Built-in Predicate
- e. `clause/2`, The Built-in Predicates `assert {a,z}/1`,
- f. The Built-in Predicate `retract/1`

8.-Logic and Expert Systems:

- a) Expert Systems,
- b) Collecting Proofs,
- c) Query-the-user,
- d) Fixing the Car (Extended Example)

9.-Logic and Grammars:

- a) Context-free Grammars,
- b) Logic Grammars,
- c) Context-dependent Languages,
- d) Definite Clause Grammars (DCGs),
- e) Compilation of DCGs into Prolog

10.-Searching in a State-space:

1. State-spaces and State-transitions,
2. Loop Detection,
3. Water-jug Problem (Extended Example),
4. Blocks World (Extended Example),
5. Alternative Search Strategies

11.-Logic Programming and Concurrency:

- 1) Algorithm = Logic + Control,
- 2) And-parallelism,
- 3) Producers and Consumers,
- 4) Don't Care Nondeterminism,
- 5) Concurrent Logic Programming

12.-Logic Programs with Equality:

- a. Equations and E-unification,
- b. More on E-unification,
- c. Logic Programs with Equality

13.-Constraint Logic Programming:

- a. Logic Programming with Constraints,
- b. Declarative Semantics of CLP,
- c. Operational Semantics of CLP,
- d. Examples of CLP-languages

14.-Query-answering in Deductive Databases:

- e. Naive Evaluation,
- f. Semi-naive
- g. Evaluation,
- h. Magic Transformation,
- i. Optimizations

Bibliography

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2.- Guillermo Morales-Luna: Lógica Matemática (Un enfoque computacional), Edición electrónica del autor, 2002. En PDF y en HTML:
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