

# Constraint Programming

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# May I introduce myself ?

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# Objectives of the lecture

## **Modelling and solution of constraint problems in the area of artificial intelligence**

(focus on finite domain constraints)

- What is constraint programming ?
- How to model/formulate problems ?
- How problems are solved ?

# Outline of the lecture

3 main parts

1. Constraint (Logic) Programming –C(L)P
2. Rule-based constraint logic programming
3. Cooperative problem solving

# Outline : C(L)P

- Introduction to CP
- Examples
- From LP to CLP
- Formal presentation : constraints, solvers
- Intuition : Solving CSP
- CP duality
- Constraint programming languages
- ECL<sup>i</sup>PS<sup>e</sup>
- From LP to CLP
- Local consistency
- Constraint store
- Search efficiency
- Global constraint and reified constraints
- Program examples
- Environment

# Outline : rule-based CP programming

- Programming with rules
- Languages
- Rewriting CSPs
- CHR
- CHR solvers
- Generating rule-based solvers

# Outline : cooperative problem solving

- Preliminaries : why cooperation ?
- Issues
- Different kinds of cooperations
- Intra-solver cooperation
- Ad-hoc cooperation
- Constraint solver cooperation languages
- Hybrid approaches

# Languages

- Prolog-based CP language : ECL<sup>i</sup>PS<sup>e</sup>
  - <http://www-icparc.doc.ic.ac.uk/eclipse/>
  - free licence for academics
  - libraries implementing several constraint systems and solvers
  - features to implement user-defined constraints and solvers
- Rule-based CP language : CHR
  - Constraint Handling Rules
  - several implementations (one on top of ECL<sup>i</sup>PS<sup>e</sup>)
  - based on concurrent rules
  - constraint rewriting to design solvers and handle constraints



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