Constraint Programming:
CP languages and systems

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Constraint programming languages and systems

Objectives

- Different types of “host” languages
  modelling : to formulate problems
- Different types of constraints and solvers
  solving : problems that can be solved
- **Choosing** the language for :
  - the programming paradigm
  - the constraints and solvers that are needed

CP languages : logic programming (1)

Based on Prolog

- **CLP($\Re$)**
  - resolution of linear constraints over real numbers (equations and inequations)
  - use of Gaussian elimination and Simplexe
  - non-linear constraints : delay mechanism

    $\Rightarrow$ incorect and incomplete system (maybe solution)
- **Prolog IV** (Prologia)
  - (non-)linear constraints over rationnal and real numbers
  - constraints over trees (equations and disequations)
  - constraints over characters (equations)
  - complete system

CP languages : logic programming (2)

Based on Prolog

- **CHIP** (COSYTEC)
  - linear constraints over rationnal numbers
  - Boolean constraints
  - programming environment : graphics, debugging, . . .
- **ECL^{i}PS^e** (IC-Parc)
  - constraints over finite domains : integer, Boolean, symbolic, . . .
  - linear constraints over rationnal/real numbers
  - and many more solvers
  - features to integrate user-define constraints (delay mechanism, attributed variables, . . .)
  - *Constraint Handling Rules* : for rewriting constraints

CP languages : logic programming (3)

Based on Prolog

- **GNU Prolog**
  - Prolog with an extension for solving constraints over finite domains
  - integrated in some Linux distribution

CP languages : object-oriented programming

- **Ilog Solver** (ILOG)
  - C++ library
  - constraints over finite domains (integer, Boolean, . . .)
  - constraints over real numbers (complete solver)
  - links to CPLEX (optimization)
  - many tools and libraries for classes of problems
  - **fiable**

CP languages : rule programming

- **CHR**
  - based on concurrent rules
  - rules for rewriting constraints
    $\Rightarrow$ design and implementation of constraint solvers
  - on top of host languages
    - Prolog : ECL^{i}PS^e, Sicstus, . . .
    - Java : JACK
  - many solvers implemented

CP languages : own modelling language

- **Numerica**
  - system with its own language
  - (non-)linear constraints over real numbers
  - complete
  - **fiable**