Hybridization of Genetic Algorithms and Constraint Propagation for the BACP

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Hybridization for CSP

- complete methods (such as propagation + split)
  - complete exploration of the search space
  - detects if no solution
  - generally slow for hard combinatorial problems
  - global optimum
- incomplete methods (such as genetic algorithms)
  - focus on some “promising” parts of the search space
  - does not answer to unsat. problems
  - no guaranteed global optimum
  - “fast” to find a “good” solution

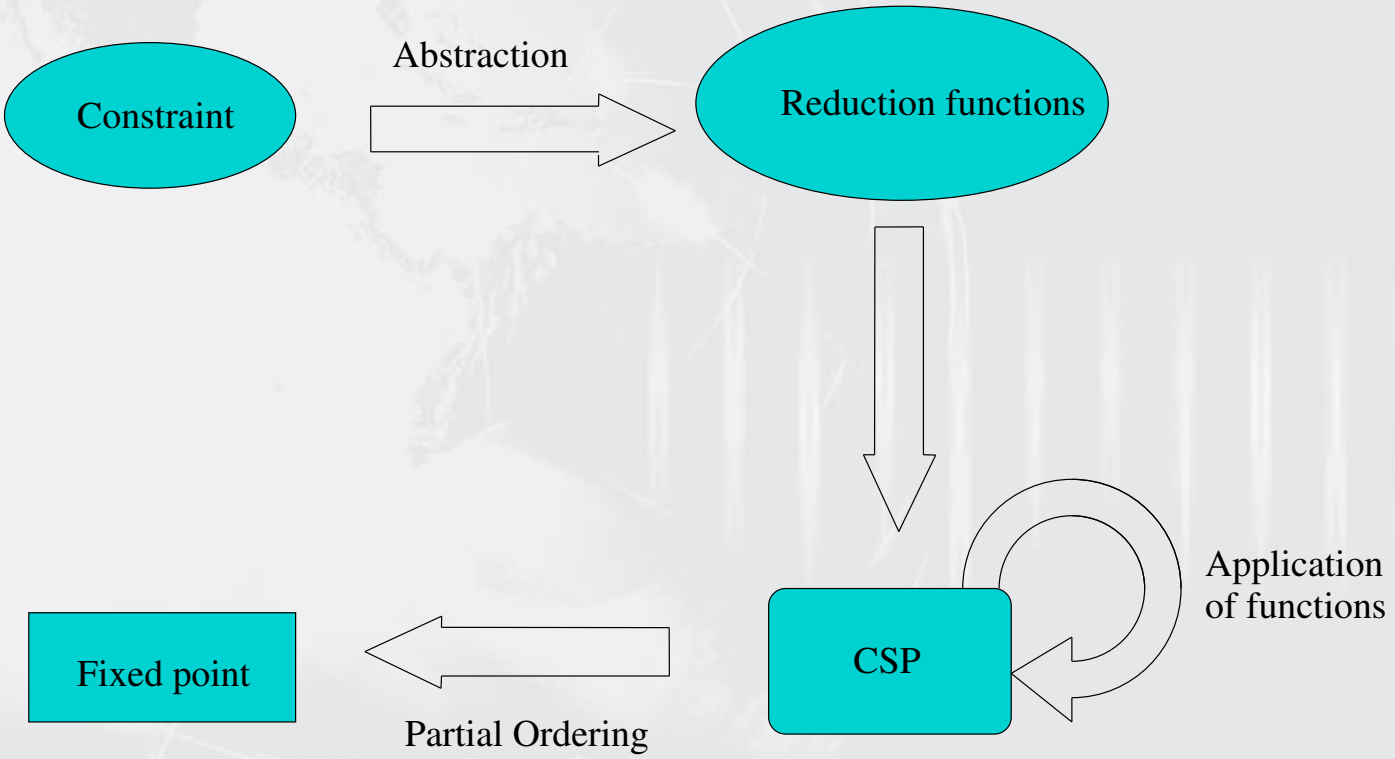
Hybridization : getting the best of both methods

- But, generally :
  - Ad-hoc systems
  - Master-slaves approaches
- Idea :
  - Fine grain control
  - More strategies
- Technique :
  - Decomposing solvers into basic functions
  - Adapting chaotic iterations for hybrid solving

Our Purpose : Hybrid Model

- Integration of genetic algorithms
- Use of an existing theoretical model for CSP solving
- Definition of the solving process

Abstract Model K.R. Apt [CP99]

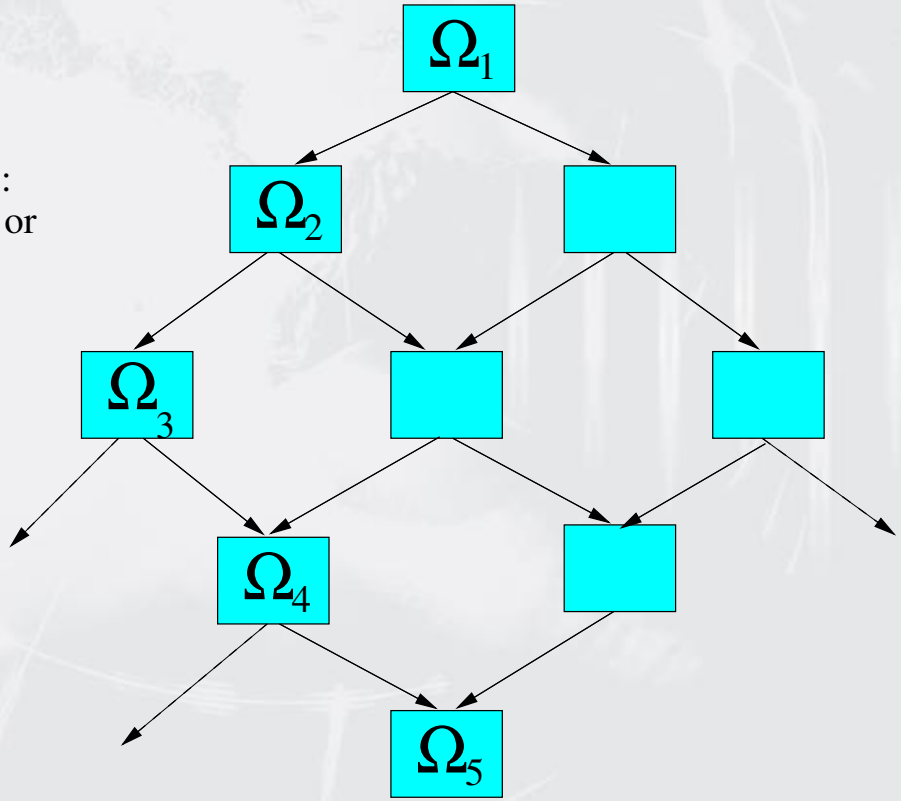


The theoretical model for CSP solving

Partial ordering :

Application of a reduction : domain reduction function or splitting function

Set of CSP



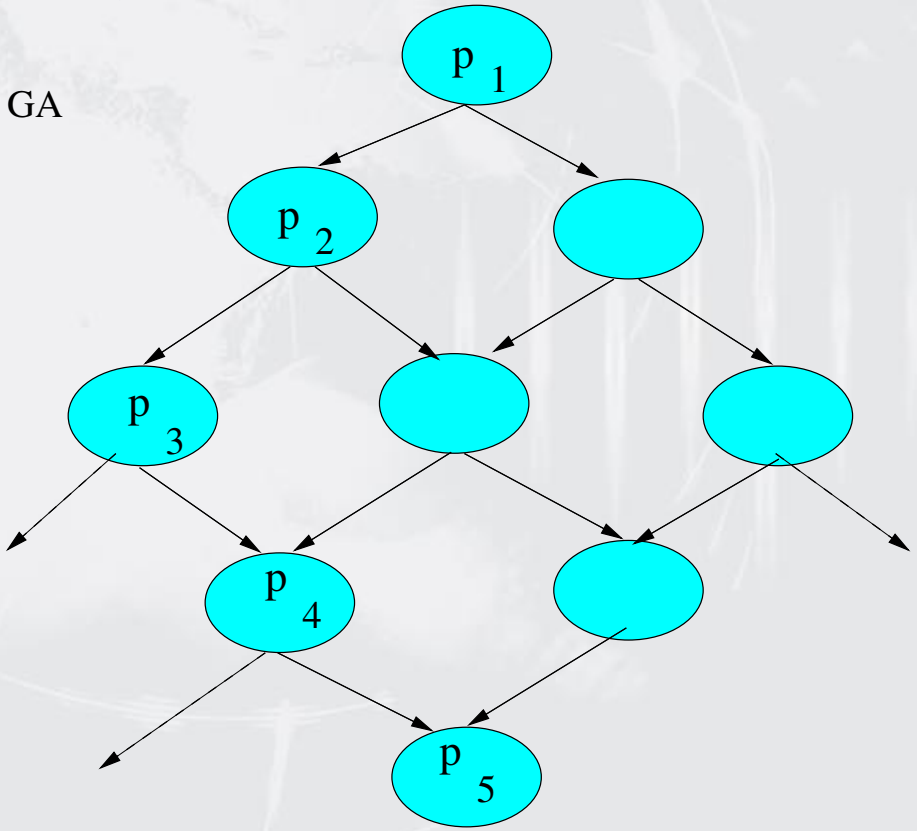
Terminates with a fixed point : set of solutions or inconsistent CSP

GA process as moves on partial ordering

Moves on a partial ordering

Function to pass from one GA state to another

State of GA

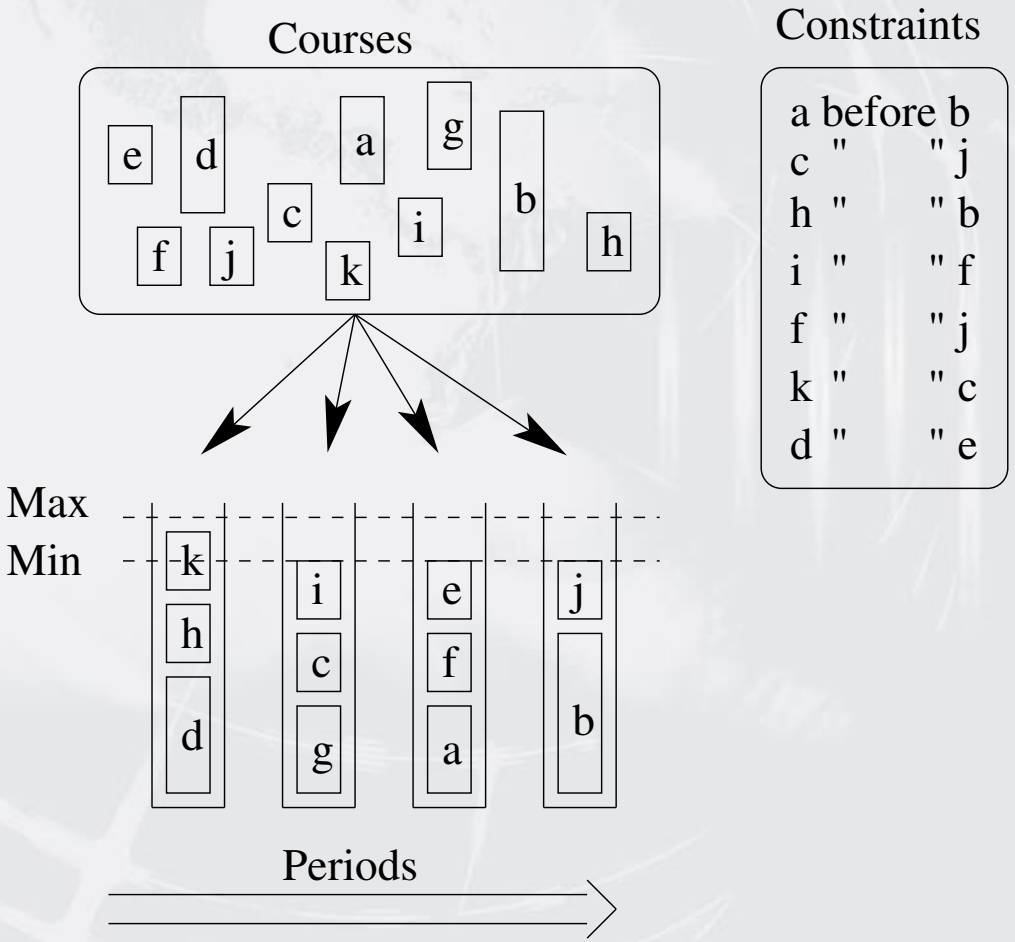


Terminates with a fixed point : maximum number of iteration

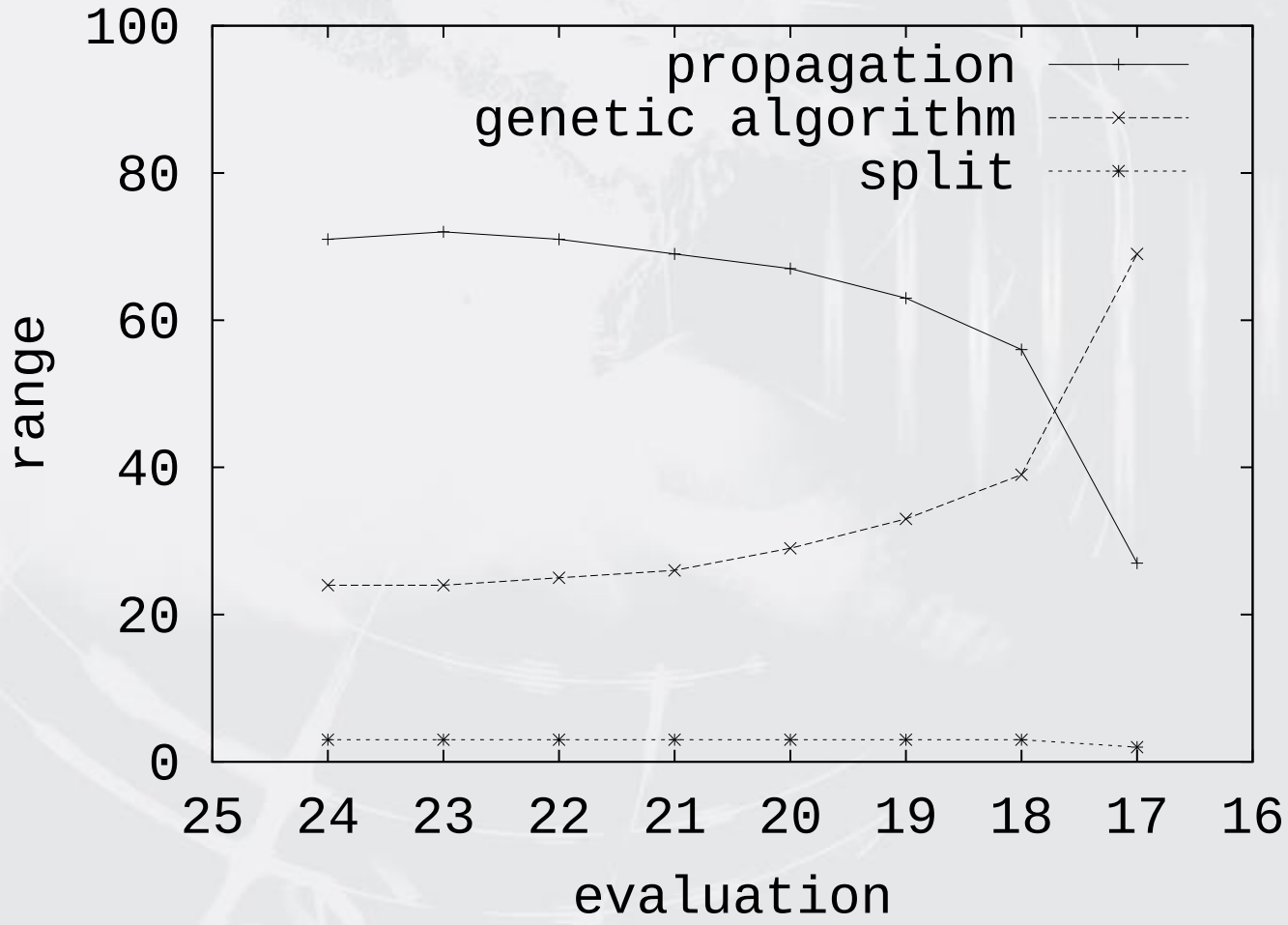
Integration of generations for GA into the CSP

- A generation :
  - Depends on a CSP
  - Corresponds to a GA state
- A structure contains :
  - A set of domains
  - A set of constraints
  - A (list of) population for GA.

CP + AG : Optimisation for balanced curriculum



BACP 8


100
80
60
40
20
0
range
propagation
genetic algorithm
split
25 24 23 22 21 20 19 18 17 16
evaluation

Conclusion

- A generic model for hybridizing complete (CP) and incomplete (GA) methods
- Implementation of modules working on the same structure
- Complementarity of methods
- Design of strategies