Autonomous Agents and Multiagent Systems

PyDCOP

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PyDCOP

Python-based

One of the packages for solving DCOPs (a Java-based alternative is for example FRODO)

Agents can be run on the same computer (the simple setting we will see) or distributed on several computers

Features

PyDCOP

https://pydcop.readthedocs.io/en/latest/index.html#
https://github.com/Orange-OpenSource/pyDcop

1. Installation
   Follow procedure at:
   https://pydcop.readthedocs.io/en/latest/installation.html
   (better in a Python virtual environment, as suggested)
2. Definition of problems
   yaml format
3. Solution of problems
   Implementation of DCOP algorithms: DPOP, Max-Sum DSA, MGM, …
4. Measurement of performance
   Metrics provided by the framework: time, number and size of messages, …

Problems in yaml

Textual representation

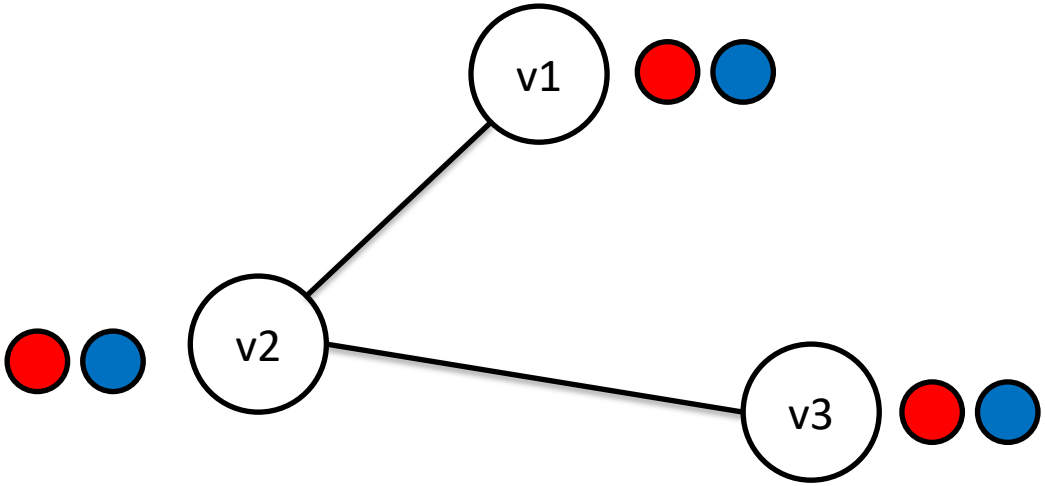
Both extensional and intentional representations of constraints

Extensional: explicitly list the combinations of values for constraints and their associated values

Intentional: define constraint functions that implicitly assign values to combinations of values

Constraints can be defined over a single variable

Example: Problem formalization in yaml



v1	v2	cost
R	R	10
R	B	0
B	R	0
B	B	10

v2	v3	cost
R	R	10
R	B	0
B	R	0
B	B	10

v1	cost
R	0
B	0.1

v2	cost
R	0.1
B	0

v3	cost
R	0.1
B	0

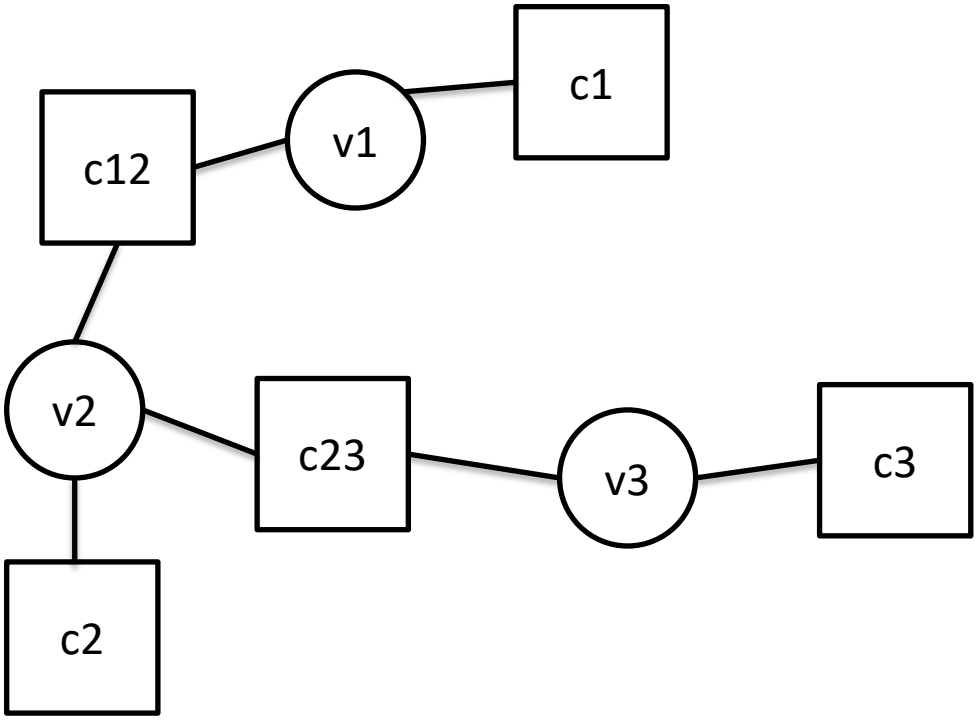
Example: Solving with PyDCOP

DPOP

Max-Sum (factor graph)

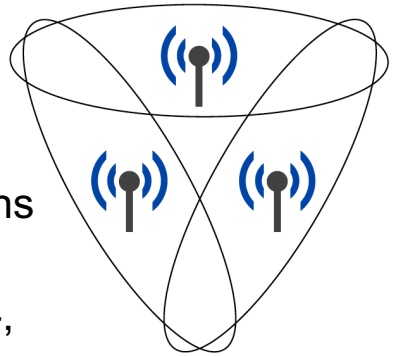
DSA (timeout)

MGM (timeout)



Homework

Consider the following setting:



- The image (from https://doi.org/10.1609/aimag.v33i3.2429) shows three access points with their corresponding coverage regions
- Each access point needs to select a channel to broadcast
- To avoid interference, no two access points with overlapping regions can select the same channel
- The first access point can choose between three channels {a, b, c}, the second access point can choose between two channels {a, b}, and the third access point can choose between two channels {b, c}
- The first access point prefers channel a over channel b over channel c, the second and third access points have no preferences over their options

  Formulate a DCOP representing the problem: define agents and variables, domains, and constraints (do not forget to include preferences of the agents in the constraints)

  Represent the DCOP in yaml and solve it with all the algorithms you know in PyDCOP