Optimization of production planning with resources allocation

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Objectives

Compare Constraint Programming and Mixed Integer Programming approaches on a problem of optimization of production planning with resources allocation.

Problem Description

Village n°1 is a company employing persons with handicap. They are looking to automate the creation of their industrial activities planning. The planification consists of:

- Assigning workers to demands for one or more periods of time
- Assigning resources to these demands like machines, production zones, etc.

People with handicap have special needs, they need to be assigned to work compatible with them. This master thesis will consist of developing two approaches to solve this problem. These techniques are Constraint Programming and Mixed Integer Programming.

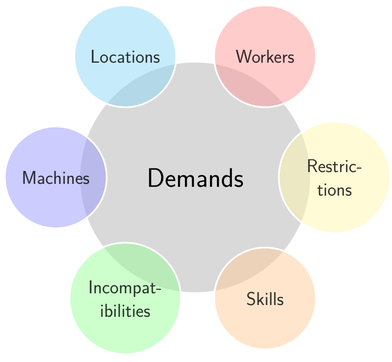
Problem Formalization

A demand has special needs:

- Set of workers with special skills and restrictions
- Locations to work at
- Machines to work with

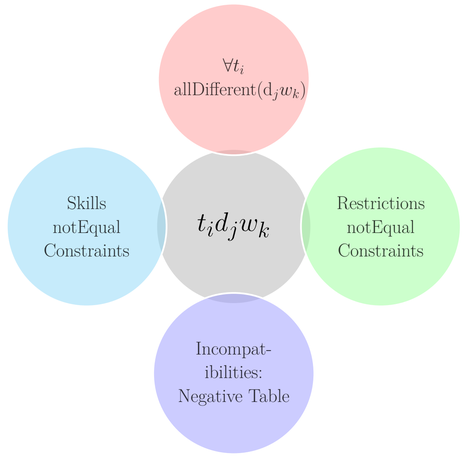
Some constraints:

- Workers, location, machines cannot be used at the same time
- Some workers cannot work together or with clients
- Workers and demands have availability periods



Draft of CP Model

- $t_i d_j w_k \in W$: Worker k ($\in N_{d_j}$) for demand j at time i
- N_{d_j}: required number of workers for demand d_j



Draft of MIP model

- Use boolean variables to know if a worker will work at a particular time with a particular client
- $w_i t_j d_k \in \{0, 1\}$: Is worker i working at time j for demand k
- $\forall_{i,j} \Sigma_k \, w_i t_j d_k \leq 1$: A worker can only work at one demand for a given time
- $\forall_{j,k} \Sigma_i \, w_i t_j d_k = N_{d_k}$: The number of required workers (N_{d_k}) for a demand need to be satisfied.

Tools

The following tools will be used to complete the thesis:

- OscaR [1] for Constraint Programming

OSCAR
OPERATIONAL RESEARCH IN SCALA

- Gurobi Optimizer [2] for Mixed Integer Programming

GUROBI
OPTIMIZATION

Supervisors

- Pierre Schaus
- Charles Thomas

References

[1] OscaR Team.
OscaR: Scala in OR, 2012.
Available from
https://bitbucket.org/oscarlib/oscar.

[2] LLC Gurobi Optimization.
Gurobi optimizer reference manual, 2018.