

Introduction and Motivation

Helmut Simonis

Constraint Based Production Scheduling

Licence



This work is licensed under the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License. To view a copy of this license, visit <https://creativecommons.org/licenses/by-nc-sa/4.0/>.

This license requires that reusers give credit to the creator. It allows reusers to distribute, remix, adapt, and build upon the material in any medium or format, for noncommercial purposes only. If others modify or adapt the material, they must license the modified material under identical terms.



Acknowledgments



This publication was developed as part of the ENTIRE EDIH project, which received funding from Enterprise Ireland and the European Commission.

Part of this work is based on research conducted with the financial support of Science Foundation Ireland under Grant number 12/RC/2289-P2 at Insight the SFI Research Centre for Data Analytics at UCC, which is co-funded under the European Regional Development Fund.

Key Points



- AI is more than LLM
- Stochastic vs. deductive AI methods
- Constraint Based Scheduling and its alternatives
- Key advantages
 - Compositional
 - Reusable
 - Explainable
- Course structure

Outline



Artificial Intelligence

Scheduling

Course Structure

Outline



Artificial Intelligence

Scheduling

Constraint-Based Scheduling

Other Solution Approaches

Course Structure

Constraint Programming - in a nutshell



- Declarative description of problems with
 - *Variables* which range over (finite) sets of values
 - *Constraints* over subsets of variables which restrict possible value combinations
 - A *solution* is a value assignment which satisfies all constraints
- Constraint propagation/reasoning
 - Removing inconsistent values for variables
 - Detect failure if constraint can not be satisfied
 - Interaction of constraints via shared variables
 - Incomplete
- Search
 - User controlled assignment of values to variables
 - Each step triggers constraint propagation
- Different domains require/allow different methods

Constraint Programming is Different



- Declarative Programming
 - Concentrate on what you want
 - Not how to get there
 - Program \neq Algorithm
 - Program = Model
- Applied to Combinatorial Problems
 - No complete polynomial algorithms known (exist?)
 - CP less ad-hoc than heuristics
 - Models can evolve

A Subtractive Process



"Oh, bosh, as Mr. Ruskin says. Sculpture, per se, is the simplest thing in the world. All you have to do is to take a big chunk of marble and a hammer and chisel, make up your mind what you are about to create and chip off all the marble you don't want." -Paris Gaulois.

Source: <https://quoteinvestigator.com/2014/06/22/chip-away/>

Other Technologies



- Heuristics
- Integer Programming
- Local search
- Deep neural networks

Outline



Artificial Intelligence

Scheduling

Course Structure

What is not covered?

A Short History

How does it all work?



-

Summary



- Why use Constraint Based Scheduling?
- Compared to other AI methods
- Compared to other solution approaches