

Introduction and Motivation

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Constraint Based Production Scheduling



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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

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 != 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/>

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Other Technologies



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

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How does it all work?



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Summary



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

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