



Enterprise
Ireland



Funded by the
European Union
NextGenerationEU

EDIH | European
Digital Innovation
Hubs Network



Constraint-Based Scheduling

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.

Part of this work is based on research conducted within the ASSISTANT European project, under the framework program Horizon 2020, ICT-38-2020, Artificial intelligence for manufacturing, grant agreement number 101000165.

Key Points



- Two Day Course
- In Person at UCC
- Based on Insight Research
- Using Open-Source Scheduling Tool
- Practical Use-case Studies

The Lecturer



- Mathematics @ TH Darmstadt
- 1986-1990 ECRC GmbH, Munich
- 1990-2000, Technical Director, Cosytec SA, Orsay
- 2000-2005, Imperial College London, Parc Technologies Ltd
- 2013-2014, President, Association for Constraint Programming
- Best Application Paper Awards, CP 2009, CP 2013
- Program Chair, CP 2020, CPAIOR 2014
- Distinguished Service Award, ACP



Top-Level Course Structure



- Background/Motivation
- Scheduling Concepts
- Machine Constraints
- Costs and Objectives
- Advanced Concepts
- Case Studies
- Literature Review

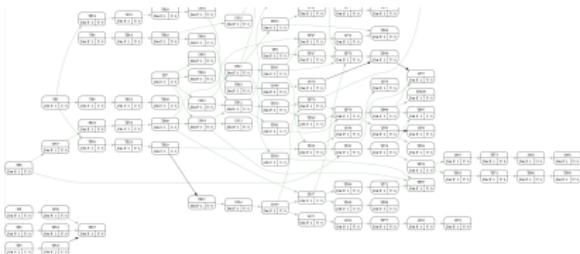


Examples from our scheduling tool

Scheduling Concepts



- Jobs, Tasks and Resources
- Orders, Products, Processes
- Temporal Relations
- Alternative Processes
- Bill of Material
- Problem Classification
- Key Visualisation Concepts



Example of complex temporal relations

Method: Constraint Programming



- Declarative modelling framework
- Combination of powerful solution methods
- Explainable results
- Good solutions found rapidly
- Recognised as preferred tool for solving scheduling problems

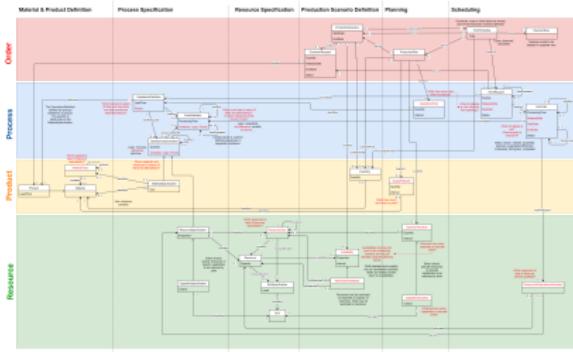


From: David Poole, Alan Mackworth. Artificial Intelligence,
Cambridge University Press, 3rd Edition, 2023

Case Studies



- Production Planning
 - Using Scheduling as a module
- Oven Scheduling
 - Unconventional resource constraints
- Blades and Vanes Production Planning
 - Multi-year scheduling for capacity planning



Generic domain model for expressing scheduling problems