Justification of research and implementation  
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## A close-up of a piece of paper Description automatically generatedMathematical Model

A close-up of a piece of paper

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## Research Approach

• Literature

• R. Rardin (2014), Optimization in Operations Research, Pearson New International Edition

• E.H.L. Aarts and J.K. Lenstra (Editors) (2003), Local Search in Combinatorial Optimization, Princeton University Press

• Use of other external sources

• ChatGPT-4o was used as help by implementing the solution method in Python

• Brainstorming on schedule data-structures

• Obtaining Python code snippets for improving search heuristics

Discrete constructive heuristic

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Description automatically generatedPython implementation

We began testing our code with 3 machines and 3 orders to keep it simple and added complexity along the way

* Orders, set of all orders O = {1, 2, 3}
* Machines, set of all machines M = {1, 2, 3}
* Functions defined:
  + Painttime(area, machine, machines): returns the time for machine M to paint an area
  + Switchtime(prevcolor, currentcolor): returns the time for any machine M to switch colors from prevcolor to currentcolor
  + Schedule\_orders(orders, machines): returns a schedule for all orders O on machines M
  + Calculate\_penalty(): returns the sum of the penaltys for all orders O on schedules S

## Organisation of the code

There is one file containing the simplified version of the problem

## Tests and Experiments

* Started with simplified version with only one machine and no deadlines/penaltys
* Started with ChatGPT Snippet for scheduling orders
  + Double-checked implementation of switchtime: **NOK**
    - Didn’t use the right syntax for variable types
  + Double-checked implementation of painttime: N**OK**
    - Didn’t use the right syntax for variable types
* Implemented function to calculate the penaltys of all orders
* Added 7 orders to test function calculate\_penalty()