Aalto-yliopisto
Perustieteiden
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Extending the decision programming framework with continuous decisions

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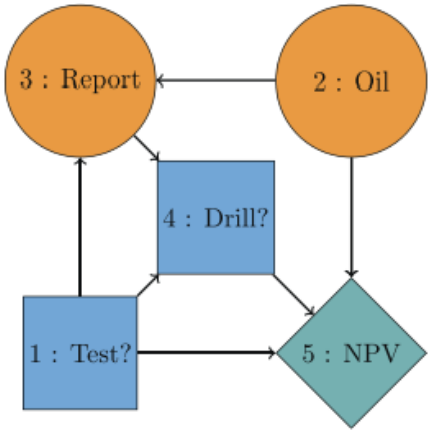
Background

- Influence diagrams are acyclic directed graphs with nodes of types: chance (circles), decision (squares) and value (diamonds)
  - Can be used to model decision problems
- Decision Programming framework can be used to turn decision problems modelled with influence diagrams into MILP problems
- The framework is applicable for problems with discrete set of states



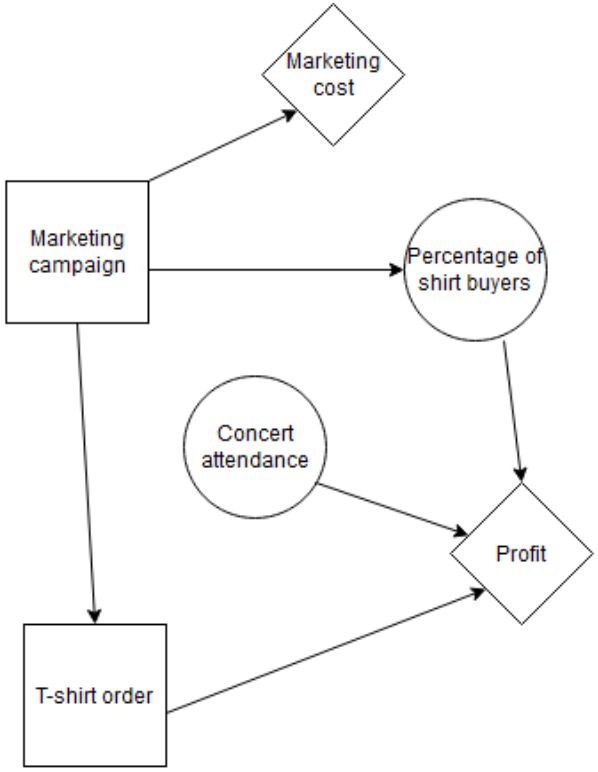
Salo, A., Andelmin, J., Oliveira, F. 2021. Decision programming for mixed-integer multi-stage optimization under uncertainty. European Journal of Operational Research 299 (2022), pp. 550-565.

Background

- Newsvendor problems
  - Unknown demand of goods
  - Goods can be purchased from a supplier at a fixed cost
  - Aim is to maximize the expected profit
- Newsvendor problems can be modelled with influence diagrams
- Often the order from supplier is continuous decision rather than discrete

T-shirt sales problem

- T-shirts sold in front of a concert venue
- Concert attendance and percentage of attendance who will buy the shirt are unknown
- T-shirt order size is a continuous decision
- A decision (yes/no) for arranging a marketing campaign
  - Increases the popularity of t-shirts among the attendees



Objective and limitations

- The objective is to extend the decision programming framework with a continuous decision
- Solve optimal t-shirt order size in T-shirt sales problem using the extended framework
- Compare the solutions between continuous and discrete version of the problem
- This is a very small example
  - Does not give insight on the computational performance of the proposed extensions

Literature

- Salo, A., Andelmin, J., Oliveira, F. 2021. Decision programming for mixed-integer multi-stage optimization under uncertainty. European Journal of Operational Research 299 (2022), pp. 550-565.
- Clemen, R. T., Reilly, T. 2013. Making Hard Decisions with DecisionTools. Cengage Learning.

Methods

- The problem is modelled using Julia package DecisionProgramming.jl with continuous decision variables added on top of the framework
- The model is solved with Gurobi

Schedule

- Studying Julia package and developing the model 6-7/2023
- Topic presentation 20.7.2023
- Writing the thesis 7-8/2023
- Result presentation 9/2023