

Initial models for optimisation

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Initial model for installation

$$\text{maximize } \sum_{p \in P} [DIS^p(A_p \cdot v_p - \sum_{r \in R} N_{rp} \cdot C_{rp})] \quad (1)$$

subject to:

$$s_i = \max_{j \in IP_i}(f_j) \quad \forall i \in I \quad (2)$$

$$d_i = \sum_{t=s_i}^{f_i} \omega_{it} \quad \forall i \in I \quad (3)$$

$$N_{rp} \geq \sum_{i|s_i \leq t \leq f_i} \rho_{ir} \quad \forall r \in R \quad \forall p \in P \quad t \in T_p \quad (4)$$

$$A_p = \sum_{f_i \leq \tau_p} 1 \quad \forall p \in P \quad \forall i \in F \quad (5)$$

Notation overview

Sets:

- P : All time periods (large scale)
- T_p : All time intervals (small scale) in period p
- R : All resources
- I : All tasks
- $F \subset I$: All final tasks that complete a turbine
- IP_i : All prerequisite tasks of task i

Decision variables:

- A_p : Number of active turbines after period p
- N_{rp} : Number of resources r used in period p
- s_i : Starting time of task i
- f_i : Finishing time of task i

Parameters:

- DIS : The discount factor per period
- v_p : The value of energy a single turbine produces in period p
- C_{rp} : The cost of chartering resource r in period p
- d_i : The duration of task i
- ω_{it} : Binary parameter representing weather, 1 if task i can be completed at time t , 0 otherwise
- ρ_{ir} : The amount of resource r used by task i
- τ_p : The final time interval (from T) in period p

Initial model for maintenance

$$\text{maximize } \sum_{p \in P} [DIS^p(A_p \cdot v_p - \sum_{r \in R} N_{rp} \cdot C_{rp})] \quad (6)$$

subject to:

$$s_{ic} = \max(\gamma \cdot c, \max_{j \in IP_i}(f_{jc})) \quad \forall i \in I \quad \forall c \in C \quad (7)$$

$$d_{ic} = \sum_{t=s_{ic}}^{f_{ic}} \omega_{it} \quad \forall i \in I \quad \forall c \in C \quad (8)$$

$$N_{rp} \geq \sum_{i | s_{ic} \leq t \leq f_{ic}, \forall t \in T_p} \rho_{ir} \quad \forall r \in R \quad \forall p \in P \quad \forall c \in C \quad (9)$$

$$A_p = A_{p-1} \cdot \lambda + \text{number fully repaired} \quad \forall p \in P \quad \forall i \in F \quad (10)$$

Initial mixed model

Sets:

- P : All time periods (large scale)
- T_p : All time intervals (small scale) in period p
- C : All cycles
- R : All resources
- I : All tasks
- $F \subset I$: All final tasks that complete a turbine
- IP_i : All prerequisite tasks of task i

Decision variables:

- γ : The length of a cycle
- A_p : Number of active turbines after period p
- N_{rp} : Number of resources r used in period p
- s_{ic} : Starting time of task i in cycle c
- f_{ic} : Finishing time of task i in cycle c

Parameters:

- DIS : The discount factor per period
- v_p : The value of energy a single turbine produces in period p
- C_{rp} : The cost of chartering resource r in period p
- d_i : The duration of task i
- ω_{it} : Binary parameter representing weather, 1 if task i can be completed at time t , 0 otherwise
- ρ_{ir} : The amount of resource r used by task i
- τ_p : The final time interval (from T) in period p