MATH3202 Assignment 3
Section A - Boss Report

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Data

demandNormal$_t$	normal demand for day t
demandHigh$_t$	high demand for day t
batteryCapacity	80 MWh battery

Stages

Days in June, t

State

Electricity in battery, s_t
Remaining days of reducing chance, n
Demand status of previous day, $p \in \{0, 1\}$, where 0 is the normal and 1 is high demand

Actions

Order, a_t

Transformation Function

Cost function:

$$f(x) = \begin{cases} 0, & \text{if } x = 0 \\ 300 + 80x^{0.9}, & \text{if } x > 0 \end{cases}$$

Chance of high demand function:

$$R(k, p) = \begin{cases} 0.1, & \text{if the chance is reduced } k = 1 \\ 0.2, & \text{if the previous day is normal } k = 0, p = 0 \\ 0.5, & \text{if the previous day is high } k = 0, p = 1 \end{cases}$$

Value Function

$V_t(s_t, n, p)$ is the minimum cost of satisfying daily electricity demands (MWh) for June.

Stopping condition: $V_{31}(s_{31}) = 0$

$$V_t(s_t) = \min_{a_t} \left\{ \begin{array}{l} (1 - R(k,p)) \times (f(a_t) + V_{t+1}(s_t + a_t - \text{demandNormal}_t, n - \min(n,k), 0)) \\ + R(k,p) \times (f(a_t) + V_{t+1}(s_t + a_t - \text{demandHigh}_t, n - \min(n,k), 1) \end{array} \right\}$$

We want $V_1(0, 5, 0)$.

Constraints

$$0 \leq a_t \leq \text{batteryCapacity} + \text{demandHigh}_t$$

$$0 \leq s_t + a_t - \text{demandHigh}_t \leq \text{batteryCapacity}$$

$$s_t \leq \text{batteryCapacity}$$

$$n - k \geq 0$$