Why

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Definition

Let $\mathcal{P} = ((\mathcal{A}^i)_{i=1}^n, (\mathcal{O}^i)_{i=1}^n, \preceq)$ be an n-stage decision problem with constant actions sets $\mathcal{A}_h^t = U_t$ for each history $h \in H^{t-1}$. In other words, the actions available at stage t do not depend on the history, only on the stage t.

A *state representation* for $\mathcal{P}$ is tuple

$$(\{\mathcal{X}_t\}_{t=1}^{n+1}, \{f_t : \mathcal{X}_t \times \mathcal{U}_t \to \mathcal{X}_{t+1}\}_{t=1}^n)$$

satisfying $x_{t+1} = f_t(u_t, x_t)$ for all $x_t \in \mathcal{X}_t$, $x_{t+1} \in \mathcal{X}_{t+1}$, $u_t \in \mathcal{U}_t$, $t = 1, \dots, n$.[2]

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[1]Future editions will include. Those editions may rename this sheet and also provide examples.

[2]Future editions will continue this development, and add the other necessary conditions on state representations. To say more here is involved, and this sheet will likely me reworked to use the genetic method via applications in celestial mechanics.

State Representations

Sequential Decisions

Sequences

Lists　　Decisions

Direct Products　　Set Numbers

Finite Sets

Equivalent Sets　　Orders

Family Unions and Intersections　　Function Inverses　　Natural Order

Families　　Function Composites　　Function Images

Equivalence Relations　　Functions

Relations　　Peano Axioms

Natural Induction

Uncertain Outcomes　　Set Products

Generalized Set Dualities　　Set Powers　　Natural Numbers

Set Unions and Intersections　　Partitions　　Intersection of Empty Set　　Set Dualities　　Unordered Triples　　Successor Sets

Set Intersections　　Set Complements　　Pair Unions　　Ordered Pairs

Pair Intersections　　Set Unions　　Set Differences

Empty Set　　Unordered Pairs

Set Specification

Set Inclusion

Standardized Accounts

Accounts

Deductions

Quantified Statements

Logical Statements

Statements

Identities　　Sets

Names

Letters　　Objects