



## Why

1

## 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

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

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

---

<sup>1</sup>Future editions will include. Those editions may rename this sheet and also provide examples.

<sup>2</sup>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 be reworked to use the genetic method via applications in celestial mechanics.



