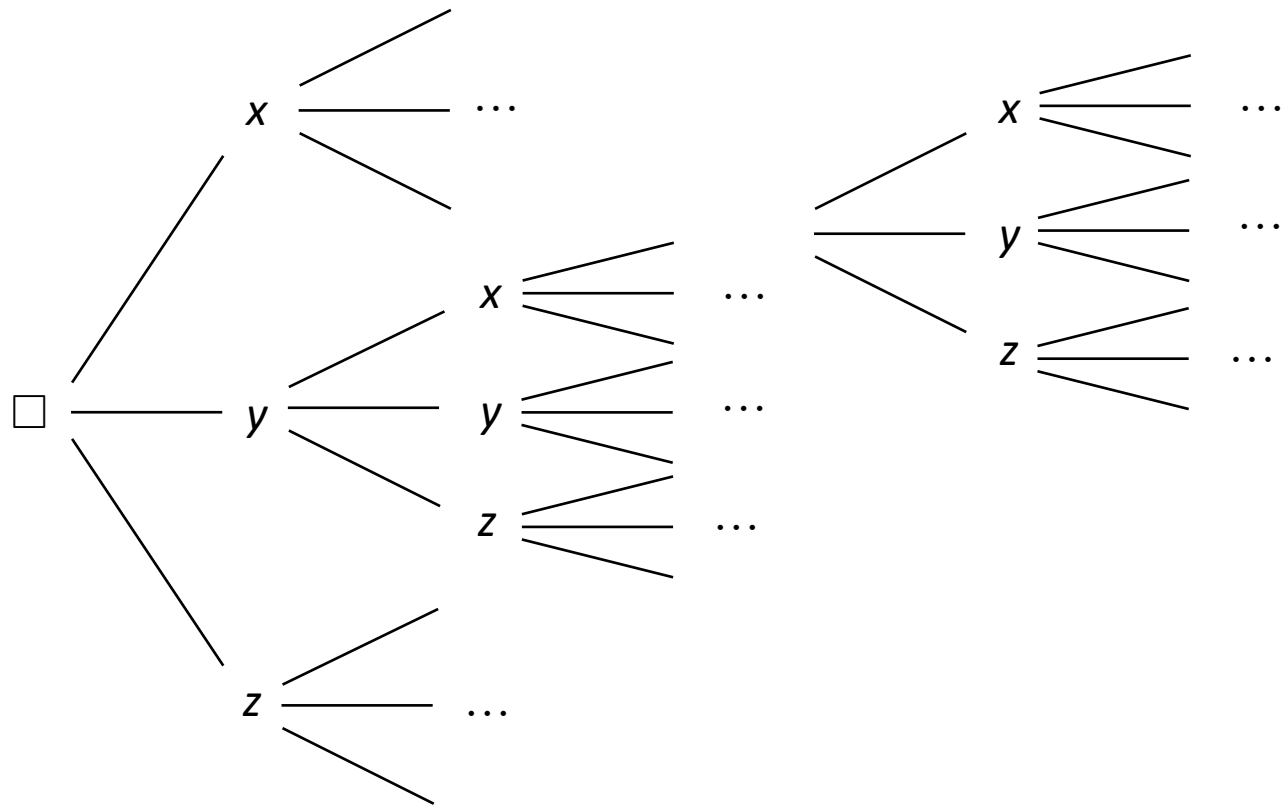
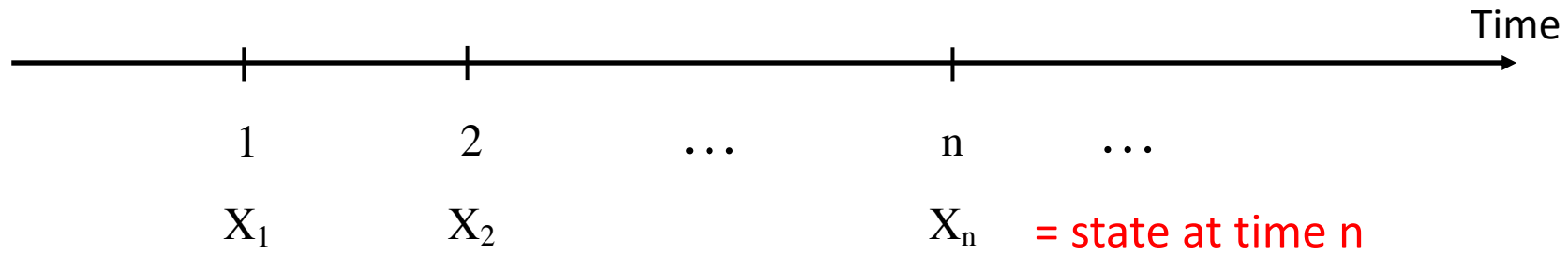
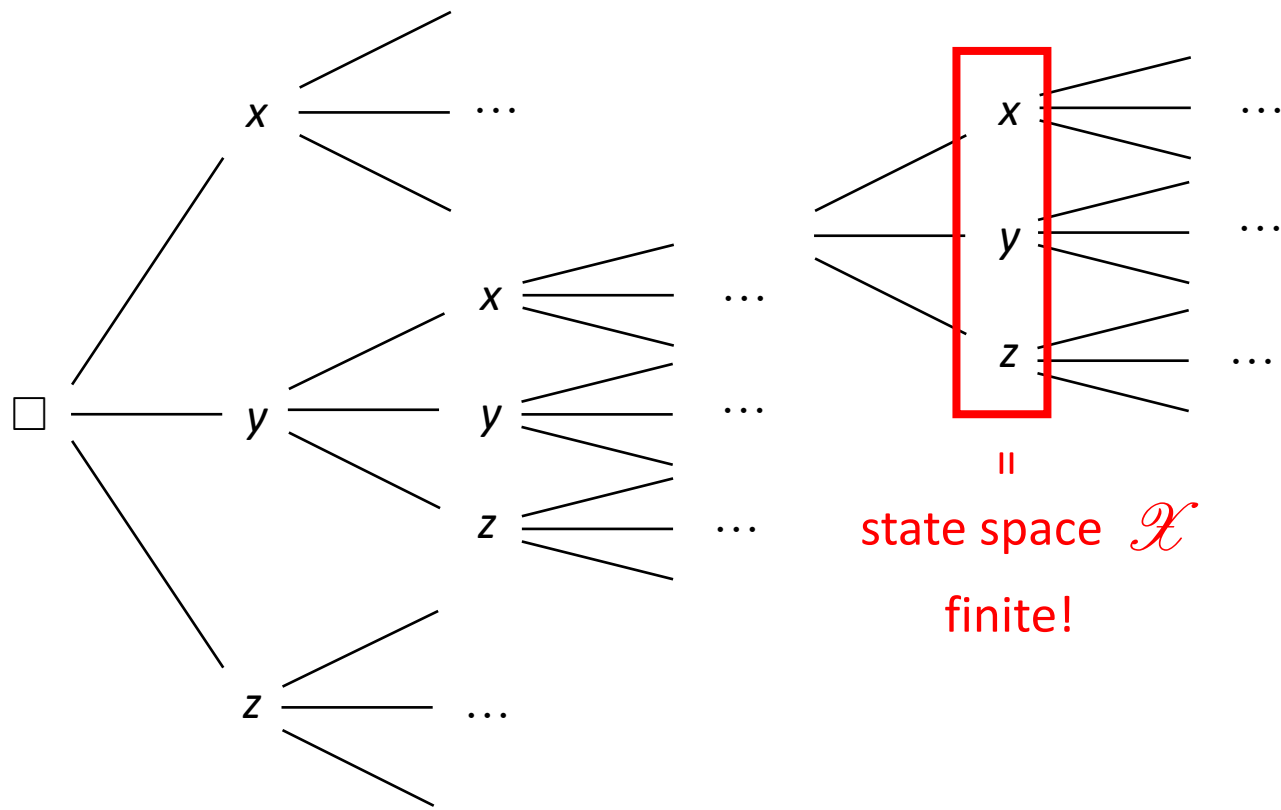
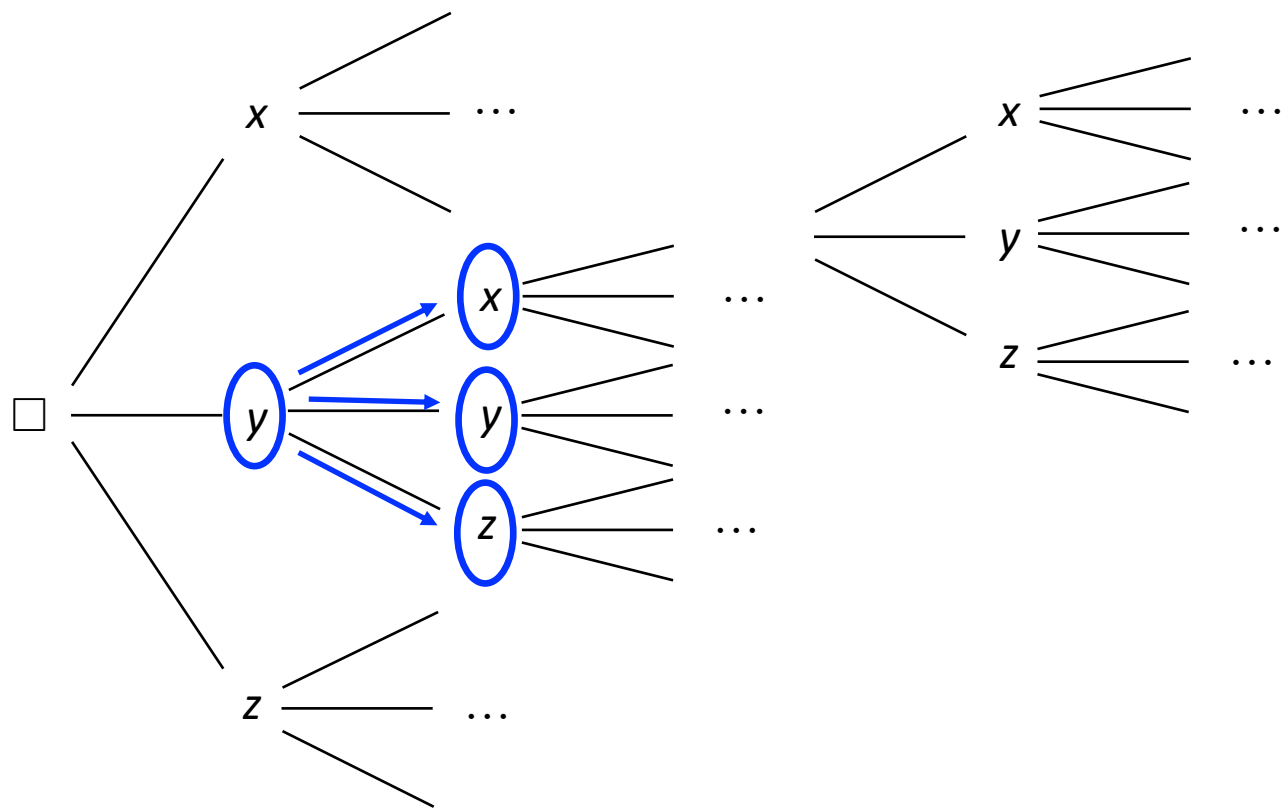


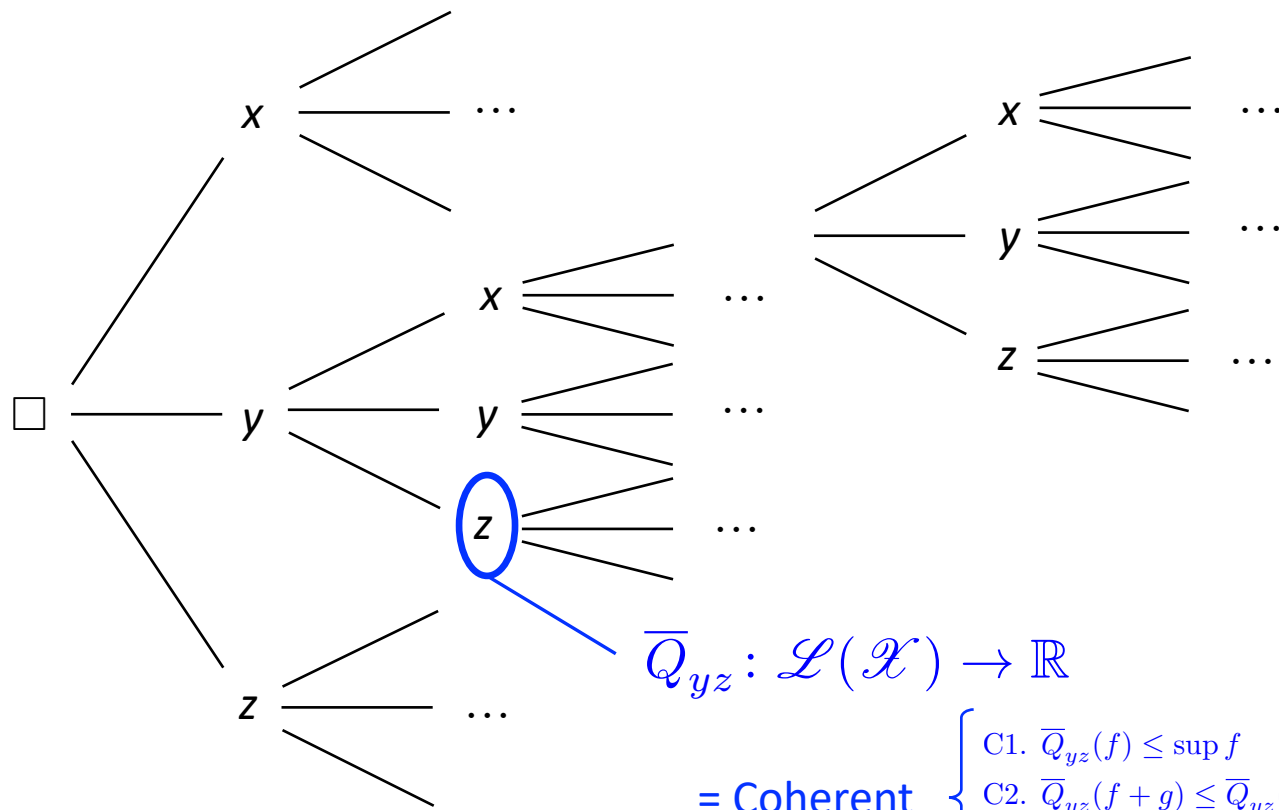
In Search of a Global Belief Model for Discrete-time Uncertain Models

Natan T'Joens, Jasper De Bock, Gert de Cooman



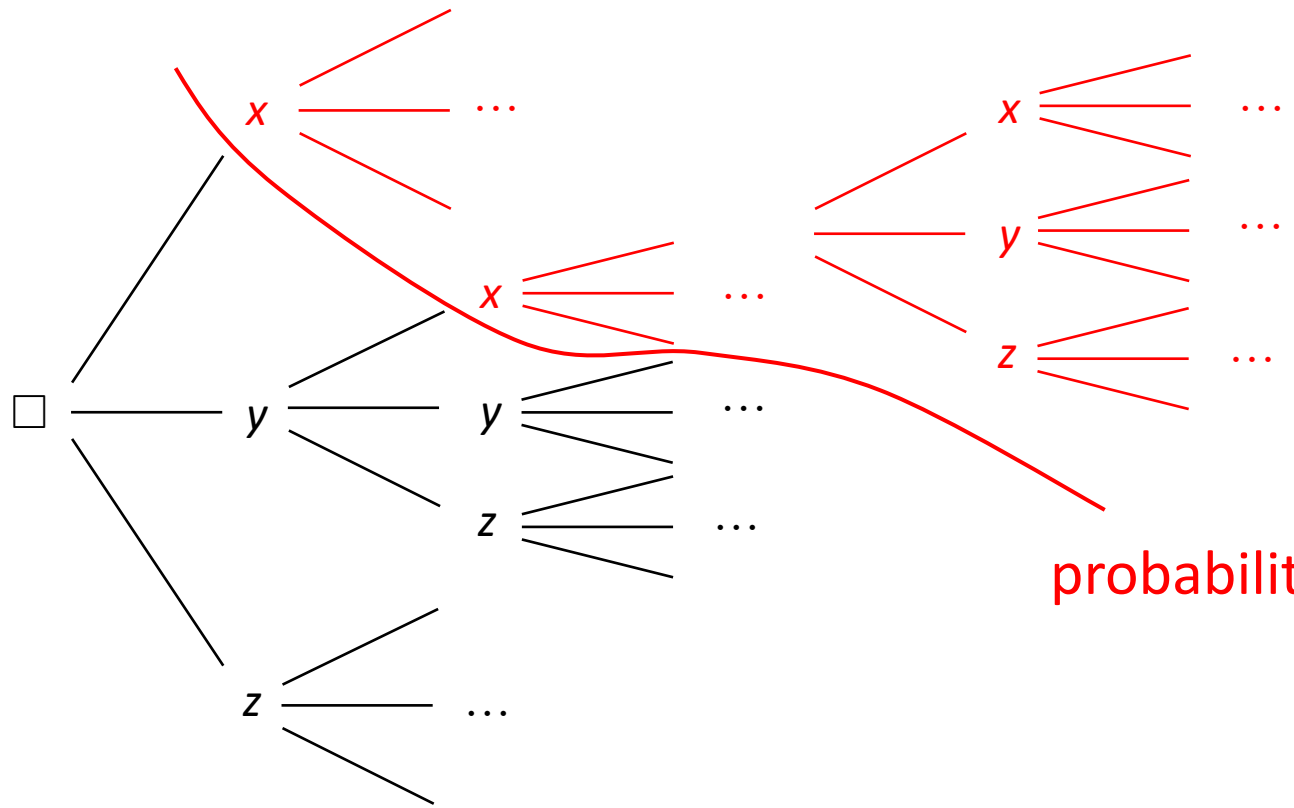
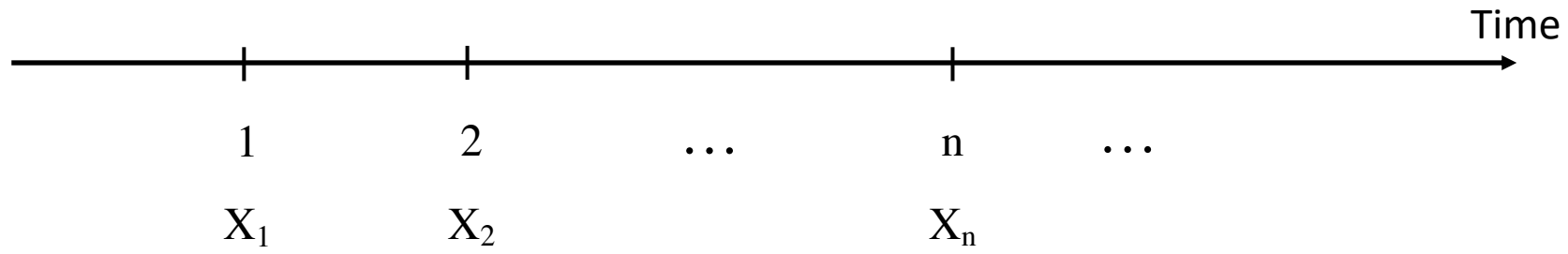




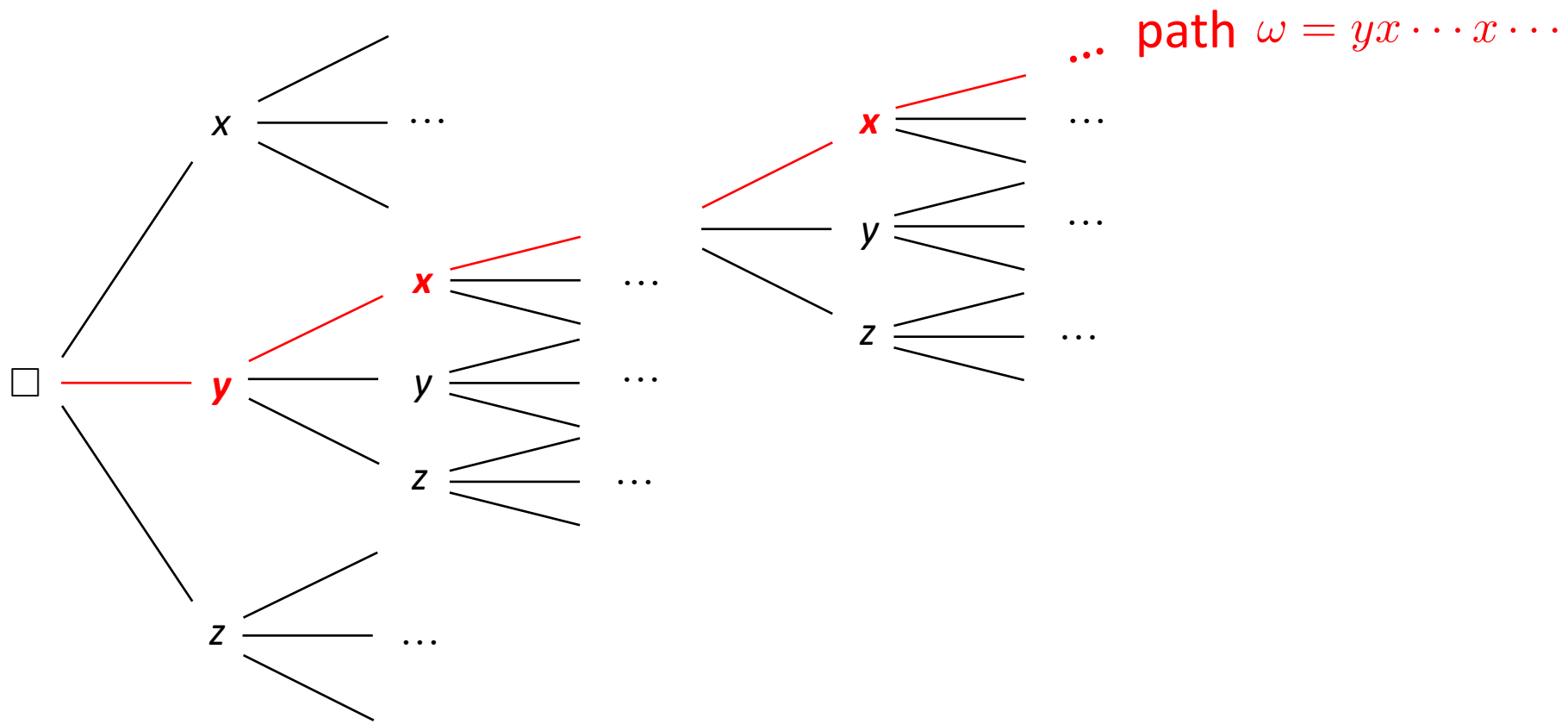
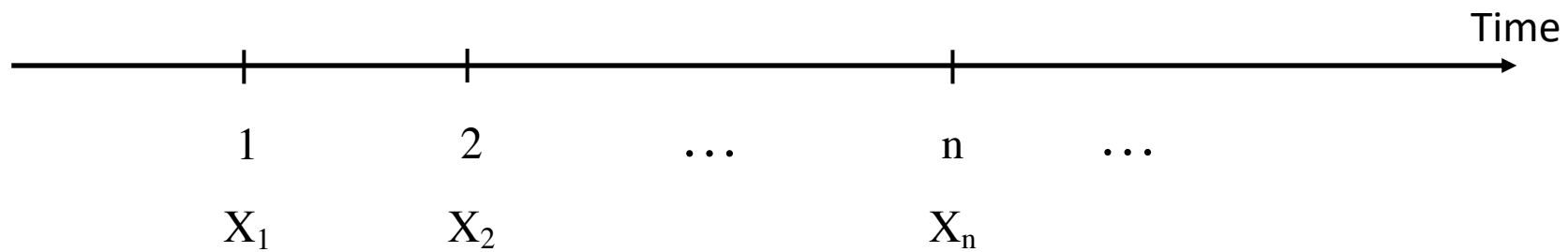


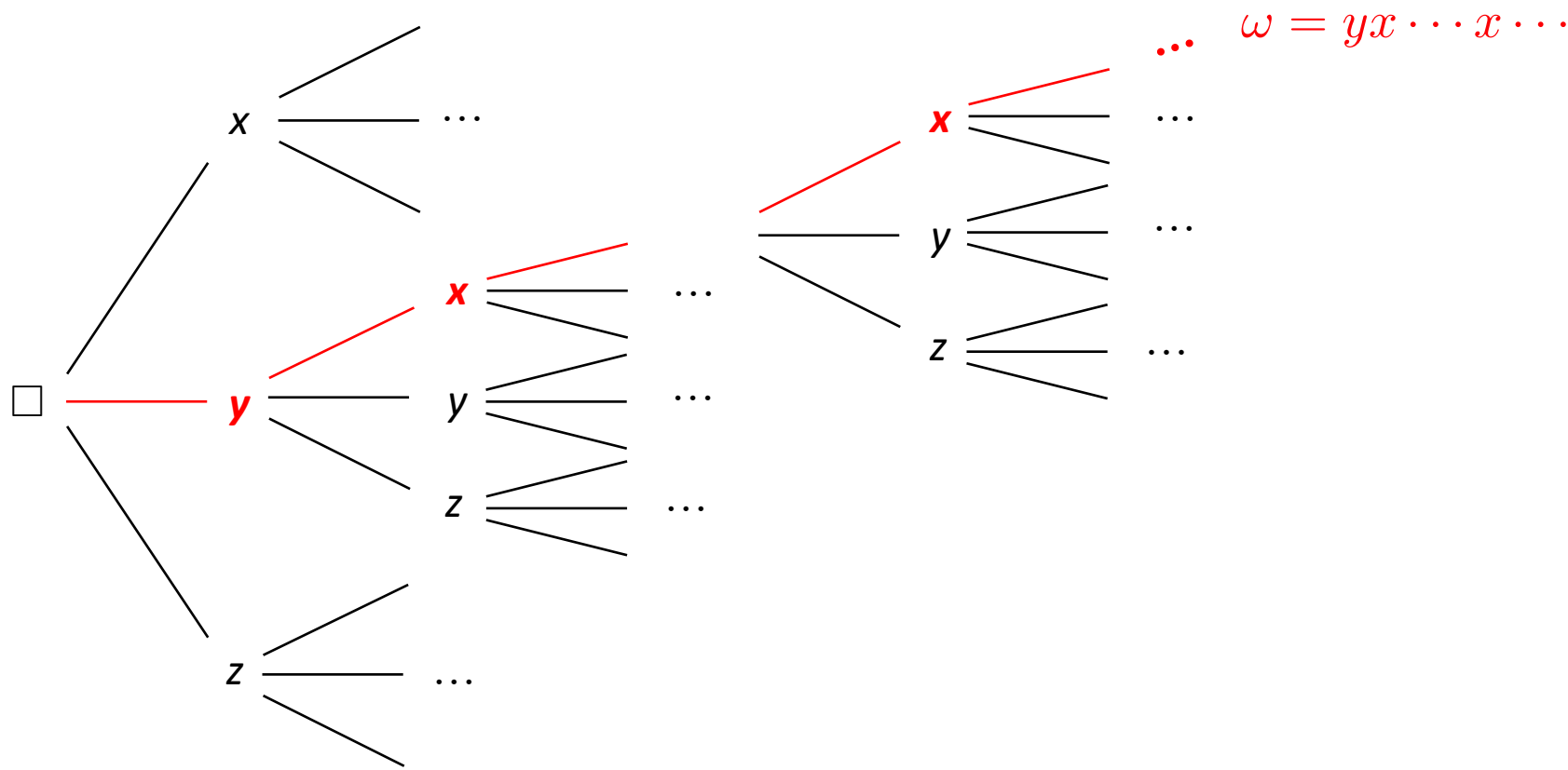
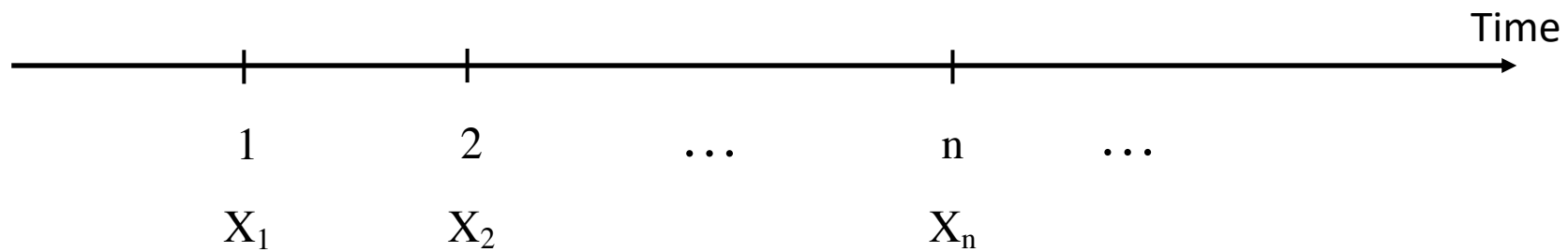
$\bar{Q}_{yz} : \mathcal{L}(\mathcal{X}) \rightarrow \mathbb{R}$

- = Coherent
- C1. $\bar{Q}_{yz}(f) \leq \sup f$
 - C2. $\bar{Q}_{yz}(f + g) \leq \bar{Q}_{yz}(f) + \bar{Q}_{yz}(g)$
 - C3. $\bar{Q}_{yz}(\lambda f) = \lambda \bar{Q}_{yz}(f)$



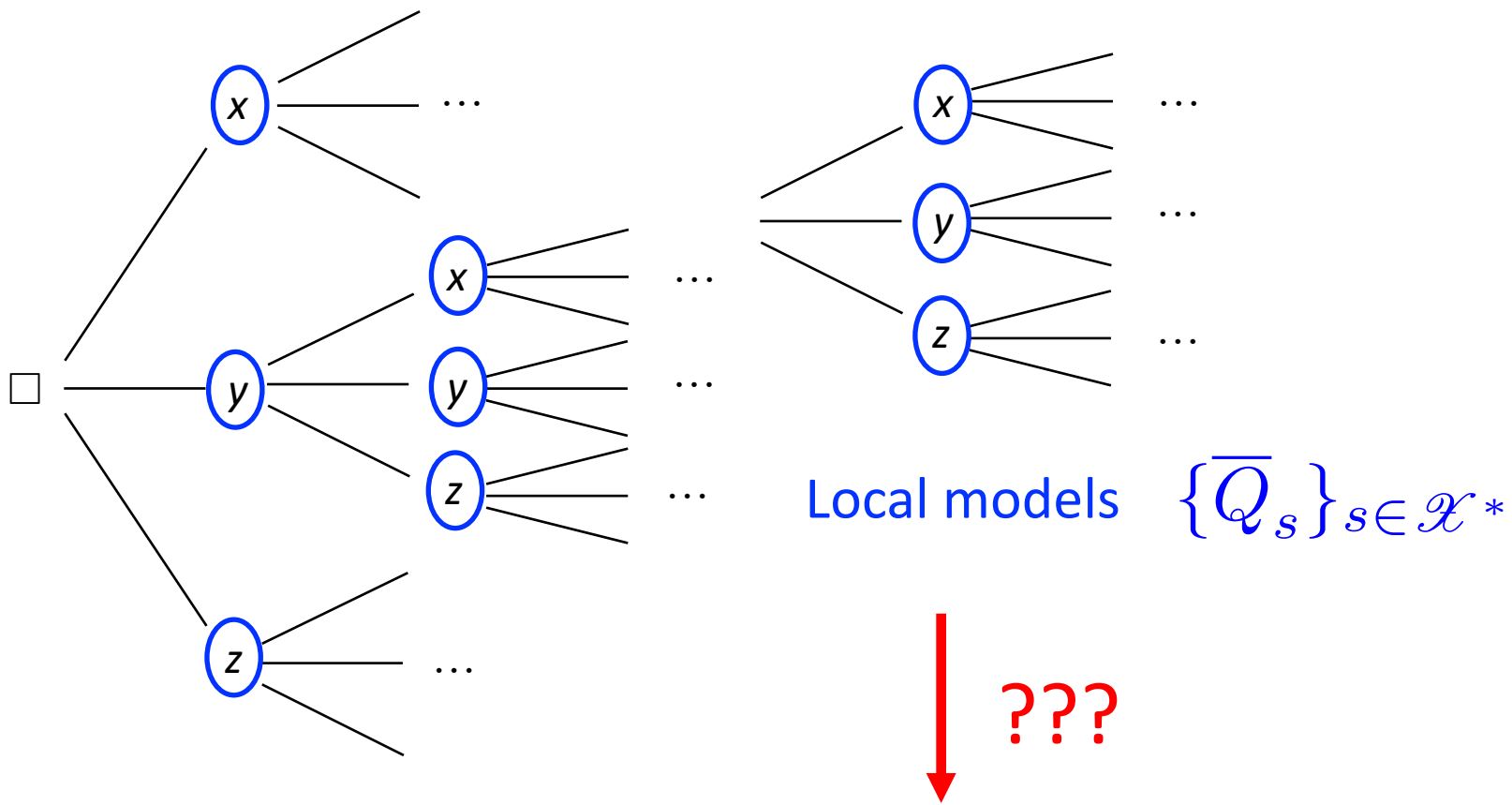
probability that the state will ever be x?





sample space

$$\Omega := \mathcal{X}^{\mathbb{N}}$$



global model \bar{E}

What properties should \overline{E} satisfy?

● P1. $\bar{\mathbb{E}}(f(X_{n+1})|x_{1:n}) = \bar{\mathbb{Q}}_{x_{1:n}}(f)$ [Compatibility.]

P2. $\bar{\mathbb{E}}(f|s) = \bar{\mathbb{E}}(f \mathbb{I}_s|s)$ [Conditioning.]

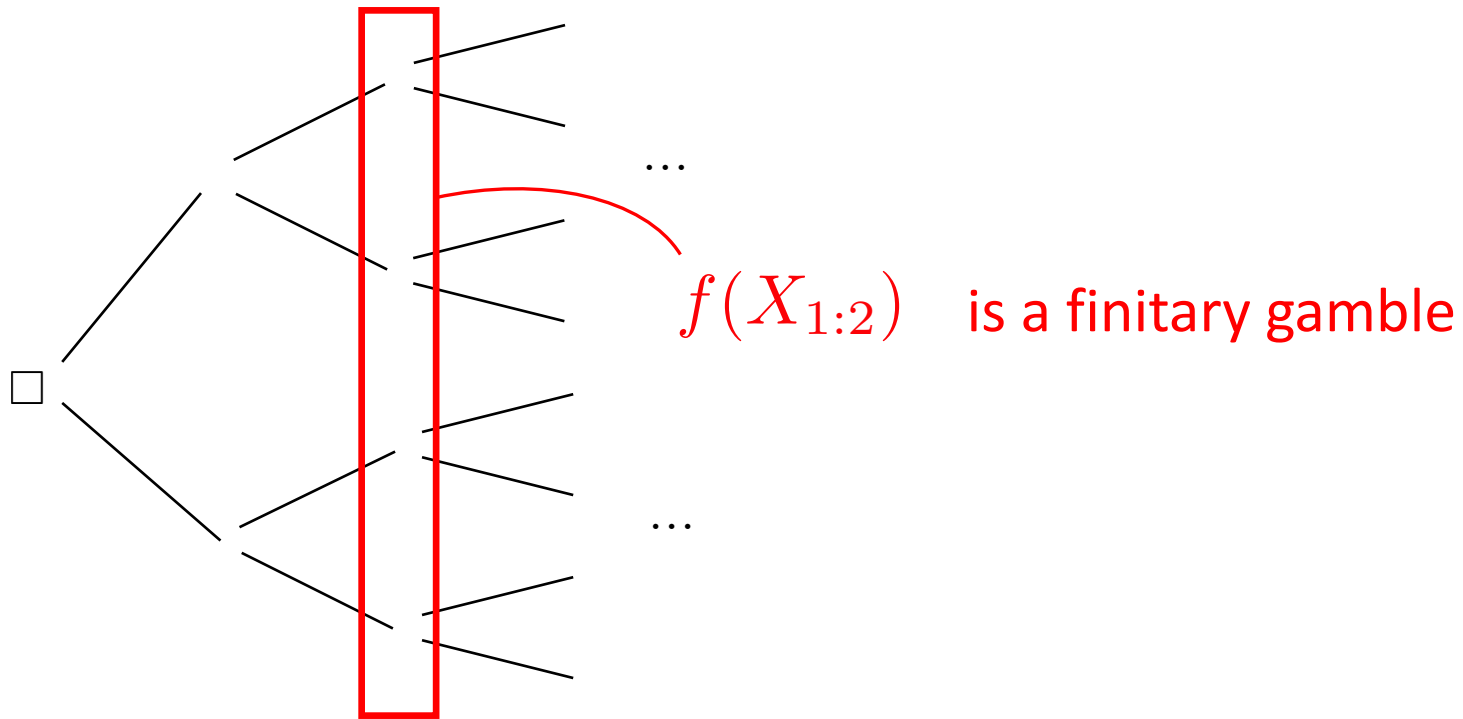
P3. $\bar{\mathbb{E}}(f|X_{1:k}) \leq \bar{\mathbb{E}}(\bar{\mathbb{E}}(f|X_{1:k+1})|X_{1:k})$ [Iterated Expectations.]

P4. $f \leq g \Rightarrow \bar{\mathbb{E}}(f|s) \leq \bar{\mathbb{E}}(g|s)$ [Monotonicity.]

P5. $\lim_{n \rightarrow +\infty} f_n = f \Rightarrow \limsup_{n \rightarrow +\infty} \bar{\mathbb{E}}(f_n|s) \geq \bar{\mathbb{E}}(f|s)$ [Continuity].

P5. For any sequence $\{f_n\}_{n \in \mathbb{N}_0}$ of **finitary gambles** that is uniformly bounded below and any $s \in \mathcal{X}^*$:

$$\bullet \lim_{n \rightarrow +\infty} f_n = f \Rightarrow \limsup_{n \rightarrow +\infty} \bar{E}(f_n | s) \geq \bar{E}(f | s).$$



● P1. $\bar{\mathbb{E}}(f(X_{n+1})|x_{1:n}) = \bar{\mathbb{Q}}_{x_{1:n}}(f)$ [Compatibility.]

P2. $\bar{\mathbb{E}}(f|s) = \bar{\mathbb{E}}(f \mathbb{I}_s|s)$ [Conditioning.]

P3. $\bar{\mathbb{E}}(f|X_{1:k}) \leq \bar{\mathbb{E}}(\bar{\mathbb{E}}(f|X_{1:k+1})|X_{1:k})$ [Iterated Expectations.]

P4. $f \leq g \Rightarrow \bar{\mathbb{E}}(f|s) \leq \bar{\mathbb{E}}(g|s)$ [Monotonicity.]

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Cool thing #1

P1-P5 is consistent + There is a unique largest model!



Cool thing #2

Coincides with a version of Shafer and Vovk's game-theoretic upper expectation!

strong properties + alternative definition



Interested? Come see
us at our poster!