

# II-Probabilities

## Gibbs Sampling

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## Sampling a distribution $\mathbb{P}$

Sampling is a random procedure to get index pairs

$j_0, \dots, j_{d-1} \in \times_{k \in [d]} [m_k]$  such that the probability of  $j_0, \dots, j_{d-1}$  is  $\mathbb{P}(j_0, \dots, j_{d-1})$ .

A naive approach would not succeed: Typically, the tensors  $\mathbb{P}$  is too large to be created.

## Approach

Use the representations like Markov Networks

$$\mathbb{P} = \mathcal{N}(\{T^e : e \in \mathcal{E}\}, \mathcal{V}, \emptyset)$$

to draw samples.

Draw State for atom  $k$  a state  $i_k$  from marginalized distribution

$$\mathbb{P}[\mathbf{X}_k] = \frac{\mathcal{C}(\{\mathbb{P}\}, \{\mathbf{X}_k\})}{\mathcal{C}(\{\mathbb{P}\}, \emptyset)}$$

Iterate over  $k \in [d]$  and draw  $i_k$  from

$$\mathbb{P}[\mathbf{X}_k | \{\mathbf{e}_{i_l} : l \neq k\}] = \frac{\mathcal{C}(\{\mathbb{P}\} \cup \{\mathbf{e}_{i_l} : l \neq k\}, \mathbf{X}_k)}{\mathcal{C}(\{\mathbb{P}\} \cup \{\mathbf{e}_{i_l} : l \neq k\}, \emptyset)}$$

## Intuition

While we initialize with an independent sample, the resampling iterations implement the dependencies of the variables with respect to each other.

# Implementation in tntreason : Subpackage algorithms

The subpackage algorithms implements algorithms such as Gibbs Sampling.

