(14)

BNs: Inference

* Inference

⇒ Calculating some useful quantity from a joint probability distribution.

* Variable Elimination

⇒ Idea: Interleave joining & marginalizing!.

(#) Factor Zoo

- Zoo 1
  - Joint distribution $P(X, Y)$
  - Selected Joint $P(x, Y)$
- Zoo 2
  - Single conditional $P(Y \mid x)$
  - Family of conditionals $P(Y \mid X)$
- Zoo 3
  - Specified family $P(y \mid X)$

★ General Variable Elimination

- Query $P(Q \mid E_1 = e_1, \cdots E_k = e_k)$
- Start with initial factors
  - ↳ Local CPTs (but instantiated by evidence)
- While there are still hidden variables
  - → Pick a hidden variable H
  - → Join all factors mentioning H
  - → Eliminate (sum out) H
- Join all remaining factors & normalize.

★ Polytrees

- A polytree is a directed graph with no undirected cycles.
- For poly-trees you can always find an ordering that is efficient.
- Cut-set Conditioning for bayes's net inference
  - → Choose set of variables such that if removed only a polytree remains.