On Intercausal Interactions in Probabilistic Relational Models

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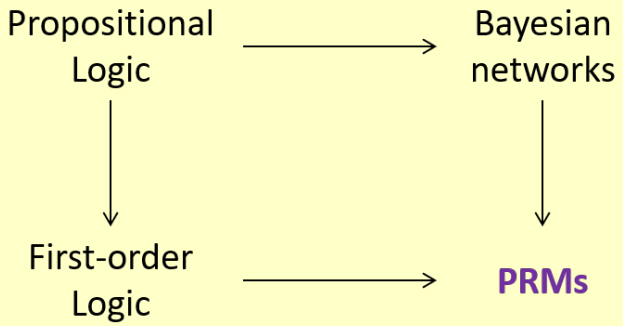
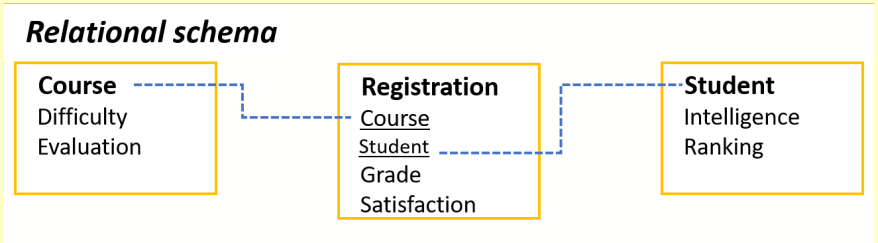
Probabilistic Relational Model (PRM)

- Extends Bayesian network to work with relational information



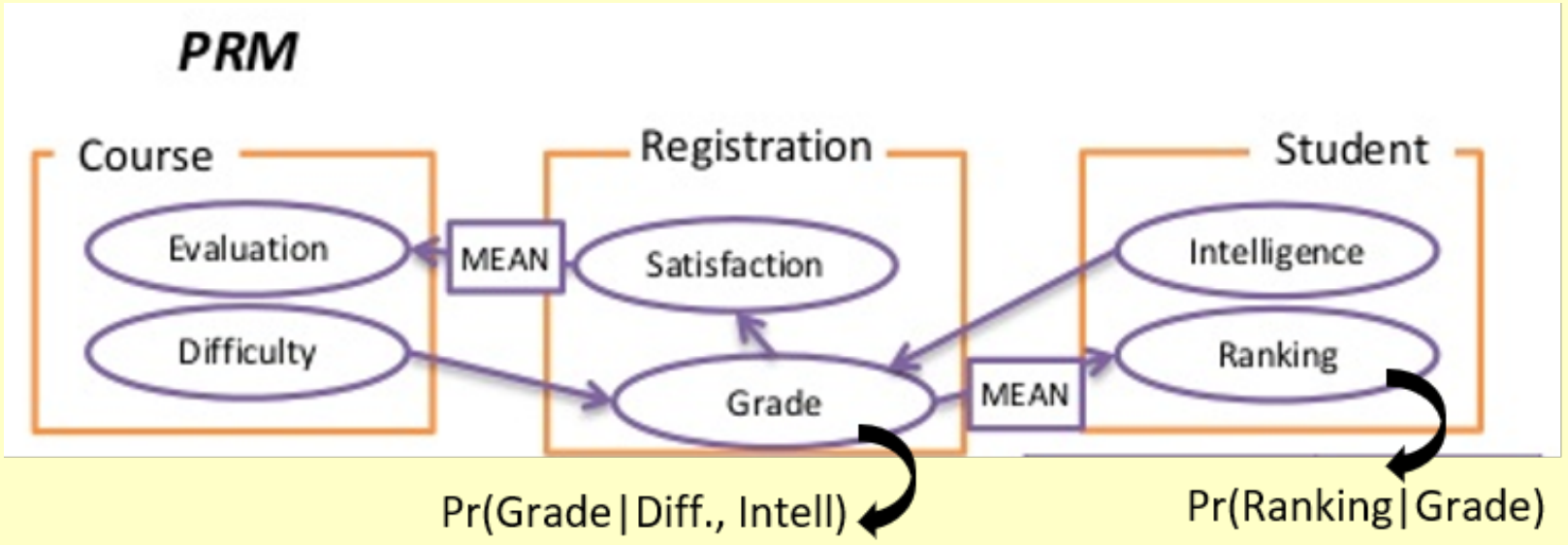
- Expresses a joint probability distribution over all possible instantiations of a relational schema



Example adapted from L. Getoor

Probabilistic Relational Model (PRM)

- Provides a template or meta-model covering all possible instantiations



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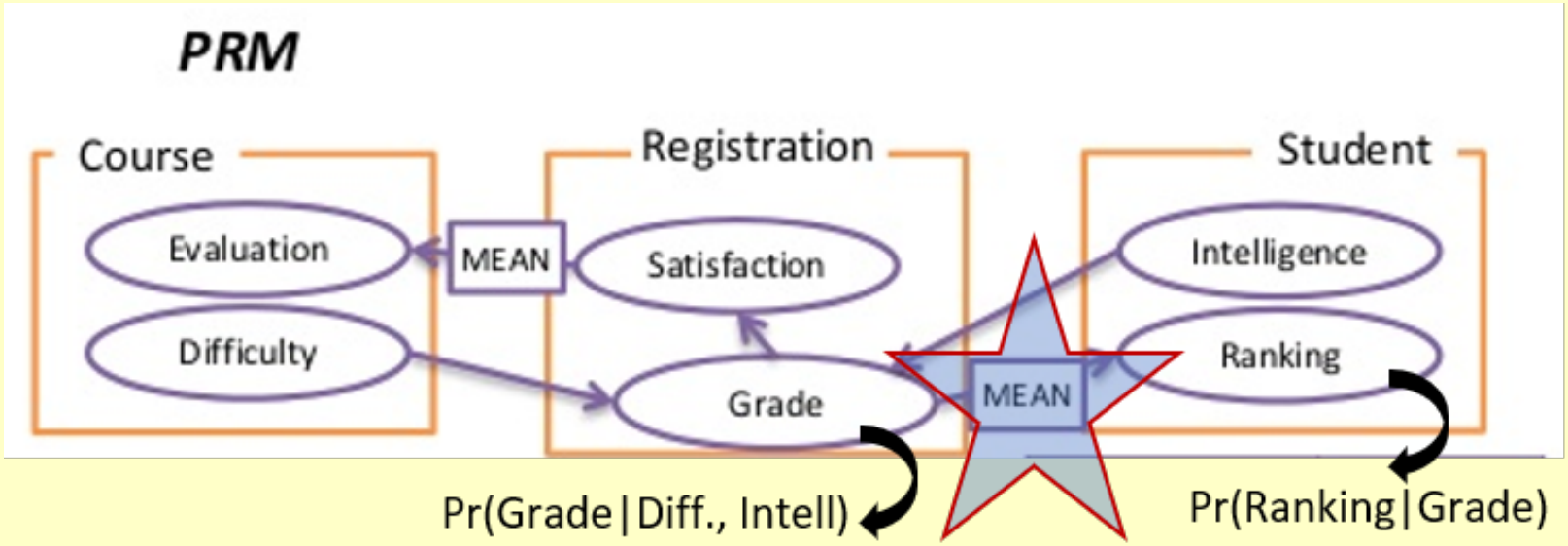
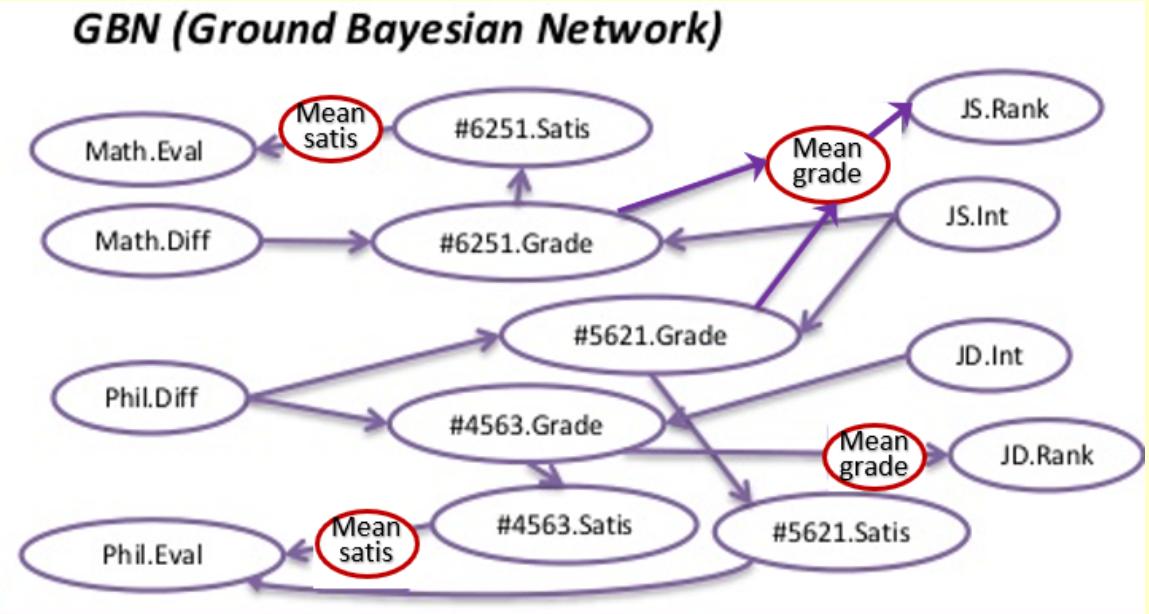


- Many-to-one dependencies are described by aggregators (functions such as MEAN, (stochastic) MODE, logical OR,. . .)

Inference in PRMs

- Concerns a concrete instance
- Is performed in a Ground Bayesian network (GBN);
- The GBN replicates attributes for the given instance



- An aggregator is encoded in the CPT of an additional random variable

Questions & Approach

Replication induces causal interaction patterns upon inference in the GBN, not directly obvious from the PRM.

- Do PRM properties constrain the set of interaction patterns?
- If so, is every type of interaction possible?
  ($-$ *explaining-away*; $+$ *explaining-in*; 0 no interaction)

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We answer these questions

- for the interaction between two binary-valued variables
- involved in an aggregation (many-to-one relationship)
- by studying the space of possible CPTs for the aggregator
- using 'tools' from qualitative probabilistic networks