Note Title 4/3/2009

Choose a paper for presentation in pairs from the special section on Bayesian Modelling in International Journal of Approximate Reasoning, Vol. 50, No. 3 (March 2009), edited by Linda van der Gaag and Russell Almond

1) Planning for success: the interdisciplinary approach to building Bayesian models

2) Verifying monotonicity of Bayesian networks with domain experts

3) Modeling human reasoning about meta-information

4) Bayesian networks: ~~A~~ teacher's view

5) Preventing knowledge transfer errors: Probabilistic decision support systems through the users' eyes.

Your choice?

- Ben Fine & Nick Stiffler ; Paper #4 April 15

1. ***Reflexivity.*** For any lottery A, $A \succeq A$

2. ***Completeness.*** For any pair (A, B) of lotteries, $A \succeq B$ or $B \succeq A$.

3. ***Transitivity.*** If $A \succeq B$ and $B \succeq C$, then $A \succeq C$.

4. ***Preference increasing with probability.*** If $A \succeq B$ then $\alpha A + (1-\alpha)B \succeq \beta A + (1-\beta)B$ if and only if $\alpha \geq \beta$.

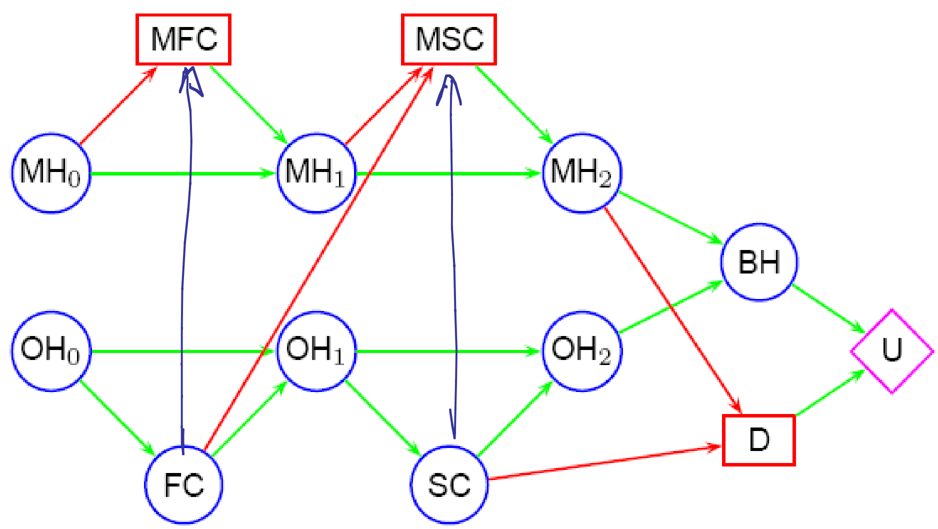
5. ***Continuity.*** If $A \succeq B \succeq C$ then there exists $\alpha \in [0,1]$ such that $B \sim \alpha A + (1-\alpha)C$

6. ***Independence.*** If $C = \alpha A + (1-\alpha)B$ and $A \sim D$, then $C \sim (\alpha D + (1-\alpha)B)$.

Theorem: For an individual who acts according to a preference ordering satisfying rules 1-6 above, there exists a utility function over the outcomes s.t. the expected utility is maximized.

Influence Diagrams (Sect. 9.4 [J07])

A better representation (an influence diagram):

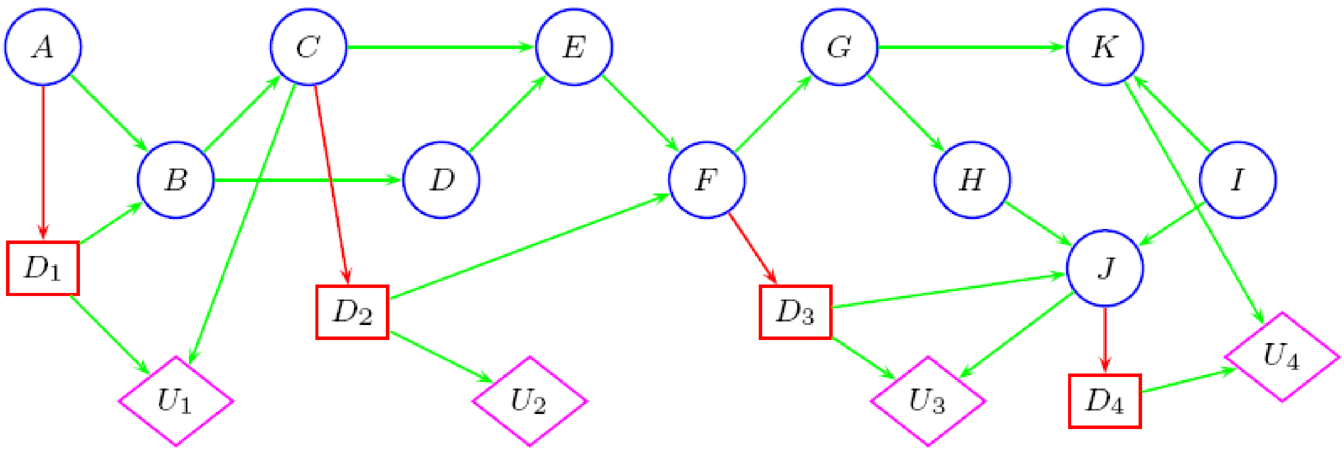


$\{MH_0\} < MFC < \{MH_1, FC\} < MSC < \{SC, MH_2\} < D < \{OH_0, OH_1, OH_2, BH\}$

Advantages:

- You can read the sequence of decisions.
- You can read what is known at each point of decision.

$\{MH_0, FC\} < MFC < \{MH_1, SC\} < MSC < \{MH_2\} < D < \{OH_0, OH_1, OH_2, BH\}$



Nodes and links:

- ◯ Chance variable $\longrightarrow$ causal links
- ☐ Decision variable $\longrightarrow$ information links
- ◇ Utility function $\longrightarrow$ utility link, $U = \sum_i U_i$.

Note:

- We assume no-forgetting.
- A directed path comprising all decisions $\Rightarrow$ the scenario is well-defined.

$\{A\} < D_1 < \{C\} < D_2 < \{F\} < D_3 < \{J\} < D_4 < \{B, D, E, G, H, I, K\}$