

Probabilistic Reasoning

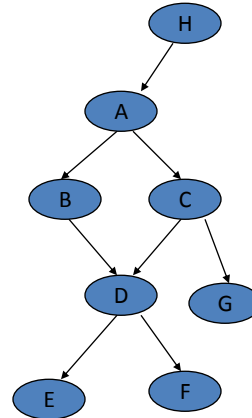
Unit # 5

d-Separation

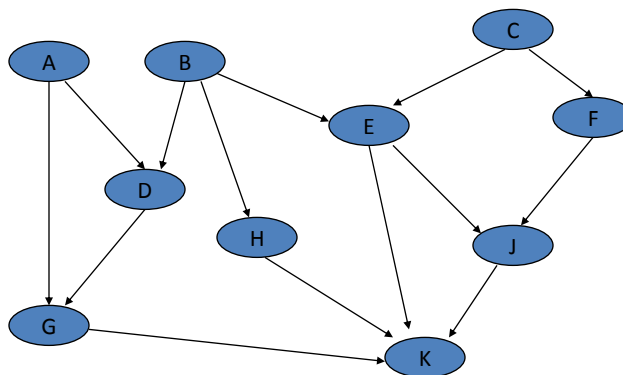
- d-separation is short for direction-dependent separation
- d-separation of vertices in a graph corresponds to conditional independence of the associated random variables
- d-separation is the mathematical basis for efficient inference algorithms in Bayesian networks
- Two nodes X and Y are d-separated by a set Z if all paths between X and Y are blocked by Z .
- When X and Y are d-separated by Z , no information can be transmitted between X and Y given Z . Hence X and Y are conditional independent given Z .

Markov Blanket

- **A node's Markov blanket consists of its parents, children, and other parents of its children (co-parents)**
 - The Markov blanket of node B consists of all nodes whose local probability table mentions B and all nodes their local probability tables mention
- **A node's Markov blanket d-separates it from all other nodes in the graph**
 - A node is conditionally independent of all other nodes given its Markov blanket

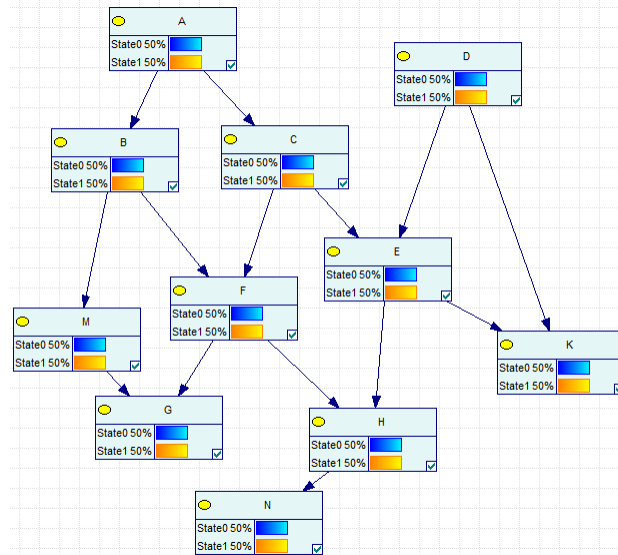


Inference Mechanism



- A and K are independent?
- A and K are independent given G?
- What's the Markov blanket of H?
- A and B are independent given D?
- E and J are independent given K?
- G and B are independent given D?
- E and H are independent given B?
- E and H are independent given B and K?

Inference Mechanism Using GeNIe

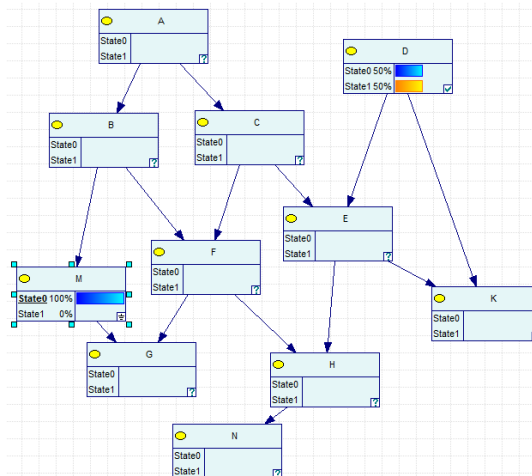


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5

Inference Mechanism Using GeNIe (Cont'd)

- When you enter evidence on a node (say E), GeNIe doesn't hide/change the probability of nodes which are independent of the node E.
- For instance, in this example, M and D are independent. Hence entering evidence on M doesn't change the probability of D.



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