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 dent  
 $(XY)$   
 $p(x, y) =$   
 $p(x)p(y)$   
 $x$   
 $y$   
 $Y$   
 $Y$   
 $X$   
 $R$   
 $L$   
 $R$   
 $L$   
 $X$   
 $Y$   
 $Z$   
 $Z$   
 $Z$   
 $X$   
 $Y$   
 $Y$   
 $X$   
 $p$   
 $V$   
 $X, Y, Z \subseteq$   
 $V$   
 $X$   
 $Y$   
 con-  
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 ally  
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 dent  
 given  
 $Z$   
 $(XY|Z)$   
 $p(x|y, z) =$   
 $p(x|z)$   
 $p(y, z) >$   
 $0$   
 $(PR)$   
 $P$   
 $R$   
 $H$   
 $(PR|H)$   
 $(XY|Z)$   
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 me-  
 try  
 $(XY|Z)$   
 $(YX|Z)$

$(PO)$   
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 tion  
 $\mathcal{Y}$   
 $\mathcal{X}$   
 $\mathcal{X}$   
 $(XW|ZY) \wedge$   
 $(XY|ZW) \Rightarrow$   
 $(XYW|Z)$   
 $\mathcal{L}$   
 $\mathcal{L}$   
 $\mathcal{O}$   
 $\mathcal{W}$   
 $(LR|O, W)$   
 $(LW|O, R)$   
 $(LR|O)$   
 $(LW|O)$   
 $(XY|Z)$   
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 $(RO|H)$   
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 $(XY)$   
 $(XY|S)$   
 $(XY)$   
 Bayesian  
 net-  
 works  
 $?$   
 $p(v)$   
 $\mathcal{V} =$   
 $\{X_1, \dots, X_n\}$   
 $PA_j \subset$   
 $\mathcal{V}$   
 Marko-  
 vian  
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 ents  
 $X_j \in$   
 $\mathcal{V}$   
 $X_j$   
 $X_j$   
 $p$   
 $p(x_1, \dots, x_n) =$   
 $\prod_i p(x_i|pa_i)$   
 $\mathcal{G}$   
 $\mathcal{G}$   
 $\mathcal{G}$   
 (Markov)  
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 pat-  
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 ble  
 Markov  
 con-  
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 tion  
 $?$   
 $?$   
 causal  
 graph  
 $\mathcal{G} =$   
 $(V, E)$   
 $\mathcal{V}$   
 $E \subset$   
 $\mathcal{V} \times$   
 $\mathcal{V}$   
 $E =$   
 $E \rightarrow \cup$   
 $E \leftrightarrow \cup$   
 $E \text{---}$   
 $X \text{---} \text{---} Y$   
 $(X, Y) \in$   
 $E \text{---}$   
 $\mathcal{X} \rightarrow$   
 $\mathcal{Y}$   
 $(X, Y) \in$   
 $E \rightarrow$   
 $\mathcal{X} \leftrightarrow$   
 $\mathcal{Y}$   
 $(X, Y) \in$   
 $E \leftrightarrow$   
 $\text{---} \text{---}$   
 neigh-  
 bors