Probabilistic Reasoning: Homework 4

Due on March 9, 2015

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Problem 1

Create a corresponding clique tree

Solution

Calculations

The clique tree is constructed using the variable elimination technique when finding P(A).

$P(A) = \sum_N \phi(N) \sum_M \phi(M,N,A) \sum_E \phi(E) \sum_B \phi(B)\phi(A,B,E) \sum_T \phi(T) \sum_J \phi(J,T,A)$

$\psi_1(J,T,A) = \phi(J,T,A)$

$\tau_1(T,A) = \sum_J \psi_1(J,T,A)$

$\psi_2(T,A) = \phi(T)\tau_1(TA)$

$\tau_2(A) = \sum_T \psi_2(T,A)$

Since, scope(ψ_2) $\subset$ scope(ψ_1), only one clique is sufficient to represent these factors.

$\psi_3(A,B,E) = \phi(B)\phi(A,B,E)\tau_2(A)$

$\tau_3(A,E) = \sum_B \psi_3(A,B,E)$

$\psi_4(A,E) = \phi(E)\tau_3(A,E)$

$\tau_4(A) = \sum_E \psi(A,E)$

Again, scope(ψ_4) $\subset$ scope(ψ_3), only one clique is sufficient to represent these factors.

$\psi_5(M,N,A) = \phi(M,N,A)\tau_4(A)$

$\tau_5(N,A) = \sum_M \psi_5(M,N,A)$

$\psi_6(N,A) = \phi(N)\tau_5(N,A)$

$\tau_6(A) = \sum_N \psi(N,A)$

Again, scope(ψ_6) $\subset$ scope(ψ_5), only one clique is sufficient to represent these factors.
Also, the messages passed between the cliques are all $\tau_i(A)$ so the cliques will have message $\delta_{i\to j}(A)$ passed between them.

Problem 1 continued on next page...

Clique Tree

The clique tree description:

- 1:$\psi(J, T, A)$ connected to $\psi(B, E, A)$ over $\delta_{1\to 2}(A)$.
- 2:$\psi(B, E, A)$ connected to $\psi(J, T, A)$ over $\delta_{2\to 1}(A)$.
- 2:$\psi(B, E, A)$ connected to $\psi(M, N, A)$ over $\delta_{2\to 3}(A)$.
- 3:$\psi(M, N, A)$ connected to $\psi(B, E, A)$ over $\delta_{3\to 2}(A)$.

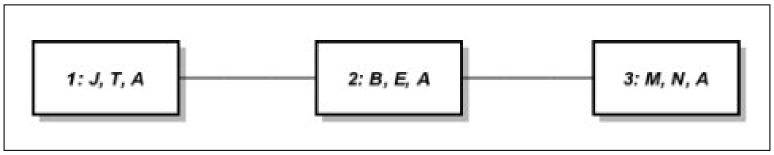

Figure 1: The clique tree