

# STA 294 Homework 3

Due 2/8/99

## Graphs from JPDs

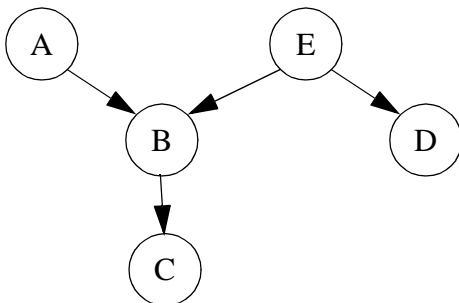
1. (40) Consider the following JPD over 4 binary variables.

A	B	C	D	P{A,B,C,D}
FALSE	FALSE	FALSE	FALSE	0.119
FALSE	FALSE	FALSE	TRUE	0.02975
FALSE	FALSE	TRUE	FALSE	0.0442
FALSE	FALSE	TRUE	TRUE	0.01105
FALSE	TRUE	FALSE	FALSE	0.0252
FALSE	TRUE	FALSE	TRUE	0.0063
FALSE	TRUE	TRUE	FALSE	0.0702
FALSE	TRUE	TRUE	TRUE	0.01755
TRUE	FALSE	FALSE	FALSE	0.0595
TRUE	FALSE	FALSE	TRUE	0.08925
TRUE	FALSE	TRUE	FALSE	0.1989
TRUE	FALSE	TRUE	TRUE	0.29835
TRUE	TRUE	FALSE	FALSE	0.0084
TRUE	TRUE	FALSE	TRUE	0.0126
TRUE	TRUE	TRUE	FALSE	0.0039
TRUE	TRUE	TRUE	TRUE	0.00585

- (5) Compute the marginal probabilities for each variable,  $P(A)$ ,  $P(B)$ ,  $P(C)$ ,  $P(D)$ .
- (5) Compute the conditional probabilities  $P(A|D=FALSE)$ ,  $P(B|D=FALSE)$ ,  $P(C|D=FALSE)$ .
- (15) Find the undirected graph with the minimum number of arcs for this distribution.
- (15) Find the directed graph with the minimum number of arcs for this distribution.

## Inference Algorithms (Notes and Peot+Shachter (course reader))

2. (30) Consider the following directed graph over 5 binary variables:



$$\begin{aligned}
 P\{A = T\} &= 0.1 & P\{C = T|B = T\} &= 1 \\
 P\{B = T|A = T, E = T\} &= 0.95 & P\{C = T|B = F\} &= 0.3 \\
 P\{B = T|A = T, E = F\} &= 0.85 & P\{D = T|E = T\} &= 0.2 \\
 P\{B = T|A = F, E = T\} &= 0.9 & P\{D = T|E = F\} &= 0.8 \\
 P\{B = T|A = F, E = F\} &= 0.05 & P\{E = T\} &= 0.15
 \end{aligned}$$

- (10) Use bucket elimination to compute  $P\{C|D = T\}$ .
- (10) Compute all of the  $\pi$  and  $\lambda$  messages for this graph given no entered evidence.
- (10) Compute all of the  $\pi$  and  $\lambda$  messages for this graph given that  $C = T$  and  $A = T$ . What is the probability for  $D$ ?