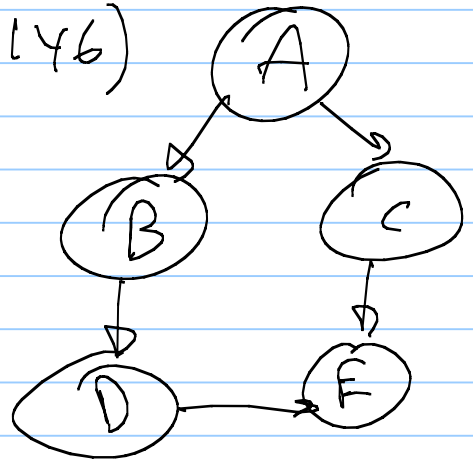
2010-11-12

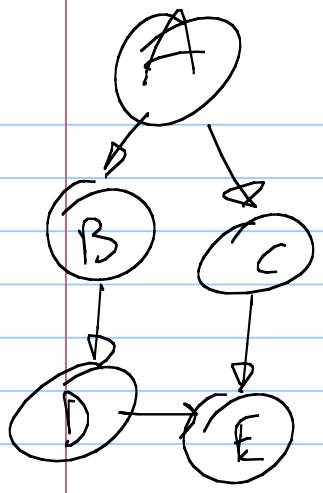
Note Title 2010-11-12

Stochastic Simulation in BN's (4.8 [J07])

$$P(E=y) \approx \frac{\text{number of cases for which } E=y}{\text{total number of cases}} = \frac{N(E=y)}{N}$$

Example (p. 146)





B	A = T	A = F
T	.3	.8
F	.7	.2

C	A = T	A = F
T	.7	.4
F	.3	.6

D	B = T	B = F
T	.5	.1
F	.5	.9

$P(A) = (.4, .6)$

D	C = T	C = F
T	(.9, .1)	(.999, .001)
F	(.999, .001)	(.999, .001)

$P(E|C,D)$

4.8.1 Probabilistic Logic Sampling

1. Let $\langle X_1, \ldots X_n \rangle$ be a topological ordering of the variables (e.g. $\langle A, B, C, D, E \rangle$)

2. For $j = 1$ to N [N is the number of samples]

a) For $i = 1$ to n [n is the number of variables in the BN]

sample a state x_i of X_i using $P(X_i \mid pa(X_i) = \pi)$, where π is the configuration already computed for $pa(X_i)$

b) If $X = \langle x_1, \ldots, x_n \rangle$ is consistent with the evidence, then $N(X_k = x_k) := N(X_k = x_k) + 1$, where x_k is the state that was sampled for X_k

[else, discard x, b/c it is inconsistent with the evidence]

3. Return

$$P(X_k = x_k \mid \underline{e}) = \frac{N(X_k = x_k)}{\sum_{x \in X_k} N(X_k = x)}$$

Problem: if the evidence is a rare case ($P(\underline{e})$ is small), then many samples are thrown away.