HW07: More Bayes' Net *

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1   D-Separation

(a)   AV and SL are **not independent**.

(b)   AA and FP are **independent**.

(c)   U and BB are **independent**.

(d)   SL and BB are **not independent**.

1.   Assuming no evidence is given, nothing changes. **Not independent**.

2.   SL is a sink that connects AA and FP. **Not independent**.

3.   AA would actually "block" the dependence. **Independent**.

4.   FP actually "blocks" the dependence. **Independent**.

2   Variable Elimination

The joint distribution is represented by $P(a, b, c, d, e, f) = P(A)P(B|A)P(C|A)P(D|B)P(E|B)P(F|C)$. One way to think of our factored representation is as

$$P(a, b, c, d, e, f) = P(A) \sum_{b \in B} P(B|A) \sum_{c \in C} P(C|A) \sum_{d \in D, e \in E} P(D|B)P(E|B) \sum_{f \in F} P(F|C) \qquad (1)$$

Note that because each of these sums adds to 1, we can chop off an arbitrary number of factors to eliminate them. Thus our variable elimination results in $P(C = c|F = f, D =\sim d) = 0.6943$.

3   Sampling

1.   Of the $N = 20$ samples generated, there are 10 for which is is true that $S = s$. Of these there are 3 for which it is true that $A = a$, and 7 for which it is true that $A =\sim a$.

Having generated and rejected these samples, we must now normalize these counts. Normalizing them gives us $P(A = a|S = s) = \frac{3}{7+3} = 0.3$.

2. The number of rejected samples, straightforwardly, is the number of samples for which it is *not* true that $S = s$. In other words, it is quite literally: $P(S =\sim s)$.