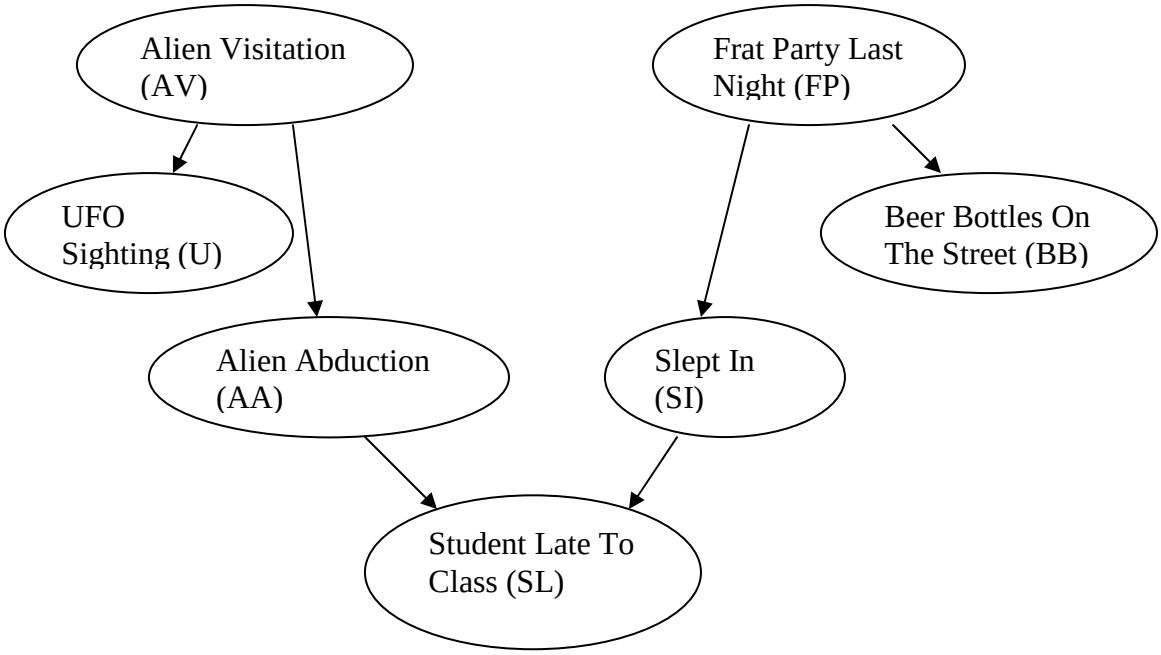
CS 188: Bayes Nets – D-Separation and Variable Elimination

Consider the following Bayes Net for answering the questions. All the random variables are boolean (i.e True/False).



1. D-Separation

For each of the following sub-parts, answer whether these four pairs of variables are independent?

i) AV and SL
ii) AV and FP
iii) U and BB
iv) SL and BB

a) Assuming that you have no evidence.

b) Assuming that SL is observed.

c) Assuming that AA is observed.

d) Assuming that FP is observed

2. Variable Elimination

Now, lets say we are trying to solve P (AA | u) using variable elimination. In the following sub-parts, write down the factors remaining after each variable is eliminated. For new factors that get created use names like m1(..), m2(..) etc. Example: m1(X,Y), or m2(W, z). Also, write down the symbolic formula for the new factors, for example $m1(X,Y) = \sum_{Z} P(X \mid Z, Y)\, P(Z)$

a) Write down all the initial factors.

b) After FP is eliminated:

c) Next, BB is eliminated:

d) Next, SL is eliminated.

e) If we switched the order of parts b) and c), i.e. eliminated BB first and then FP, would we have generated fewer intermediate factors? Explain.