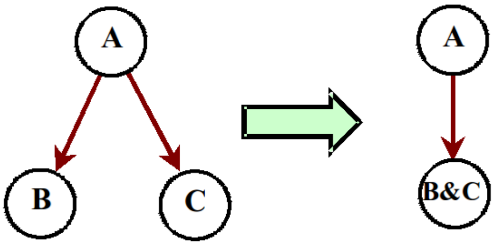
Tutorial 5: Exact Inference

NB This tutorial is much longer and harder than any exam question would be. It is worth working through it to consolidate the material of lectures 10 and 11.

The following (part of a) network is to be subjected to a join as shown:

a_1	b_1	c_1
a_1	b_1	c_2
a_1	b_2	c_1
a_1	b_2	c_2
a_2	b_1	c_2
a_2	b_1	c_2
a_2	b_2	c_1
a_2	b_2	c_1



1. Given the eight point data set what are the conditional probability matrices for the original network ($P(B|A)$ and $P(C|A)$) and the joined network $P(B\&C|A)$?

2. Given that neither B or C are instantiated, but the π message from A is $[0.1, 0.2]$ what are the individual posterior probability distributions for B and C using:

   (a) The original network

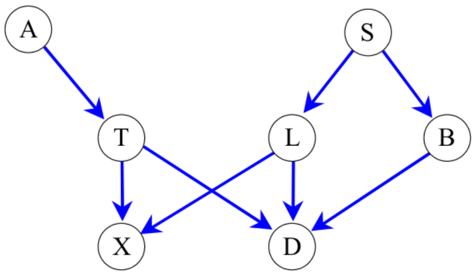
   (b) The joined network

3. Given that B is instantiated to state b_1, and C remains uninstantiated, find the λ evidence at node A using:

   (a) The original network

   (b) The joined network

4. The Asia network was used in the lectures as an example to illustrate cutset conditioning. It is also possible to create a join tree from it using the Lauritzen and Spiegelhalter algorithm.



A	Asia
B	Bronchitis
D	Dyspnea
L	Lung Cancer
S	Smoking
T	Tuberculosis
X	XRay

- First moralise the graph noting that D has 3 parents all of which must be joined.
- Find the cliques of the moral graph and allocate variables to each.
- Define a join tree satisfying the running intersection property.
- Discuss with a friend the λ and π messages that would be sent before and after instantiating node D.

(NB this is much harder than the example given in the lectures so you may want to wait till you see the solution)