Lecture Graphical Models
`https://ml01.zrz.tu-berlin.de/wiki/Main/SS09_GraphicalModels`
Machine Learning Group, TU Berlin

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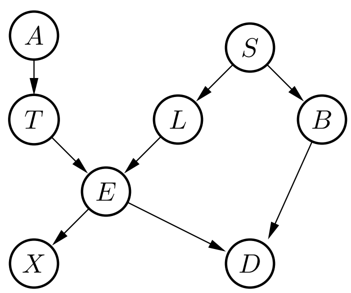
Sheet 4

Due: 19 May 2009

1. Conditional independence (1/2)

Read Section 8.2 on conditional independence (p. 372-383) in Chapter 8 of Bishop's book (which you find on the course website).

Then, once again, take a look at the ASIA network below. (By the way, it models the diagnosis of lung disease with T=tuberculosis and L=lung cancer, where a visit to A=asia increases the probability of tuberculosis.)



State if the following independence relationships hold and explain your decision:

1. $I(T, S \mid D)$
2. $I(L, B \mid S)$
3. $I(A, S \mid L)$
4. $I(A, S \mid L, D)$

2. Conditional independence (2/2)

Consider modelling a distribution over variables A, B, C, D. Create Bayesian nets for which the following sets $\mathcal{I}$ of independence statements hold.

1. $\mathcal{I} = \{I(A, B), I(A, C), I(A, D), I(B, C), I(B, D), I(C, D)\}$
2. $\mathcal{I} = \{\neg I(A, B), \neg I(A, C), \neg I(A, D), \neg I(B, C), \neg I(B, D), \neg I(C, D)\}$
3. $\mathcal{I} = \{I(A, B), I(A, B \mid C), \neg I(A, B \mid D), I(C, D)\}$
4. $\mathcal{I} = \{\neg I(A, B), \neg I(B, C), \neg I(C, D), I(A, C \mid B), I(B, D \mid C)\}$

3. Junction tree

Construct a valid junction tree for the car network shown below. State the separators and give a valid assignment of potentials.

(a) Calculate $P(TurnOver = yes, Start = yes)$ using the junction tree algorithm.

(b) Calculate $P(Fuel = empty \mid Start = no)$ using the junction tree algorithm.