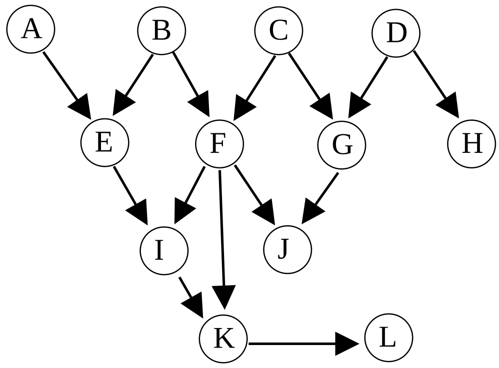
Advanced AI Techniques (WS06/07)

Exercise sheet 1

Deadline: 14:00 o'clock (ct), Thursday, November 2, 2006

Exercise 1 (2 points) Show that the independence of A and B given C neither implies, nor is implied by, the independence of A and B.

Exercise 2 (6 points) Consider the the structure of a Bayesian network below:



1. What probability distributions (e.g. of the form $P(X|Y)$) should be specified in order to obtain a Bayesian network from the structure?
2. Which variables are d-separated from A given evidence on K?
3. Which variables are d-separated from A given evidence on F and I?

Exercise 3 (4 points) A used car sales man offers all potential costumers to have a test performed on the car they are interested in buying. The test should reveal whether the car has either no defects or one (or more) defects; the prior probability that a car has one or more defects is 0.3. There are two possible tests: `Test1` has three possible outcomes, namely `no` $-$ `defects`, `defects` and `inconclusive`. If the car does not have any defects, then the probabilities for these test results are 0.8, 0.05 and 0.15, respectively. On the other hand, if the car has defects, then the probabilities for the test results are 0.05, 0.75 and 0.2. For `Test2` there are only two possible outcomes (`no` $-$ `defects` and `defects`). If the car does not have any defects, then the probabilities for the test results are 0.8 and 0.2, respectively, and the if the car has defects then the probabilities are 0.25 and 0.75.

1. Construct a Bayesian network (both structure and probabilities) representing the relations between the two tests and the state of the car.

2. Calculate the probabilities $P(\texttt{StateOfCar}|\texttt{Test1})$ and $P(\texttt{Test1})$.