

Advanced AI Techniques (WS05)

Exercise sheet 1

Deadline: 11.15.05

Exercise 1 Consider the following JPD over the three binary variables A , B , and C :

C	B	A	probability
0	0	0	1/8
0	0	1	1/4
0	1	0	1/24
0	1	1	1/12
1	0	0	1/12
1	0	1	1/24
1	1	0	1/4
1	1	1	1/8

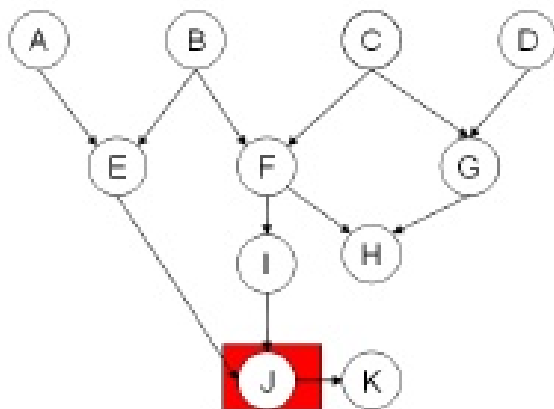
1. Are A and B independent?
2. Are A and B conditionally independent?

Give evidence for your answers.

Exercise 2 On a late Saturday evening, a policeman stops all drivers to take a test whether the driver is drunk. The prior probability that a driver is drunk is 0.2. There are two ways to test whether a driver is drunk. The first one is to ask the driver to walk a straight line heel-to-toe. This test has two possible outcomes: drunk and not drunk. If the driver is drunk, then the probabilities for the test results are 0.75 for drunk and 0.25 not drunk. And if the driver is not drunk and the the probabilities for the test results are 0.3 for drunk and 0.7 not drunk. Another test is to use the Breathalyzer test which again produces two possible outcomes(drunk and not drunk). If the driver is drunk, then the probabilities for the test results are 0.95 and 0.05 respectively and if the driver is not drunk then the probabilities are 0.2 and 0.8.

1. Compute a Bayesian network that represents the joint probability of the two states of the driver and the tests.
2. Compute the probabilities $P(\text{StateOfDriver}|\text{BreathalyzerTest})$ and $P(\text{BreathalyzerTest})$.

Exercise 3 Determine which variables are *d-separated* from *A* by *J* in the following graph:



Additionally, use *u-separation* in the moral graph to give reasons for *D* being *d-separated* from *A* by *J* or not.