CSCI 3202 Problem Set 3

CSCI 3202 Problem Set 3; due Tuesday Nov. 3, 2009

Problem 3.1 (9 points)

Consider the Bayesian network whose graph is shown on the final page. The probability entries are as follows:

T means "Todd Helton has a good day"
P(T) = 0.7

B means "Brad Hawpe has a good day"
P(B) = 0.4

L means "The Rockies lose"
P(L | (not T) and (not B)) = 0.8
P(L | (not T) and B) = 0.6
P(L | T and (not B)) = 0.5
P(L | T and B) = 0.2

J means "Jim Tracy is grumpy"
P(J | L) = 0.9
P(J | not L) = 0.2

M means "Mike is grumpy"
P(M | L) = 0.6
P(Ml not L) = 0.3

R means "Rhombi is grumpy"
P(RlM) = 0.8
P(Rl not M) = 0.1

3.1.a (1 point) What are the a priori probabilities for L, J, M, and R? (That is, in the absence of any other information, what is the probability that the Rockies will lose; the probability that Jim Tracy will be grumpy; the probability that Mike will be grumpy; and the probability that Rhombi will be grumpy?)

3.1 b (2 points) You are told that Brad Hawpe had a good day today. What's the probability that both Jim and Mike are grumpy?

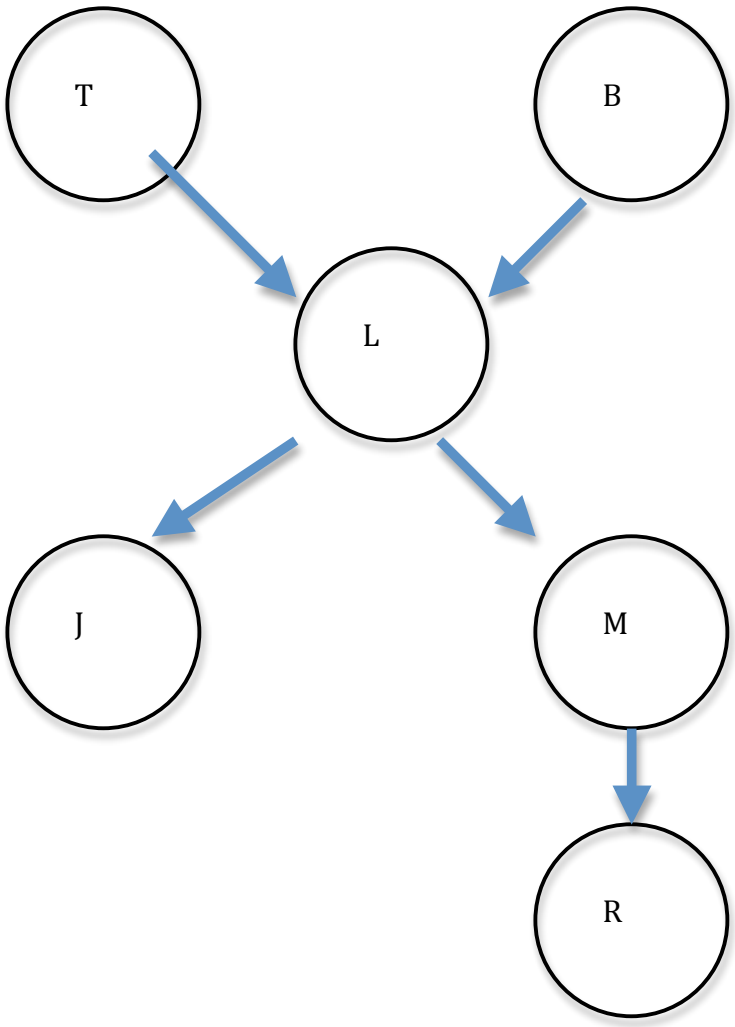
3.1 c (2 points) You run into Rhombi in the evening and he growls at you. What is the probability that Brad Hawpe had a good day?

3.1d (2 points)You run into Jim in the evening and he is grumpy. What is the probability that both Todd Helton and Brad Hawpe had a good day today?

3.1 e (2 points) You are told that Todd Helton did NOT have a good day today, and that Jim is grumpy. What's the probability that Mike is also grumpy?

Problem 3.2 (5 points)
Make up your own Bayesian network for some situation of interest to you. Your Bayesian network should be singly connected; there should be at least five nodes altogether; at least one node should have more than one direct ancestor (i.e., at least one node's probability should be determined by at least two direct influences); and at least one node with multiple ancestors should be designed along the lines of a "Noisy OR" gate as described in the textbook.

3.2 a (2 points) Explain the semantics of your "Noisy OR" gate, and also calculate the a priori probabilities for the nodes in your network.
3.2 b (2 points) Do at least one sample problem in which information about the value of one node alters your estimate of the probability of a node at least two links away in the network.
3.2 c (1 point) Suppose you wished to alter your network to include multiple connection paths between nodes, or to permit reciprocal influences. Where, in your network, might it make sense to go beyond the standard "polytree" Bayesian network model described in Russell and Norvig?


T
B
L
J
M
R