CSE 5522 Homework 2

February 18, 2015

Problem 1 (1 point)

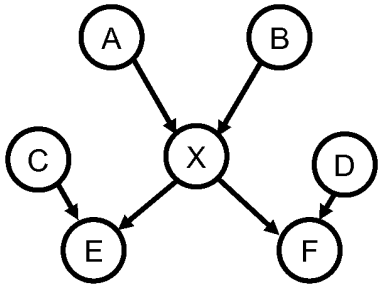

Figure 1: GM for problem 1

Consider the DAG G in Figure 1. Assume it is a minimal I-map for $P(A, B, C, D, E, F, X)$. Now consider marginalizing out X. Construct a new DAG G' which is a minimal I-map for $P(A, B, C, D, E, F)$. Specify and justify which extra edges need to be added.

Problem 2 (1 point)

Here we compute global independence statements from some directed graphical models. You can use the "bayes ball" algorithm or the d-seperation criteria.

- Consider the DAG in figure 2, list all the variables that are independent of A given evidence on B.
- Consider the DAG in figure 3, list all the variables that are independent of A given evidence on J.

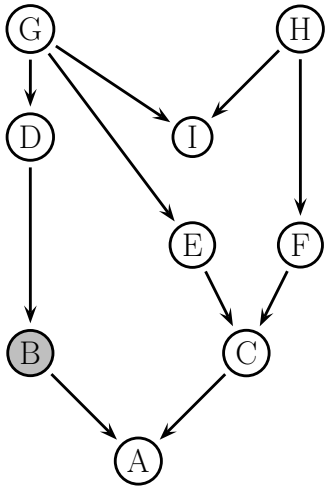

Figure 2: GM for problem 2 part 1

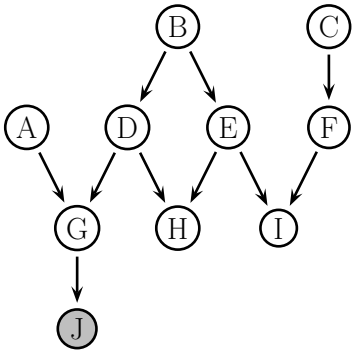

Figure 3: GM for problem 2 part 2

Problem 3 (3 points)

Consider an HMM with three states, three outputs, and the following transition and emission probabilities. Assume a uniform distribution for the initial state, 0.

π_i	π_{i+1}	a	b	c
a		0.5	0.4	0.1
b		0.1	0.5	0.4
c		0.4	0.1	0.5

π	x_i	p	q	r
a		0.7	0.1	0.2
b		0.2	0.7	0.1
c		0.1	0.2	0.7

1. Compute the most likely sequence of hidden states for the observed sequence (p, p, r, r, q, r) by stepping through the Viterbi algorithm by hand.

2. Use the forward-backward algorithm to compute the probability distribution over states at position 3.

3. Is the most likely state the same as the state in the most likely sequence? Will this always be the case? Why?