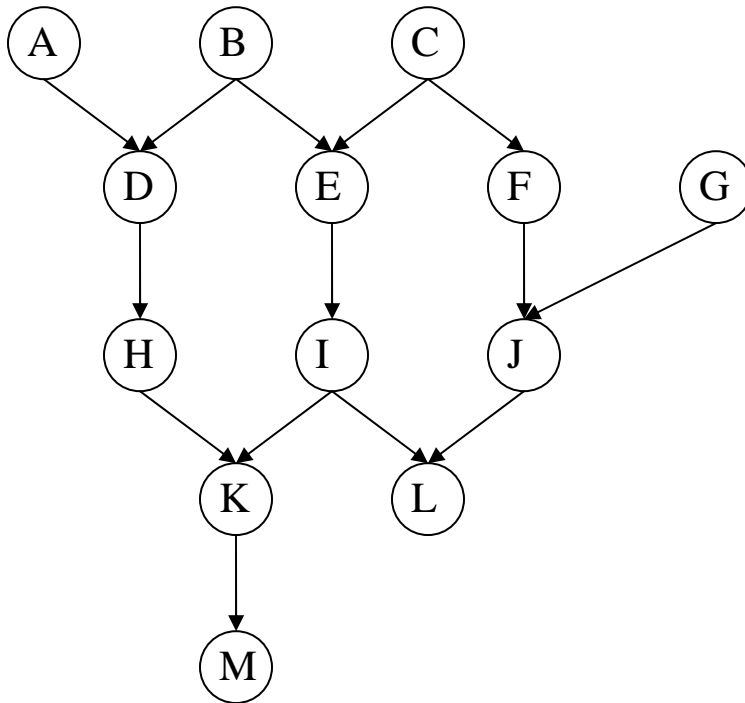# 6.825: Techniques in Artificial Intelligence
## Exercises for week 5



## *Part I*

Use the above Bayesian network to answer the following questions:

1. Are A and F d-separated if M is instantiated?
2. Are A and F d-separated if nothing is instantiated?
3. Are A and E d-separated if I is instantiated?
4. Are A and E d-separated if B and H are instantiated?
5. Describe a situation in which A and G are d-separated.
6. Describe a situation in which A and G are d-connected.

## *Part II*

Now consider the following network:
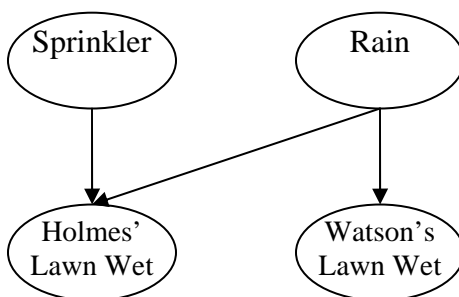


Now suppose you are given the following CPTs for the above network:

P(R) = 0.2
P(S) = 0.1

|      | P(W|R) |
|------|--------|
| R    | 1.0    |
| ~R   | 0.2    |

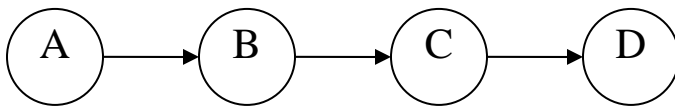|         | P(H|R,S) |
|---------|----------|
| R, S    | 1.0      |
| R, ~S   | 1.0      |
| ~R, S   | 0.9      |
| ~R, ~S  | 0.1      |

Calculate the following:
P(H), P(R|H), P(S|H), P(W|H), P(R|W,H), P(S|W,H)

## Part III

Do the variable elimination algorithm on the net below using the elimination order: A,B,C (that is, eliminate C first). In computing P(D=d), what factors do you get?
What if you wanted to compute the whole marginal distribution P(D)?



## Part IV

Find an elimination order that keeps the factors small for the net below, or show that no such order exists.