1. Consider the Bayesian network below. It covers symptoms of colds, whether or not the patient chooses to take medicine for the symptoms, and an alternate cause of sneezing (sunlight). All variables are binary, with distributions dened by the given conditional probability tables. For brevity, just the conditional probabilities of each variable being true (i.e., taking on the value “1”) are given.

(a) What is the Markov blanket of Light in the Bayesian network?

(b) Convert the Bayesian network to an equivalent Markov network using one potential for each maximal clique. Please show the numbers for each clique. (NOTE: Since this problem asks for potentials over maximal cliques, simply reusing the BN CPDs is not sufficient.)

(c) Let $H$ be the graph of this Markov network. What is the Markov blanket of Light in $H$?
2. Consider the following statements:

- People send email more often when indoors.
- Spending time indoors is a consequence of the weather outside and whether or not you’re a vampire. (Vampires spend more time indoors, especially when it’s sunny.)
- Both the current season and time of day affect the weather.
- Being bitten by a vampire causes you to be a vampire.
- Vampires are preternaturally beautiful (as an effect of being a vampire)

(a) Use these statements to come up with a Bayesian network over variables Email, Indoors, Weather, Time, Season, Vampire, Bitten, and Beauty.

(b) In this network, what is the Markov blanket of Vampire?

(c) According to this network, are beautiful people more likely to send email?

(d) According to this network, are time of day and beauty independent?

(e) According to this network, are time of day and beauty independent, given email?

(f) How many different Bayesian network structures are there that specify this same set of independencies?

3. K&F 3.7 (Computing the distribution over a single variable. HINT: Use the Markov blanket.)

4. [Grads only] K&F 4.18. (HINT: Show that, given evidence Z, X and Y are d-separated in G if and only if they are d-separated in H.)

5. (Extra Credit) K&F 3.18.