Worksheet 10: PGMs I

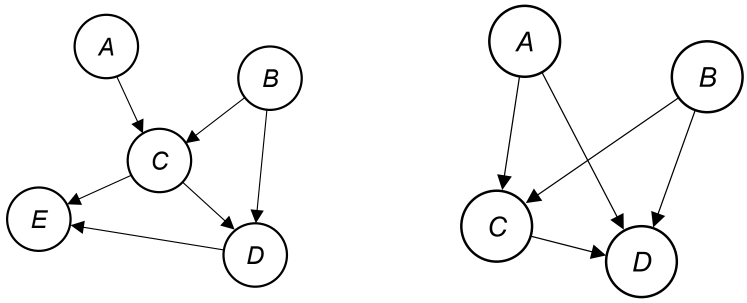
COMP90051 Statistical Machine Learning

Semester 2, 2020

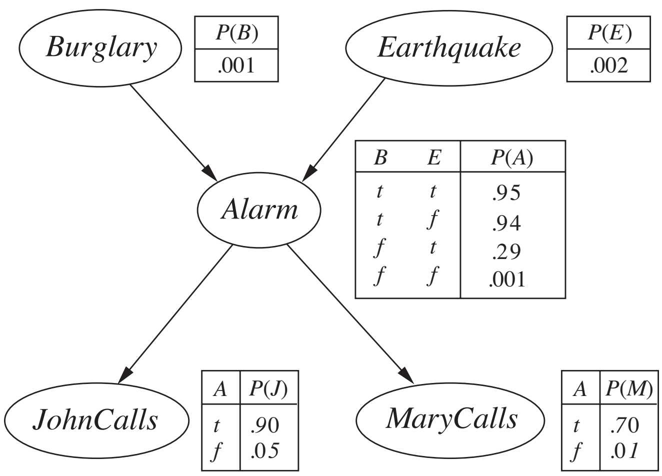
Exercise 1. For the following PGMs:

(a) Find the factorized joint distribution.

(b) Count the number of free parameters in the conditional probability tables, assuming each variable is boolean.



Exercise 2 (Based on RN 14.15)**.** Leo is a botanist who lives in the Bay Area. His neighbourhood is a hotspot for burglars, so his house is fitted with an alarm system. Unfortunately, the alarm is not perfectly reliable: it doesn't always trigger during a home invasion, and it may be erroneously triggered during minor earthquakes, which occur occasionally. Leo has asked his neighbours John and Mary (who don't know each other) to call him if they hear the alarm. Leo would like to determine the likelihood that his home is being burgled if he receives a phone call from both John and Mary. Use Bayes' theorem and marginalisation and the following PGM to help him answer this question.



Exercise 3 (Based on RN 14.4)**.** The following questions relate to the PGM from Exercise 2.

(a) If no evidence is observed, are the *Burglary* and *Earthquake* nodes independent?

(b) Assume we observe $Alarm = t$, now are *Burglary* and *Earthquake* independent? Justify your answer by calculating whether the probabilities involved satisfy the definition of conditional independence.

(c) **[Discussion]** Explain intuitively why knowledge of the *Alarm* random variable renders the random variables *Earthquake* and *Burglary* non-conditionally independent.