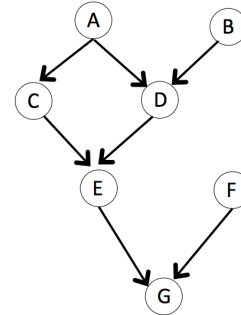


UW CSE 473 Problem Set 5 – Due 12/5 at 11:59pm

Students should work individually on this problem set – please no collaboration on the problems.

Consider the following Bayes Net:

The following questions are worth 1 point each with a negative point for incorrect answers (don't guess randomly).



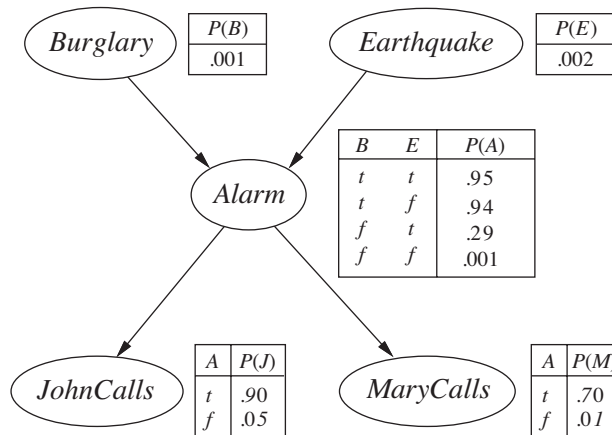
- 1) Are A and F independent?
- 2) Are A and F independent given G?
- 3) Are A and G independent?
- 4) Are A and G independent given C?
- 5) Are A and G independent given C and D?
- 6) Are A and G independent given B, C and D?
- 7) Are A and B independent?
- 8) Are A and B independent given C and D?
- 9) Are C and D independent?
- 10) Are C and D independent given A?
- 11) Are C and D independent given E?
- 12) Are C and D independent given A and E?
- 12) Are C and D independent given A and F?
- 13) Are there CPTs that would make G independent of F? If yes, provide CPT(s) for E, F, and/or G that do the job. If not, explain why.

14) (5 points) Suppose my hat contains 3 quarters (a, b, and c) that *appear* identical, but in fact are subtly weighted so that the odds of getting heads upon a flip are 40%, 60% and 75%, respectively. You pick one quarter from the hat uniformly at random and then flip it 3 times to generate outcomes X1, X2, and X3. Show a Bayesian network corresponding to this scenario and include the relevant conditional probability tables.

15) Which coin is the mostly likely to have been drawn if the observed flips were heads, tails, heads? Show your work.

16) Consider the Burglar alarm network shown to the right:

- a) Suppose one used variable elimination (VE) to compute  $P(+b | +j)$ . What would be the dimensionality and size of the largest factor be if you used the elimination ordering (A, E, M)?
- b) What about (M, E, A)?



- c) Use the more efficient ordering to compute the answer. Write the intermediate factors as tables.
- d) Use VE to compute  $P(+b | +j, +e)$ . (You don't have to write out all the factors on this one, just get the answer.) Why does the likelihood of a burglary change when we observe an earthquake? (Answer in terms of the graphical structure.)