

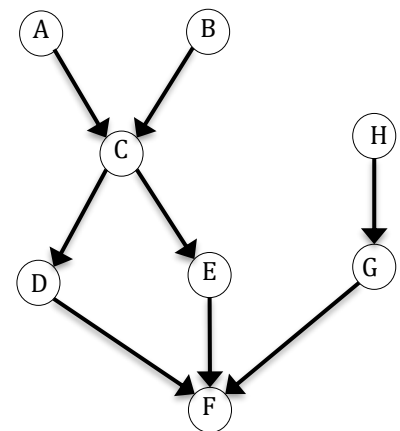
### Instructions

1. Students should work individually on this problem set – please no collaboration on the problems.
2. As in past projects, instead of downloading and uploading your assignment directly, you must do so through Github. Use the invitation link (<https://goo.gl/ALVu01>) to accept Project 5. For those of you with multiple Github accounts, make sure you use the same account you used in P0-4 to work on this project. This will create a private repository in the CSE473-16au organization on Github for you to work on. For example, if your Github ID is “dsweld” then this will create a repository with URL <https://github.com/CSE473-16au/p5-bayesnet-dsweld>.
3. Please submit your solutions by replacing the PDF file named “solutions.pdf” with your own file. It’s up to you whether you type these up (e.g. in LaTeX) or write them by hand and scan them in. Regardless, please make sure they are legible and easy to read. Also, don’t forget to fill your details in “config.json”.
4. As in P0-4, we will be using the state of your remote Github repo by the deadline as your submission. This means you need to push your changes by the deadline, not just commit them!

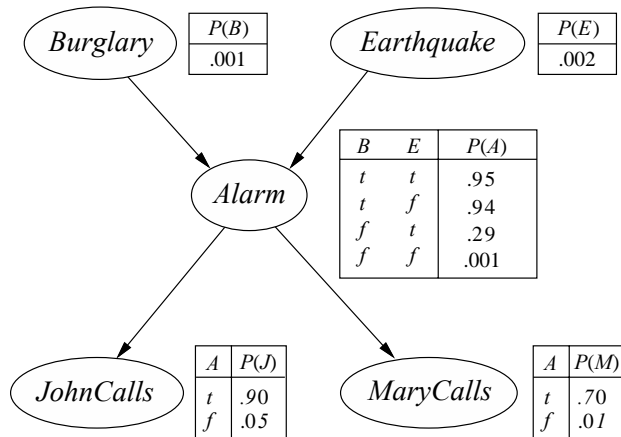
Consider the following Bayes Net:

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 C?
- 3) Are A and G independent?
- 4) Are A and G independent given C?
- 5) Are A and G independent given E and F?
- 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 D and E independent?
- 10) Are D and E independent given C?
- 11) Are D and E independent given F?
- 12) Are D and E independent given C and F?
- 13) Are D and E independent given C and H?
- 14) Are there CPTs that would make G independent of H? If yes, provide CPT(s) for F, G, and/or H that do the job. If not, explain why.
- 15) (5 points) I’m holding 3 coins (A, B, and C) that *look* identical, but in fact are subtly weighted. The chance of flipping heads is 35%, 60% and 70%, respectively. You pick one of my coins 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.



16) (6 points) Consider the classic Burglar alarm network shown to the right:



- (2 points) Suppose one used variable elimination (VE) to compute  $P(+b | +m)$ . What would be the dimensionality and size of the largest factor be if you used the elimination ordering  $(A, E, J)$ ?
- (2 points) What about  $(J, E, A)$ ?
- (2 points) Use the more efficient ordering to compute the answer. Write the intermediate factors as tables.