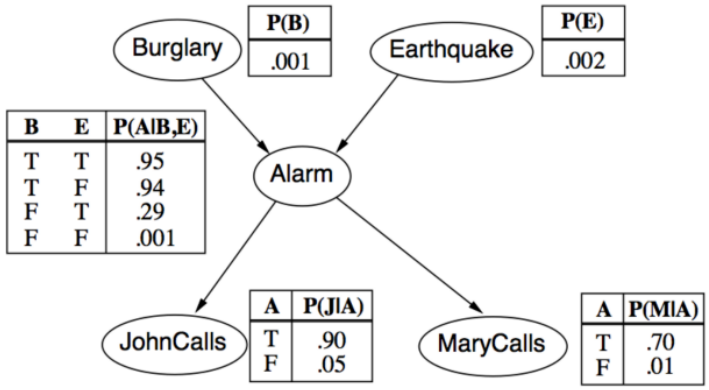
CMSC 678 Machine Learning - Fall 2023
Homework Assignment 6
Due on December 7^{th} by 11:59pm

Consider the Bayesian Network below whose variables are Boolean and can take on values T and F:



- Write down an expression for $p(B, \overline{E}, A, J, \overline{M})$ using the conditional independencies implied by the structure of the Bayes net.
- Compute the value of that expression as a number. Show your work.
- Compute the value of $p(E, J, M)$ by hand. Show all of your work. That requires computing and summing 4 joint probability values using the Bayes net above.
- If the value of $p(J, M) = 0.002084100239$, what is the value of $p(E|J, M)$?
- Write a function to sample values from the joint distribution defined by this network. Use that function to sample instances and use those samples to estimate $p(E, J, M)$ and $p(J, M)$. Use those estimates to estimate $p(E|J, M)$. Turn in your code and show the counts that you used to estimate the probabilities and the probabilities themselves. How many samples do you need to draw to get a good estimate of $p(E|J, M)$? Why does it take such a large number of samples? (For what it's worth, I wrote a 28 line python solution to this question.)