HOMEWORK ASSIGNMENT #4

DUE: March 9, 2015
CSCI573: Probabilistic Reasoning, Prof. Nevatia
Spring Semester, 2015

This assignment consists of only one problem; it does require some programming.

Goal of this assignment is to implement the clique-tree sum-product message passing algorithm and apply it to the network specified in detail in Problem 2 of Assignment #3. Note that you are not being asked to implement a general version of the algorithm but only one sufficient to carry out the calculations for the specific problem. You are also not asked to implement a general input and output representation for the parameters of the problem. You may use any programming language; however, you must not use library packages designed specifically for graphical model inference.

Do the following:

a) **Create a corresponding clique tree** for the specified network. The clique tree should be without the knowledge of any evidence so any evidence query can be plugged into it at the time of inference. You may use the variable elimination algorithm or the chordal graph algorithm to construct the clique-tree. If you choose to use the variable elimination algorithm, note that you need not compute the factor entries that would be generated in the process to infer the clique tree structure. A trivial solution to creating a clique tree is to lump all the variables into one clique; please avoid such solutions and try to keep the size of the maximal clique relatively small though you are not expected to try all possible combinations to find the smallest tree. You need NOT write a program for this part but can carry out the calculations by hand.

b) **Implement a program for the sum-product message passing algorithm** (Algorithm 10.2) given on page 357 of the KF book to *calibrate* the clique tree assuming that no evidence variables are given and apply it to the tree resulting from part (a) above.

c) **Implement a program to marginalize the calibrated clique distributions** to compute distributions of all the variables in the network and apply to results obtained in part (b) above.

d) **Implement a program to update the distributions of all variables** given that the evidence variables to be JohnCalls = True and MaryCalls = False (as in assignment #3). Apply to the results of part (c) above and verify that the probability of earthquake under

these conditions is the same as the one obtained by use of the VE algorithm of assignment #3 (of course, assuming correct application of the VE algorithm).

What o Hand In?:
For this assignment, it is requested that you submit your answers in electronic form. Part (a) can be solved by hand. For parts (b), (c) and (d), turn in all source code you implement. Also show the results of the intermediate steps of the execution of your code, in addition to the final results.