IITM-CS6730 : Probabilistic Reasoning in AI — Given on: Mar 31, 12am

Programming Assignment #3 — Due on : Apr 07, 5pm

- The goal of this assignment is to gain an understanding of exact inference techniques.
- This is an individual assignment. Collaborations and discussions with others regarding the problems and solutions are strictly prohibited.
- You have to turn in your report and code in the prescribed format in Moodle. Report should be typesetted in Latex only.
- You can use only Python.

1. In this programming assignment we will implement two exact inference algorithms.
   - Message Passing in a tree.
   - Junction Tree Algorithm.

   You have been provided with a starter code in Python, on the top of which you should implement your algorithm. We have defined all the necessary methods. You are not allowed to add any additional methods to the code. The idea is to reuse your implementation for message passing in trees to Junction Tree Algorithm. Your code should be able to do following inferences.

   1. Marginal distribution of a single variable in a tree using message passing.
   2. Joint distribution of a set of variables in a tree using message passing.
   3. Conditional distributions of the following form : p(x|y) in a tree using message passing. Note that x and y are single variables and not a set.
   4. Marginal distribution of a single variable in a Bayes Net using Junction Tree Algorithm (JTA).
   5. Joint distribution of a set of variables in a Bayes Net using JTA. Note that the variables need not be present in a single clique.
   6. Conditional distribution of the following form : p(x|y) in a Bayes Net using JTA. Again x and y are single variables only. Here again, the variables need not be present in a single clique.

   You have been provided with a sample tree network and a sample Bayes Net. For the given sample tree network, report the following distributions.

   1. P(A), P(W), P(G)
   2. P(W,G), P(A,B)
   3. P(G|B)

For the given Bayes Net, report the following distributions.

1. P(G), P(S), P(L)
2. P(G,S)
3. P(L|I)

You have to turn in a single zipped folder containing all the python files and the data file. You are not supposed to rename any of these files. The folder name should be your roll number (in capital letters. Ex: CS12S043.zip).

The code should be properly documented with detailed comments for every method.

Also turn in a report containing answers for all the above questions separately. Do not write unnecessary details in the report.