IITM-CS6730 : Probabilistic Reasoning in AI — Given on: Feb 28, 11pm

Programming Assignment #2 — Due on : Mar 15, 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.

   - Variable elimination for arbitrary graphs.
   - Message Passing in a chain.

   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. Your code should be able to do following inferences.

   1. Marginal distribution of a single variable using variable elimination.
   2. Joint distribution of a set of variables using variable elimination.
   3. Conditional distributions of the following form : p(x|y) using variable elimination. Note that x and y are single variables and not a set.
   4. Marginal distribution of a single variable in chain using message passing.
   5. Joint distribution of a set of consecutive variables in a chain using message passing.
   6. Joint distribution of any two non-consecutive variables in a chain using message passing.
   7. Conditional distribution of the following form : p(x|y) using message passing in chain. Again x and y are single variable only.

   You have been provided with a sample graph network and a sample chain network. For the given sample chain network, report the following distributions.

   1. P(A), P(B), P(C), P(D)
   2. P(A,B), P(C,D), P(A,D)
   3. P(A|D)

   For the give graph network, report the following distributions.

1. P(J), P(A)
2. P(J,M)
3. P(B|J), P(E|A)

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.