

NAME:

COLLABORATOR(S): Please write down the names of your collaborators. If none, please write so. Otherwise, you'll be deducted 10 points. You need to write your own solutions.

CS480 – HOMEWORK 4

Assigned on: Thursday, 10/30/2014

Due: Sunday, 11/16/2014, 11:59pm

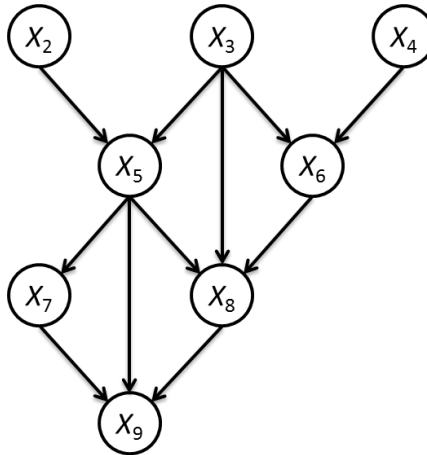
Please submit your solutions through blackboard assignment page.

1. We are given the following joint distribution for variables A, B, and C. Please compute the requested probabilities. Show each probability distribution as a table/vector. Feel free to use a calculator.

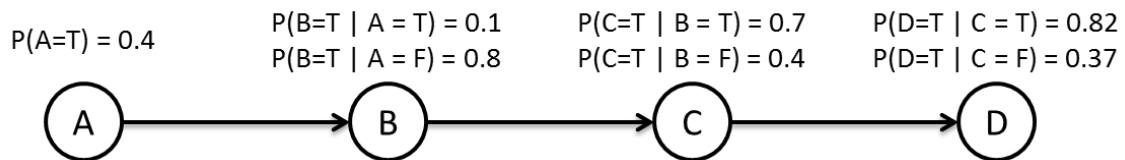
A	B	C	P(A, B, C)
T	T	T	0.014
T	T	F	0.126
T	F	T	0.012
T	F	F	0.048
F	T	T	0.392
F	T	F	0.168
F	F	T	0.144
F	F	F	0.096

- $P(A, C)$
 - $P(C)$
 - $P(A|C)$
 - $P(A, B | C)$
 - $P(B | A, C)$
2. We are given random variables X_2, X_3, \dots, X_n , where $n > 2$. (There is no X_1). Please answer the following questions.
- Assuming that all variables are binary, how many independent parameters are need to represent
 - $P(X_2)$?
 - $P(X_n)$?
 - $P(X_2, X_3, \dots, X_n)$?
 - $P(X_2 | X_3, \dots, X_n)$?
 - $P(X_2, X_3, \dots, X_{n-1} | X_n)$?
 - Assuming that the size of the domain of X_i is i for all $i \in \{2, 3, \dots, n\}$, how many independent parameters are need to represent
 - $P(X_2)$?
 - $P(X_n)$?
 - $P(X_2, X_3, \dots, X_n)$?
 - $P(X_2 | X_3, \dots, X_n)$?
 - $P(X_2, X_3, \dots, X_{n-1} | X_n)$?

3. We are given the following Bayesian network over X_2, X_3, \dots, X_9 . Note that there is no X_1 .



- What is the Bayesian network factorization of the joint $P(X_2, X_3, \dots, X_9)$?
 - Assume X_i can take i possible values (for e.g., X_2 is binary, X_3 can take on 3 possible values, ..., X_9 can take on 9 possible values)
 - What is the number of independent parameters required to represent the full joint using the naïve table representation? Show your work.
 - What is the number of independent parameters required for this network? Show your work.
 - For each of the following independence statements, indicate whether it is True or False.
 - $X_2 \perp X_3$
 - $X_2 \perp X_3 \mid X_8$
 - $X_2 \perp X_3 \mid X_6$
 - $X_2 \perp X_4 \mid X_9$
 - $X_7 \perp X_6$
4. We are given the following Bayesian network. Please compute the requested probabilities using variable elimination.



- $P(B)$
- $P(C \mid A=T)$
- $P(A, B \mid C=T, D=F)$.