

CS 8750: Artificial Intelligence II

Spring 2015

Programming assignment #1 (10 points)

1. Problem description

For this assignment, you may form teams with up to 3 members. Only one submission is required for each team.

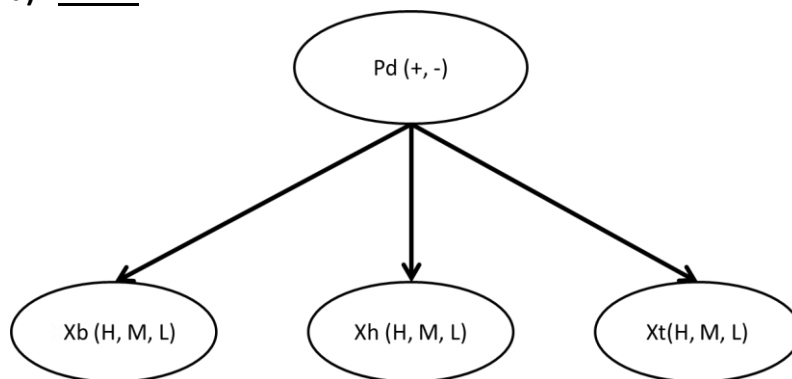
In this programming assignment, you are required to implement two Bayesian networks to answer questions of a person had a drink or not, given evidence of breathing rate, heart rate, skin temperature, and ambulation status. You may use any programming language.

There are 5 random variables:

- Pd: drink or not. Domain {+, -}
- Xb: breathing rate. Domain {H, M, L}
- Xh: heart rate. Domain {H, M, L}
- Xt: skin temperature. Domain {H, M, L}
- Xa: ambulation status. Domain { Fast, Slow, Stationary}

The structures and parameters of the two BNs and a list of 10 queries are as follows.

a) BN#1:



$P(Pd)$

+	0.13
-	0.87

$P(Xb|Pd)$

Drink	H	M	L
+	0.64	0.22	0.14
-	0.09	0.42	0.49

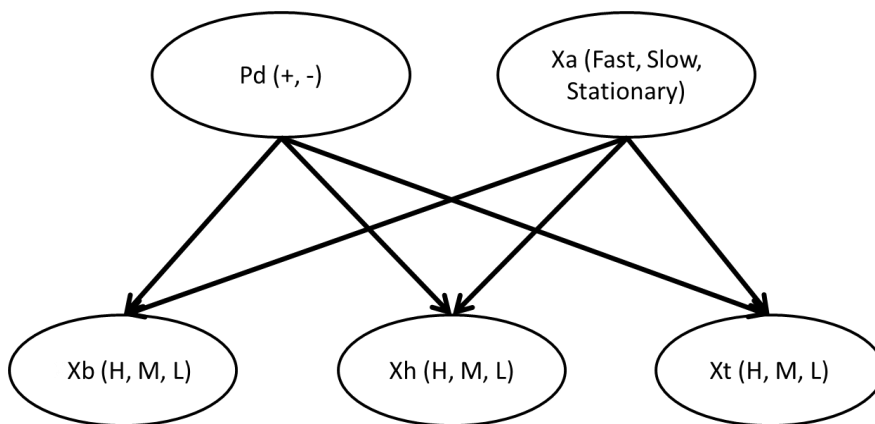
$P(Xh/Pd)$

Drink	H	M	L
+	0.54	0.31	0.15
-	0.12	0.42	0.46

$P(Xt/Pd)$

Drink	H	M	L
+	0.73	0.18	0.09
-	0.03	0.76	0.21

b) **BN#2:**



$P(Pd)$

+	0.13
-	0.87

$P(Xa)$

Fast	0.21
Slow	0.22
Stationary	0.57

$P(Xb/Pd, Xa)$

Drink	Ambulation	$P(Xb=H D, A)$	$P(Xb=M D, A)$	$P(Xb=L D, A)$
+	Fast	0.95	0.03	0.02
+	Slow	0.77	0.19	0.04
+	Stationary	0.71	0.2	0.09
-	Fast	0.87	0.11	0.02
-	Slow	0.14	0.74	0.12
-	Stationary	0.03	0.16	0.81

$P(X_h/P_d, X_a)$

Drink	Ambulation	$P(X_h=H D, A)$	$P(X_h=M D, A)$	$P(X_h=L D, A)$
+	Fast	0.97	0.02	0.01
+	Slow	0.76	0.2	0.04
+	Stationary	0.63	0.23	0.14
-	Fast	0.92	0.07	0.01
-	Slow	0.11	0.82	0.07
-	Stationary	0.07	0.08	0.85

$P(X_t/P_d, X_a)$

Drink	Ambulation	$P(X_t=H D, A)$	$P(X_t=M D, A)$	$P(X_t=L D, A)$
+	Fast	0.91	0.06	0.03
+	Slow	0.54	0.36	0.1
+	Stationary	0.49	0.38	0.13
-	Fast	0.74	0.18	0.08
-	Slow	0.21	0.47	0.32
-	Stationary	0.11	0.62	0.27

c) Queries:

ID	X_b	X_h	X_t	X_a	$P(P_d=+)$
1	H	H	H	Stationary	?
2	H	M	M	Fast	?
3	H	M	L	Slow	?
4	M	M	M	-	?
5	M	L	M	-	?
6	M	-	L	Slow	?
7	L	-	L	Fast	?
8	L	M	-	-	?
9	L	H	-	-	?
10	M	-	-	-	?

2. Submission requirement

Your submission is required to have the following 5 parts:

- 1) For each BN, the derivations of the formulas to answer the queries.
- 2) For each BN, the pseudocode of the algorithms to implement the formulas.
- 3) For each BN, your program code that implements the algorithm.
- 4) For each BN, execution results on all queries.
- 5) For each BN, a printout of Samlam's BN graph and solution for one query. You are recommended to use Samlam to check your program's answers, although it is not required.