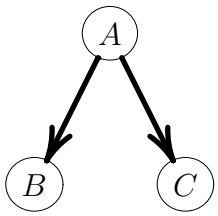
Advanced AI Techniques (WS05)

Exercise sheet 3

Deadline: 29.11.05

Exercise 1 (8 points)

Consider the following Bayes Net structure:



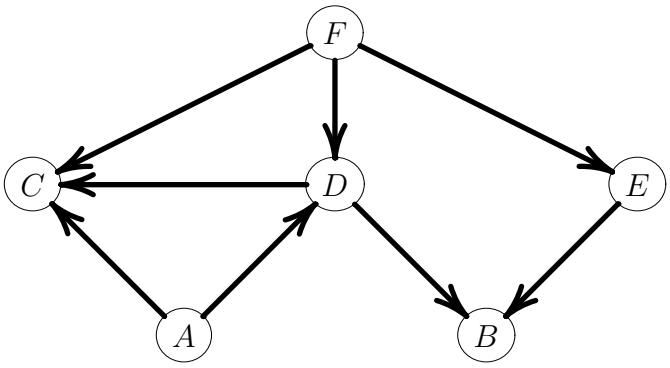
We want to learn the maximum likelihood parameters using the following training data:

case	A	B	C
1	*0*	*0*	*1*
2	*0*	*1*	.
3	*1*	*0*	*0*
4	*1*	.	*1*
5	*0*	*1*	*0*
6	*1*	.	*0*
7	*1*	*0*	*1*
8	.	*0*	*1*
9	*0*	*1*	.
10	.	*0*	*1*

Use the EM algorithm to compute the parameters. Initialize the first estimate using complete case analysis and go through the first two iterations of the algorithm (including the third M-step).

Exercise 2 (2 points)

Consider the following DAG G:



Give the DAG pattern representing the equivalence class of G (w.r.t markov equivalence).

Exercise 3 (8 points)

Apply the PC algorithm to generate a Bayesian Network from the following set of data over the variables A, B, C:

	A	B	C
1	0	0	0
2	0	0	1
3	0	0	0
4	0	0	0
5	0	1	1
6	1	0	0
7	1	0	1
8	1	0	1
9	1	1	1
10	1	0	1

1. *For the learn-structure-pc step, use the χ^2 test to determine the independence relations. Use a significance level of 10%, i.e. you should reject the null hypothesis of independency whenever the value of χ^2 is higher than the critical value of 2.70554.* [1]
   What is the number of degrees of freedom (and why)?

2. *Determine the V structure graph.*

[1] You find critical values e.g. under http://www.statsoft.com/textbook/sttable.html#chi