instance	N	%		MINOBSx		CaMML			
			% feasible	% sat	t	% feasible	% sat	t	
		10/5	100 / 100	100 / 100	0.1 / 0.1	100 / 100	100 / 100	4.0 / 3.9	
		25 / 10	100 / 100	100 / 100	0.1 / 0.0	100 / 96.7	100 / 98.9	4.1 / 4.0	
cancer	250	50 / 15	100 / 100	100 / 100	0.1 / 0.1	96.7 / 100	99.2 / 100	4.2 / 4.3	
		100 / 20	100 / 100	100 / 100	0.1 / 0.0	100 / 100	100 / 100	4.2 / 4.2	
5 variables		10/5	100 / 100	100 / 100	0.1 / 0.1	96.7 / 100	96.7 / 100	3.8 / 3.6	
10 parameters	1000	25 / 10	100 / 100	100 / 100	0.1 / 0.1	100 / 100	100 / 100	3.8 / 3.8	
•	1000	50 / 15	100 / 100	100 / 100	0.1 / 0.1	100 / 100	100 / 100	4.2 / 4.0	
		100 / 20	100 / 100	100 / 100	0.0 / 0.0	100 / 100	100 / 100	4.1 / 3.8	
		10/5	100 / 100	100 / 100	0.1 / 0.1	100 / 100	100 / 100	4.2 / 4.3	
	250	25 / 10	100 / 100	100 / 100	0.1 / 0.1	100 / 100	100 / 100	4.3 / 4.5	
earthquake	250	50 / 15	100 / 100	100 / 100	0.1 / 0.0	100 / 100	100 / 100	4.4 / 4.1	
•		100 / 20	100 / 100	100 / 100	0.1 / 0.0	100 / 100	100 / 100	4.5 / 4.1	
5 variables		10/5	100 / 100	100 / 100	0.1 / 0.1	100 / 100	100 / 100	3.8 / 3.9	
10 parameters	1000	25 / 10	100 / 100	100 / 100	0.1 / 0.1	100 / 100	100 / 100	3.8 / 3.9	
•	1000	50 / 15	100 / 100	100 / 100	0.1 / 0.0	100 / 100	100 / 100	4.0 / 3.8	
		100 / 20	100 / 100	100 / 100	0.0 / 0.0	100 / 100	100 / 100	4.3 / 4.0	
		10/5	100 / 100	100 / 100	0.2 / 0.1	100 / 100	100 / 100	4.7 / 4.6	
	250	25 / 10	100 / 100	100 / 100	0.3 / 0.1	100 / 100	100 / 100	5.0 / 4.6	
survey	250	50 / 15	100 / 100	100 / 100	0.2 / 0.1	93.3 / 96.7	99.0 / 99.4	4.9 / 4.4	
		100 / 20	100 / 100	100 / 100	0.1 / 0.1	100 / 100	100 / 100	4.9 / 4.4	
6 variables		10/5	100 / 100	100 / 100	0.1 / 0.1	96.7 / 96.7	98.3 / 98.9	4.3 / 4.2	
21 parameters	1000	25 / 10	100 / 100	100 / 100	0.2 / 0.1	96.7 / 96.7	99.17 / 99.3	4.6 / 4.4	
	1000	50 / 15	100 / 100	100 / 100	0.1 / 0.1	93.3 / 93.3	99.0 / 98.9	4.5 / 4.2	
		100 / 20	100 / 100	100 / 100	0.1 / 0.1	100 / 96.7	100 / 99.6	4.7 / 4.1	
		10/5	100 / 100	100 / 100	1.1 / 0.5	100 / 100	100 / 100	5.8 / 5.4	
	250	25 / 10	100 / 100	100 / 100	1.3 / 0.5	100 / 100	100 / 100	6.3 / 5.5	
asia	250	50 / 15	100 / 100	100 / 100	0.9 / 0.3	100 / 100	100 / 100	6.8 / 5.9	
		100 / 20	100 / 100	100 / 100	0.5 / 0.2	100 / 100	100 / 100	8.3 / 5.7	
8 variables		10 / 5	100 / 100	100 / 100	0.9 / 0.4	100 / 100	100 / 100	5.5 / 5.0	
18 parameters	1000	25 / 10	100 / 100	100 / 100	1.1 / 0.4	100 / 100	100 / 100	6.0 / 5.3	
	1000	50 / 15	100 / 100	100 / 100	0.7 / 0.3	100 / 96.7	100 / 99.7	6.3 / 5.6	
		100 / 20	100 / 100	100 / 100	0.4 / 0.2	100 / 100	100 / 100	7.3 / 5.6	
-		10/5	100 / 100	100 / 100	2.0 / 1.0	100 / 100	100 / 100	7.0 / 6.2	
	250	25 / 10	100 / 100	100 / 100	3.5 / 0.8	100 / 93.3	100 / 99.4	7.4 / 6.1	
sachs	250	50 / 15	100 / 100	100 / 100	4.3 / 0.8	100 / 100	100 / 100	8.4 / 6.4	
		100 / 20	100 / 100	100 / 100	2.3 / 0.7	16.7 / 100	96.2 / 100	10.3 / 6.1	
11 variables		10/5	100 / 100	100 / 100	1.6 / 1.0	80.0 / 83.3	93.3 / 97.2	6.2 / 5.9	
178 parameters	1000	25 / 10	100 / 100	100 / 100	2.5 / 0.8	30.0 / 60.0	87.8 / 94.8	7.2 / 6.0	
	1000	50 / 15	100 / 100	100 / 100	2.9 / 0.6	23.3 / 50.0	90.0 / 96.9	8.1 / 6.2	
		100 / 20	100 / 100	100 / 100	2.2 / 0.6	0 / 70.0	95.5 / 98.5	9.9 / 6.3	

Table 1: Results for small networks, with ancestral constraints only (first number in each pair) and with various constraints (second number in each pair). N is number of observations, % is the fixed percentage used to sample constraints, % feasible is the percentage of cases where the solution satisfied all constraints imposed, % sat is the percentage of satisfied constraints out of those constraints imposed, t is the running time required by the program. Highlighted cells indicate that not all constraints were able to be satisfied.

instance	N	%	Missing	Extra	Reversed	SID	Score (BDeu)
		0*	1.8	0.2	0.8	9.2	0%
		10 / 5	1.4 / 1.0	0.3 / 0.2	0.5 / 0.5	6.1 / 4.8	0.1% / 0.1%
	250	25 / 10	0.8 / 1.1	0.3 / 0.2	0.3 / 0.5	3.6 / 5.2	0.2% / 0.2%
cancer		50 / 15	0.7 / 0.6	0.5 / 0.3	0.3 / 0.3	3.3 / 3.3	0.3% / 0.3%
		100 / 20	0.2 / 0.8	0.3 / 0.2	0.0 / 0.3	0.5 / 4.0	0.4% / 0.2%
5 variables		0*	0.8	0.0	0.5	4.3	0%
10 parameters		10 / 5	0.7 / 0.6	0.1 / 0.0	0.5 / 0.4	4/3.1	0.0% / 0.0%
	1000	25 / 10	0.5 / 0.5	0.2 / 0.1	0.3 / 0.5	2.6 / 3.4	0.1% / 0.0%
		50 / 15	0.3 / 0.3	0.1 / 0.1	0.1 / 0.1	1.0 / 1.4	0.1% / 0.1%
		100 / 20	0.0 / 0.4	0.0 / 0.0	0.0 / 0.3	0 / 2.3	0.1% / 0.1%
		0*	0.8	1.0	1.5	8.7	0%
		10/5	0.6 / 0.4	1.0 / 1.0	0.6 / 0.3	4.2 / 2.7	0.2% / 0.3%
	250	25 / 10	0.4 / 0.6	0.9 / 1.0	0.2 / 0.5	1.7 / 3.9	0.3% / 0.3%
earthquake		50 / 15	0.4 / 0.3	1.2 / 1.1	0.3 / 0.2	1.9 / 2.3	0.5% / 0.7%
•		100 / 20	0.2 / 0.4	1.2 / 1.2	0.0 / 0.2	0.2 / 2.1	0.7% / 0.6%
5 variables		0*	0.0	0.5	0.3	1.5	0%
10 parameters		10/5	0.0 / 0.0	0.4 / 0.3	0.1 / 0.0	0.6 / 0	0.0% / 0.0%
•	1000	25 / 10	0.0 / 0.0	0.3 / 0.3	0.0 / 0.0	0 / 0.3	0.0% / 0.0%
		50 / 15	0.0 / 0.0	0.3 / 0.5	0.0 / 0.1	0 / 0.9	0.0% / 0.1%
		100 / 20	0.0 / 0.0	0.3 / 0.3	0.0 / 0.0	0/0	0.0% / 0.1%
		0*	4.5	0.0	0.5	15.5	0%
		10/5	3.6 / 3.1	0.8 / 0.4	0.6 / 0.6	13.1 / 12.2	0.4% / 0.4%
	250	25 / 10	2.8 / 2.8	1.4 / 0.2	0.5 / 0.1	11.7 / 8.9	0.7% / 0.5%
survey	230	50 / 15	2.4 / 2.8	1.5 / 0.6	0.5 / 0.1	9.1 / 9.7	1.0% / 0.7%
sarvey		100 / 20	2.5 / 2.1	2.0 / 0.7	0.0 / 0.3	6.2 / 8.0	1.2% / 1.0%
6 variables		0*	3.5	0.0	1.3	16.3	0%
21 parameters		10/5	2.8 / 2.3	1.0 / 0.4	1.3 / 1.1	15.9 / 13.5	0.1% / 0.1%
F	1000	25 / 10	2.7 / 2.5	1.1 / 0.3	0.3 / 0.3	10.1 / 8.3	0.1% / 0.1%
		50 / 15	2.6 / 2.5	1.4 / 0.6	0.2 / 0.2	8.2 / 8.7	0.2% / 0.2%
		100 / 20	2.7 / 1.7	1.8 / 0.5	0.0 / 0.4	6.8 / 8.5	0.2% / 0.3%
		0*	1.5	1.7	1.0	12.2	0%
		10/5	1.4 / 1.4	1.6 / 1.6	0.7 / 0.9	10.3 / 11.1	0.0% / 0.0%
	250	25 / 10	1.2 / 1.4	1.8 / 1.6	0.7 / 0.9	7.2 / 8.9	0.1% / 0.1%
asia	230	50 / 15	1.0 / 0.8	2.0 / 1.4	0.3 / 0.4	4.3 / 4.4	0.2% / 0.3%
asia		100 / 20	0.5 / 0.7	1.7 / 1.1	0.0 / 0.2	1.8 / 3.9	0.3% / 0.3%
8 variables		0*	0.8	0.3	1	9.0	0%
18 parameters		10/5	0.7 / 0.8	0.4 / 0.4	0.9 / 1.1	7.3 / 9.0	0.0% / 0.0%
10 parameters	1000	25 / 10	0.4 / 0.5	0.5 / 0.3	0.4 / 0.8	4.2 / 6.4	0.0% / 0.0%
	1000	50 / 15	0.2 / 0.3	0.4 / 0.4	0.0 / 0.5	0.4 / 3.6	0.0% / 0.0%
		100 / 20	0.0 / 0.2	0.3 / 0.3	0.0 / 0.4	0/3.1	0.0% / 0.0%
		0*			5.3	48.0	0%
			6.5	1.0			
	250	10 / 5 25 / 10	6.0 / 5.0	0.8 / 0.5	3.5 / 3.4	36.2 / 34.7	0.2% / 0.4%
sachs	250	50 / 15	5.5 / 4.5 4.9 / 3.9	0.6 / 0.3 0.3 / 0.2	2.6 / 1.7 1.4 / 1.5	33.4 / 24.8 24.5 / 22.0	0.3% / 0.6% 0.5% / 0.9%
saciis		100 / 20	3.2 / 3.5	0.3 / 0.2	0.0 / 0.8	15 / 16.2	0.5% / 0.9%
11 variables		0*	1.5	0.070.0	6.0	30.5	0.9% / 0.8%
178 parameters		10 / 5	1.3 / 1.1	0.0 / 0.0	4.1 / 3.7	22.2 / 20.7	0.0% / 0.0%
170 parameters	1000	25 / 10	1.3 / 1.1	0.0 / 0.0	3.4 / 1.8	20.7 / 13.8	0.0% / 0.0%
	1000	50 / 15	0.9 / 0.8	0.0 / 0.0	2.6 / 2.2	15.9 / 13.6	0.0% / 0.1%
		100 / 20	0.9 / 0.8	0.0 / 0.0	0.0 / 1.4	1.5 / 10.4	0.1% / 0.1%
		100720	0.570.5	0.070.0	0.071.4	1.5/10.4	0.1 /0 / 0.1 /0

Table 2: Results for small networks, with ancestral constraints only (first number in each pair) and with various constraints (second number in each pair). We report the number of missing arcs, extra arcs, reversed arcs, and the *structural intervention distance* (?) between the learned network and ground truth network. We also report the percentage difference between the BDeu score of the learned network and the baseline (0*% row) BDeu score of the optimal network when no side constraints are imposed.

Child	instance	N	%	MINOBSx			CaMML			
child 500 50/15 50/15 100/20 100/100 20 25/10 100/10				% feasible	% sat	t	% feasible	% sat	t	
Child			10/5	100 / 100	100 / 100	11.2 / 7.2	100 / 100	100 / 100	66.8 / 58.4	
child 90/15 100/100 100/100 37.8/4.1 100/100 1		500	25 / 10	100 / 100	100 / 100	29.9 / 7.3	100 / 100	100 / 100	86.0 / 62.4	
200	child	500	50 / 15	100 / 100	100 / 100	37.8 / 4.1	100 / 100	100 / 100	120.6 / 64.6	
200			100 / 20	100 / 100	100 / 100	26.1 / 5.1	66.7 / 100	99.5 / 100	197.6 / 64.6	
230 parameters	20 variables		10/5	100 / 100	100 / 100	9.4 / 6.7		100 / 100	61.0 / 55.1	
100	230 parameters	2000		100 / 100	100 / 100	19.1 / 6.0	100 / 100	100 / 100		
100/ 20	1	2000			1			1		
Insurance			100 / 20	100 / 100	100 / 100		100 / 100	100 / 100		
Insurance			10 / 5	100 / 100	100 / 100	180.5 / 104.9	50.0 / 70.0	95.9 / 99.0	439.5 / 325.3	
Insurance		500	25 / 10	100 / 100	100 / 100	318.9 / 56.5	56.7 / 50.0	98.0 / 98.9	723.9 / 385.0	
27 variables 2000	insurance	300	50 / 15	100 / 100	100 / 100	328.7 / 52.8	30.0 / 33.3	98.5 / 98.1	1165.6 / 485.2	
27 variables 2000			100 / 20	100 / 100	100 / 100	292.5 / 37.4	0 / 53.3	98.1 / 99.6	2052.3 / 571.7	
Martial Mart	27 variables		10/5	100 / 100	100 / 100	124.0 / 88.3	0 / 53.3	78.8 / 98.1	438.5 / 309.8	
100/20	984 parameters	2000	25 / 10	100 / 100	100 / 100	236.3 / 49.6	16.7 / 23.3	92.4 / 96.8	748.6 / 393.2	
water 1000 25/10 100/100 25/10 100/100 100/100 100/100 987.1/265.2 860.743.3 99.3/100 100/3.3 99.3/100/3.3 99.3/100/3.3 99.3/100/3.3 99.3/100/3.3 99.3/100/3.3 99.3/100/3.3 99.3/100/3.3 99	-	2000	50 / 15	100 / 100	100 / 100	251.5 / 48.2	3.3 / 10.0	94.4 / 96.6	1175.2 / 487.9	
water 100/5 25/10 100/100 100/100 100/100 100/100 987.1/265.2 80.0/43.3 99.3/100 100/3.3 99.3/100/3.3 99.3/100/3.3 99.3/100/3.3 99.3/100/3.3 99.3/100/3.3 99.3/100/3. 99.3/100 100/3. 99.3/100 100/3.3 99.3/100 100/3.3 99.3/			100 / 20	100 / 100	100 / 100	233.1 / 33.4	0 / 10.0	95.6 / 98.8	1956.8 / 571.1	
water 1000 25 / 10 50 / 15 50 / 15 100 / 100 100 / 100 100 / 100 1083.2 / 166.0 1083.2 / 166.0 1083.2 / 166.0 1683.2 / 166.0 1683.2 / 166.0 1683.2 / 166.0 1683.2 / 166.0 1683.2 / 166.0 1683.2 / 166.0 1683.2 / 166.0 1683.2 / 166.0 1683.2 / 166.0 1683.2 / 166.0 1683.2 / 166.0 1683.2 / 166.0 1683.2 / 166.0 1683.2 / 166.0 1683.2 / 166.0 1683.2 / 166.0 1683.2 / 166.0 1683.2 / 166.0 1683.2 / 168.0 168.2 / 167.3 / 16										
water 1000 50 / 15 100 / 100										
32 variables 100 / 20	water	1000			I					
10/5	water				1					
10083 parameters	32 variables									
Mildew										
mildew 100 / 20 100 / 100 100 / 100 934.6 / 62.0 0 / 0 98.5 / 97.6 15341.1 / 4210.0 mildew 10 / 5 100 / 100 100 / 100 193.8 / 754.7 0 / 0 26.9 / 75.6 2134.2 / 1442.0 mildew 25 / 10 100 / 100 100 / 100 632.1 / 334.2 0 / 0 29.4 / 86.5 3906.5 / 1835.7 35 variables 100 / 20 100 / 100 100 / 100 100 / 100 100 / 20 100 / 20 100 / 20 20.0 / 33.3 (-1.2215.0 0 / 0 44.4 / 89.8 12649.3 / 2572.5 35.3 (-1.2215.0 0 / 0 44.4 / 89.8 12649.3 / 2572.5 35.9 (-1.215.0) 0 / 0 19.4 / 77.8 2553.9 / 1664.6 46.6 471.6 / 266.2 0 / 0 19.4 / 87.7 4763.4 / 1983.3 35.0 / 15 / 100 / 100 100 / 100 100 / 100 471.6 / 266.2 0 / 0 19.4 / 87.7 4763.4 / 1983.3 35.0 / 15 / 100 / 100 100 / 100 701.0 / 264.8 0 / 0 28.2 / 92.3 17148.3 / 2400.38 36.6 / 2462.6 100 / 20 100 / 100 100 / 100 100 / 264.8 0 / 0 28.7 / 90.0 99.5 / 9	10065 parameters	4000			1					
mildew 10/5 25/10 100/100 100/100 100/100 100/100 632.1/334.2 0/0 26.9/75.6 2134.2/1442.0 2134.2/1442.0 35 variables 540150 parameters 10/5 100/100 100				11	1					
mildew 8000 25 / 10 100 / 100 100 / 100 100 / 100 943.3 / 321.0 0 / 0 40.3 / 88.2 7336.1 / 2215.0 7336.1 / 2215.0 100 / 20 100 / 100 100 / 100 100 / 100 1085.4 / 309.7 0 / 0 54.4 / 89.8 12649.3 / 2572.5 100 / 100 / 100 100 / 100 100 / 100 181.6 / 353.0 0 / 0 19.4 / 77.8 2553.9 / 1664.6 471.6 / 266.2 0 / 0 19.4 / 87.7 4763.4 / 1983.3 4763.4 / 1983.3 477.5 4763.4 / 1983.3 477.5 4763.4 / 1983.3 48 variables alarm 100 / 5 100 /				l						
mildew 8000 100 / 100					I					
100 / 20		8000			1					
35 variables 32000 25 / 10 100 / 100 100 / 100 181.6 / 353.0 0 / 0 19.4 / 77.8 2553.9 / 1664.6 0 / 0 19.4 / 77.8 2553.9 / 1664.6 0 / 0 19.4 / 87.7 4763.4 / 1983.3 0 / 0 24.0 / 88.0 8546.6 / 2462.6 0 / 0 24.0 / 88.0 8546.6 / 2462.6 0 / 0 24.0 / 88.0 8546.6 / 2462.6 0 / 0 28.2 / 92.3 17148.3 / 2400.38 0 / 0 28.2 / 92.3 17148.3 / 2400.38 0 / 0 28.2 / 92.3 17148.3 / 2400.38 0 / 0 28.2 / 92.3 17148.3 / 2400.38 0 / 0 28.2 / 92.3 17148.3 / 2400.38 0 / 0 28.2 / 92.3 17148.3 / 2400.38 0 / 0 28.2 / 92.3 17148.3 / 2400.38 0 / 0 28.2 / 92.3 17148.3 / 2400.38 0 / 0 / 0 / 0 / 0 / 0 / 0 / 0 / 0 / 0	illidew				1					
540150 parameters 32000 25 / 10 / 50 / 15 / 100 / 1	25				1					
alarm 50/15 100/20 100/100 100/100 100/100 702.2/210.2 761.0/264.8 0/0 24.0/88.0 28.2/92.3 8546.6/2462.6 2462.6 240.38 alarm 1006 25/10 100/100 25/10 100/100 100/100 100/100 100/100 100/100 1893.2/316.9 76.7/90.0 99.5/99.9 4070.2/2019.4 4070.2					1					
100 / 20	540150 parameters	32000			1					
alarm 1000 10 / 5 25 / 10 100 / 100 100 / 100 100 / 100 1893.2 / 316.9 100 / 100 100 / 100 1627.7 / 185.1 100 / 20 100 / 100 100 / 100 1207.2 / 147.3 100 100 100 100 100 100 100 100 100 10								1		
alarm 1000 25/10 50/15 100/100 100/100 100/100 1627.7/185.1 73.3/100 99.5/99.9 4070.2/2019.4 6753.0/2263.7 100/20 100/100 100/100 1207.2/147.3 83.3/100 99.5/100 6753.0/2263.7 100/20 100/100 100/100 1207.2/147.3 83.3/100 99.9/100 12377.2/2692.7 100/20 100/100 100/100 1336.8/224.7 86.7/86.7 99.3/99.9 3807.8/1988.3 100/20 100/100 100/100 1438.2/133.3 90.0/100 99.8/100 6268.1/2163.7 100/20 100/100 100/100 1195.6/116.5 50.0/80.0 99.0/99.8 11169.0/2581.8 1100/20 100/100 100/100 100/100 12321.4/5866.8 0/0 70.3/89.3 19824.8/11666.1 100/20 100/20 100/100 100/100 7163.0/3518.9 0/0 73.9/95.0 70433.0/20339.2 114005 parameters barley 10/5 100/20 100/100 100/100 100/100 100/100 7246.6/1806.3 0/0 80.9/96.3 114036.7/22366.9 114005 parameters 10/5 100/100 100/100 100/100 4761.1/6032.7 0/0 44.0/82.8 18092.6/10759.6 114005 parameters 8000 25/10 50/15 100/100 100/100 100/100 100/100 5137.8/3022.8 0/0 54.0/95.1 64893.5/18142.0 100/95.1				l						
alarm 1000 50/15 100/100 100/100 1627.7/185.1 73.3/100 99.5/100 6753.0/2263.7 37 variables 100/20 100/100 100/100 1207.2/147.3 83.3/100 99.5/100 6753.0/2263.7 509 parameters 10/5 100/100 100/100 602.3/115.3 70.0/83.3 97.2/99.7 2314.6/1705.3 509 parameters 25/10 100/100 100/100 1336.8/224.7 86.7/86.7 99.3/99.9 3807.8/1988.3 50/15 100/20 100/100 100/100 1438.2/133.3 90.0/100 99.8/100 6268.1/2163.7 100/20 100/100 100/100 1195.6/116.5 50.0/80.0 99.0/99.8 11169.0/2581.8 barley 25/10 100/100 100/100 2321.4/5866.8 0/0 70.3/89.3 19824.8/11666.1 50/15 100/100 100/100 7163.0/3518.9 0/0 73.9/95.0 70433.0/20339.2 48 variables 10/5 100/100 100/100 4761.1/6032.7 0/0 44.0/82.8 18092.6/10					I					
alarm 50/15 100/100 100/100 1627.7/185.1 73.3/100 99.5/100 6753.0/2263.7 37 variables 100/20 100/100 100/100 1207.2/147.3 83.3/100 99.5/100 6753.0/2263.7 509 parameters 4000 10/5 100/100 100/100 100/100 1336.8/224.7 70.0/83.3 97.2/99.7 2314.6/1705.3 509 parameters 50/15 100/100 100/100 1336.8/224.7 86.7/86.7 99.3/99.9 3807.8/1988.3 100/20 100/100 100/100 100/100 1195.6/116.5 50.0/80.0 99.0/99.8 11169.0/2581.8 100/20 25/10 100/100 100/100 2321.4/5866.8 0/0 70.3/89.3 19824.8/11666.1 50/15 100/100 100/100 4228.9/2941.3 0/0 74.4/93.6 37034.3/14864.9 48 variables 100/2 100/100 100/100 7246.6/1806.3 0/0 73.9/95.0 70433.0/22366.9 48 variables 10/5 100/100 100/100 4761.1/6032.7 0/		1000								
37 variables 509 parameters 4000 100/100 100/100 100/100 1336.8/224.7 86.7/86.7 99.3/99.9 3807.8/1988.3 90.0/100 99.8/100 6268.1/2163.7 100/20 100/100 100/100 1195.6/116.5 50.0/80.0 99.0/99.8 11169.0/2581.8 100/2581.8 100/20 100/10	alarm	1000			I					
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barley 100/20 100/100 100/100 1438.2/133.3 90.0/100 99.8/100 6268.1/2163.7 barley 10/5 100/100 100/100 2321.4/5866.8 0/0 70.3/89.3 19824.8/11666.1 10/5 100/100 100/100 4228.9/2941.3 0/0 74.4/93.6 37034.3/14864.9 48 variables 100/20 100/100 100/100 7246.6/1806.3 0/0 80.9/96.3 114036.7/22366.9 114005 parameters 8000 25/10 100/100 100/100 4063.8/3620.0 0/0 52.5/91.8 35308.3/14477.5 64893.5/18142.0 50/15 100/100 100/100 5137.8/3022.8 0/0 54.0/95.1 64893.5/18142.0					1					
barley 10/5 (50/15) 100/100 100/100 100/100 100/100 100/100 138.2/133.3 (50.0/80.0) 99.8/100 (99.8/100) 6268.1/2163.7 (50.0/80.0) barley 10/5 (50/15) 100/100 100/10	509 parameters	4000			I	1336.8 / 224.7	86.7 / 86.7	99.3 / 99.9	3807.8 / 1988.3	
barley 10/5 (25/10) (50/15) (100/100		1000		100 / 100	100 / 100	1438.2 / 133.3	90.0 / 100	99.8 / 100	6268.1 / 2163.7	
barley 2000 25 / 10 50 / 15 100 / 100 100 / 100 100 / 100 100 / 100 4228.9 / 2941.3 7163.0 / 3518.9 70433.0 / 20339.2 70433.0 / 203399.2 70433.0 / 203399.2 70433.0 / 203399.2 70433.0 / 203399.2 70433.0 / 20339			100 / 20	100 / 100	100 / 100	1195.6 / 116.5	50.0 / 80.0	99.0 / 99.8	11169.0 / 2581.8	
barley 50/15 100/20 100/100 100/100 100/100 100/100 7163.0/3518.9 7246.6/1806.3 0/0 0/0 73.9/95.0 80.9/96.3 70433.0/20339.2 114036.7/22366.9 48 variables 114005 parameters 10/5 25/10 100/100 100/100 100/100 100/100 4761.1/6032.7 406.8/3620.0 50/15 0/0 44.0/82.8 18092.6/10759.6 100/0 18092.6/10759.6 5137.8/3022.8 0/0 52.5/91.8 54.0/95.1 35308.3/14477.5 64893.5/18142.0				100 / 100		2321.4 / 5866.8		70.3 / 89.3	19824.8 / 11666.1	
barley 50/15 100/100 100/100 7163.0/3518.9 0/0 73.9/95.0 70433.0/20339.2 48 variables 10/5 100/100 100/100 4761.1/6032.7 0/0 80.9/96.3 114036.7/22366.9 114005 parameters 25/10 100/100 100/100 4063.8/3620.0 0/0 52.5/91.8 35308.3/14477.5 50/15 100/100 100/100 5137.8/3022.8 0/0 54.0/95.1 64893.5/18142.0		2000			I	4228.9 / 2941.3			37034.3 / 14864.9	
48 variables 114005 parameters 8000 10/5 100/100 100/100 100/100 4761.1/6032.7 0/0 44.0/82.8 18092.6/10759.6 100/100 100/100 100/100 4063.8/3620.0 50/15 100/100 100/100 5137.8/3022.8 0/0 44.0/82.8 18092.6/10759.6 52.5/91.8 35308.3/14477.5	barley	2000	50 / 15	100 / 100		7163.0 / 3518.9	0/0	73.9 / 95.0	70433.0 / 20339.2	
114005 parameters 8000 25 / 10 100 / 100 100 / 100 4063.8 / 3620.0 0 0 52.5 / 91.8 35308.3 / 14477.5 64893.5 / 18142.0			100 / 20	100 / 100	100 / 100	7246.6 / 1806.3	0/0	80.9 / 96.3	114036.7 / 22366.9	
8000 50 / 15 100 / 100 100 / 100 5137.8 / 3022.8 0 / 0 54.0 / 95.1 64893.5 / 18142.0	48 variables		10 / 5	100 / 100	100 / 100	4761.1 / 6032.7	0/0	44.0 / 82.8	18092.6 / 10759.6	
50/15 100/100 100/100 5137.8/3022.8 0/0 54.0/95.1 64893.5/18142.0	114005 parameters	8000	25 / 10	100 / 100	100 / 100	4063.8 / 3620.0	0/0	52.5 / 91.8	35308.3 / 14477.5	
	•	8000	50 / 15	100 / 100	100 / 100	5137.8 / 3022.8	0/0	54.0 / 95.1	64893.5 / 18142.0	
			100 / 20	100 / 100		5675.6 / 1638.8	0/0	53.4 / 95.1	111338.4 / 21184.4	

Table 3: Results for medium networks, with ancestral constraints only (first number in each pair) and with various constraints (second number in each pair).

instance	N	%	Missing	Extra	Reversed	SID	Score (BDeu)
		0*	5.3	1.0	3.0	115.7	0%
		10/5	4.8 / 4.8	1.1 / 0.8	1.9 / 1.3	91.4 / 82.6	0.1% / 0.2%
	500	25 / 10	4.7 / 4.3	1.9 / 1.6	1.6 / 1.8	93.9 / 79.4	0.2% / 0.3%
child		50 / 15	3.9 / 4.2	1.4 / 1.2	1.7 / 0.7	76.1 / 69.9	0.3% / 0.4%
		100 / 20	2.2 / 3.6	2.2 / 0.8	0.0 / 0.3	35.8 / 57.6	0.9% / 0.4%
20 variables		0*	1.7	0.2	3.5	79.2	0%
230 parameters		10/5	1.5 / 1.3	0.2 / 0.2	0.5 / 0.1	26.0 / 20.8	0.0% / 0.0%
	2000	25 / 10	0.7 / 1.0	0.3 / 0.3	0.3 / 0.5	12.1 / 18.0	0.0% / 0.0%
		50 / 15	0.7 / 1.0	0.3 / 0.3	0.5 / 0.0	12.2 / 16.2	0.0% / 0.0%
		100 / 20	0.2 / 1.0	0.3 / 0.1	0.0 / 0.0	2.5 / 16.6	0.1% / 0.0%
		0*	18.8	4.0	2.8	348.2	0%
		10/5	18.4 / 17.3	5.5 / 5.2	2.5 / 2.6	345.1 / 341.4	0.2% / 0.4%
	500	25 / 10	17.6 / 17.0	6.5 / 4.9	2.5 / 1.8	326.8 / 315.8	0.5% / 1.3%
insurance		50 / 15	17.2 / 14.4	6.9 / 5.7	2.0 / 1.2	321.6 / 276.4	0.6% / 1.4%
		100 / 20	17.3 / 12.9	10.8 / 5.8	0.0 / 1.4	282.0 / 261.8	1.6% / 2.3%
27 variables		0*	9.8	1.7	3.7	264.7	0%
984 parameters		10/5	9.9 / 10.0	3.1 / 2.6	2.7 / 2.5	235.7 / 235.0	0.1% / 0.1%
	2000	25 / 10	9.8 / 9.8	4.2 / 2.2	2.4 / 1.8	230.6 / 223.2	0.2% / 0.9%
		50 / 15	9.9 / 8.9	4.2 / 3.3	2.1 / 1.2	223.8 / 191.4	0.2% / 0.4%
		100 / 20	8.3 / 8.1	5.8 / 3.2	0.0 / 0.5	144.2 / 155.4	0.5% / 0.8%
		0*	38.3	21.5	5.7	439.5	0%
		10/5	38.1 / 35.6	19.3 / 16.6	5.6 / 4.8	434.4 / 426.1	0.1% / 0.2%
	1000	25 / 10	37.3 / 33.1	19.8 / 16.5	4.3 / 3.7	446.5 / 415.1	0.2% / 0.9%
water		50 / 15	35.9 / 30.8	18.5 / 15.4	2.9 / 2.3	420.3 / 381.0	0.4% / 0.8%
22		100 / 20	36.3 / 28.9	20.3 / 14.6	0.0 / 1.7	359.8 / 365.1	0.6% / 0.9%
32 variables		0*	33.2	18.0	5.2	434.3	0%
10083 parameters	4000	10/5	31.8 / 30.8	14.8 / 14.2	5.0 / 4.7	428.6 / 421.4	0.0% / 0.1%
	4000	25 / 10 50 / 15	30.8 / 27.9 30.0 / 26.1	15.5 / 14.4 15.6 / 13.1	3.4 / 3.9 2.5 / 1.7	417.9 / 396.4	0.1% / 0.5% 0.2% / 0.3%
		100 / 20	30.0 / 20.1	19.3 / 12.7	0.0 / 1.6	390.2 / 348.1 343.7 / 347.9	0.2% / 0.3%
		0* 10/5	14.2 15.0 / 15.1	2.0 8.6 / 8.1	7.5 5.6 / 5.6	448.7 410.7 / 408.4	0% 0.5% / 1.1%
	8000	25 / 10	15.1 / 14.0	13.2 / 9.2	5.5 / 2.8	405.7 / 304.0	1.4% / 1.7%
mildew	8000	50 / 15	11.6 / 13.8	11.2 / 9.5	2.1 / 2.3	256.3 / 303.8	1.7% / 2.8%
minue "		100 / 20	9.0 / 10.6	9.2 / 8.7	0.0 / 2.0	145 / 212.6	2.3% / 3.9%
35 variables		0*	6.3	5.0	7.3	317.1	0%
540150 parameters		10/5	7.1 / 8.4	5.9 / 5.1	6.0 / 4.5	277.5 / 233.6	0.0% / 0.1%
ī	32000	25 / 10	6.6 / 7.5	5.7 / 4.1	4.9 / 1.5	244.1 / 140.2	0.0% / 0.3%
		50 / 15	7.7 / 8.6	7.4 / 5.5	2.6 / 1.1	202.8 / 153.7	0.1% / 0.7%
		100 / 20	7.5 / 7.3	7.8 / 6.1	0.0 / 1.2	122.3 / 141.9	0.2% / 0.7%
		0*	2.2	5.8	1.3	45.7	0%
		10/5	2.0 / 1.6	6.2 / 5.5	1.1 / 1.6	34.7 / 46.4	0.0% / 0.1%
	1000	25 / 10	2.0 / 1.8	6.3 / 5.4	0.7 / 0.8	27.7 / 32.2	0.1% / 0.1%
alarm		50 / 15	2.0 / 1.5	6.1 / 5.0	0.3 / 0.6	22.4 / 27.7	0.1% / 0.2%
		100 / 20	2.0 / 1.5	6.2 / 4.4	0.0 / 0.1	18.0 / 18.3	0.1% / 0.2%
37 variables		0*	2.0	3.2	1.8	39.5	0%
509 parameters		10/5	2.0 / 1.6	4.6 / 4.5	0.6 / 1.2	24.9 / 38.8	0.0% / 0.0%
	4000	25 / 10	2.0 / 1.8	4.5 / 4.3	0.3 / 0.6	20.1 / 28.0	0.0% / 0.0%
		50 / 15	2.0 / 1.5	4.1 / 4.2	0.0 / 0.4	18.0 / 22.3	0.0% / 0.1%
		100 / 20	1.7 / 1.4	4.2 / 3.7	0.0 / 0.3	12.3 / 20.4	0.0% / 0.1%
		0*	32.3	8.2	9.7	949.5	0%
		10/5	33.3 / 31.7	14.4 / 12.2	5.1 / 4.4	792.9 / 756.7	0.6% / 1.4%
1 . 1	2000	25 / 10	31.9 / 31.0	15.6 / 13.8	5.3 / 4.8	802.6 / 741.5	0.9% / 1.7%
barley		50 / 15	31.0 / 27.5	17.4 / 11.3	3.0 / 3.2	699.4 / 666.9	1.4% / 2.9%
48 variables		100 / 20	30.2 / 26.4	19.5 / 11.8	0.0 / 1.5	619.3 / 628.1	2.4% / 3.9%
		0*	25.5	3.7	9.7	794.7	0%
114005 parameters	8000	10/5	25.6 / 24.6	8.9 / 8.0	5.3 / 5.2	636.6 / 625.4	0.3% / 0.8%
	8000	25 / 10 50 / 15	25.0 / 24.0 22.1 / 20.5	10.4 / 8.8	5.5 / 4.3 3.3 / 1.9	644.4 / 584.7 541.7 / 487.4	0.4% / 0.9% 0.6% / 1.4%
		100 / 20	20.8 / 19.3	9.2 / 7.6 12.0 / 7.0	0.0 / 1.6	457.2 / 507.2	0.9% / 1.8%
	I	100720	20.0717.3	12.077.0	0.071.0	137.27 307.2	0.57671.676

Table 4: Results for medium networks, with ancestral constraints only (first number in each pair) and with various constraints (second number in each pair).