Inference for SRL

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Chapter 1

Probabilistic Inference Using Weighted Model Counting

1.1

1.1.1 ENC 1

For our conversion from the cancer bayesian network to ENC1 please look at 2.1 in our appendix.

1.1.2 ENC 2

As for ENC1 please look at 2.2 in our appendix.

1.2

The CNF of the monty hall problem is given in image 1

```
CNF:
select_door(1)
∧ win_keep ∨ -prize(1)
∧ -win_keep ∨ prize(1)
∧ open_door(2) ∨ prize(2) ∨ -prize(3)
∧ -open_door(2) ∨ -prize(2)
∧ -open_door(2) ∨ prize(3)
∧ open_door(3) ∨ prize(3) ∨ -prize(2)
∧ -open_door(3) ∨ -prize(3)
∧ -open_door(3) ∨ prize(2)
∧ win_switch ∨ -prize(2) ∨ open_door(2)
∧ win_switch ∨ -prize(3) ∨ open_door(3)
∧ -win_switch ∨ prize(2) ∨ prize(3)
∧ -win_switch ∨ prize(2) ∨ -open_door(3)
∧ -win_switch ∨ -open_door(2) ∨ prize(3)
∧ -win_switch ∨ -open_door(2) ∨ -open_door(3)
Queries:
query(prize(1))
query(prize(2))
query(prize(3))
query(select_door(1))
query(win_keep)
query(win_switch)
```

Figure 1.1: Grounded problog cnf

TODO WEIGHTS

1.3

1.3.1

We will use minic2d and Cachet as WMC counters.

minic2d

minic2d needs to use the $-W$ option to do weighted model counting.

- ENC1:

```
Constructing CNF... DONE
CNF stats:
  Vars=30 / Clauses=74
  CNF Time      0.000s
Constructing vtree (from primal graph)... DONE
Vtree stats:
  Vtree widths: con<=5, c_con=40 v_con=5
  Vtree Time    0.003s
Counting... DONE
  Learned clauses       0
Cache stats:
  hit rate      16.7%
  lookups       12
  ent count     10
  ent memory    0.5 KB
  ht  memory    152.6 MB
  clists        1.0 ave, 1 max
  keys          4.2b ave, 6.0b max, 3.0b min
Count stats:
  Count Time    0.000s
  Count/Probability     1.00000
Total Time: 0.128s
```

Figure 1.2: Grounded problog cnf

- ENC2:

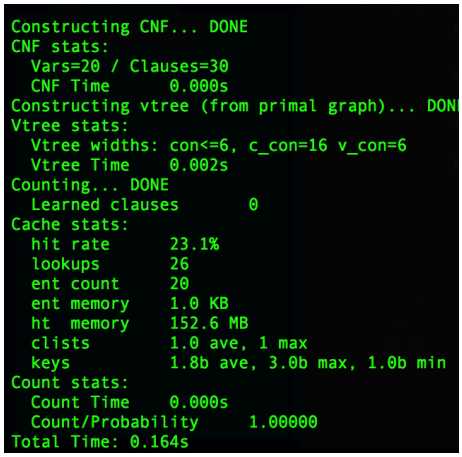

Figure 1.3: Grounded problog cnf

- Prolog first:

Cachet

- ENC1:

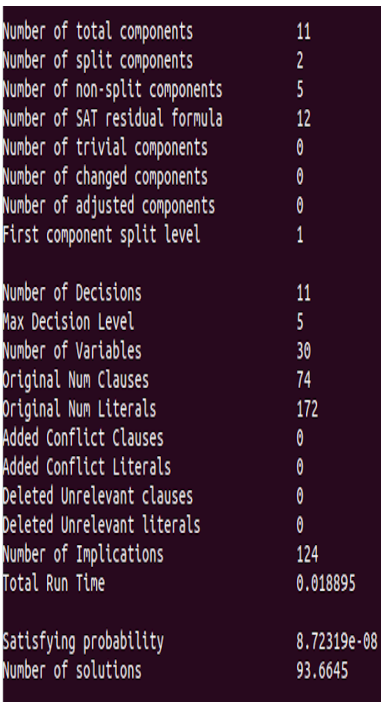

Figure 1.4: Grounded problog cnf

- ENC2:

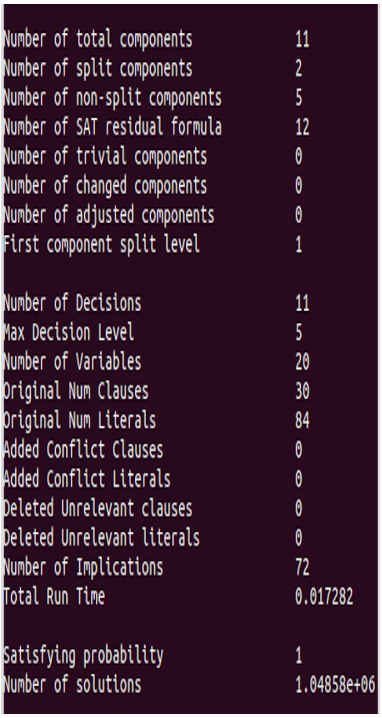

Figure 1.5: Grounded problog cnf

- Prolog first:

For ENC1 we see that with Cachet we get a satisfying probability of almost 0. This is due to the fact that with ENC1 all our negative literals have a weight of 1, while Cachet expects that a literal + its negation = 1.

1.3.2. Difference between the used WMC's

minic2d Vs Cachet

Minic2d and Cachet are both weighted model counters but how to do this is quite different. Minic2d is a top down compiler that compiles CNF's into a SDD which results in a faster system but it also uses less space while Cachet is an algorithm that uses formula caching together with clause learning and component analysis. Minic2d needs vtree's to be able to compile the CNF's into an SDD. TThey, however, both use things from the SAT literature. They both use clause learning and component caching as to be able to reuse components that later appear again in the search. Cachet on the other hand also uses some other things from SAT literature like an explicit on the fly calculation of connected components. This is different in minic2d as it uses a vtree to identify disconnected CNF components.

[1] [2]

1.3.3 Overview of computational requirements

All the tests can be found in the test folder. We used our scripts to create the dimac files. The input files for our enc1 and enc2 converter ard ".dsc" files which can be found at

`http://www.bnlearn.com/bnrepository/discrete-small.html#cancer`.

Test 1: Cancer network

Table 1.1: My caption

	ENC1			ENC2		
	Prob	**Memory**	**Runtime**	**Prob**	**Memory**	**Runtime**
Minic2d	1.0	0.2 KB	0.155s	1.0	1.0 KB	0.000s
Cachet	val1	val2	a	b	val3	val4

Test 2: asia network

Table 1.2: My caption

	ENC1			ENC2		
	Prob	**Memory**	**Runtime**	**Prob**	**Memory**	**Runtime**
Minic2d	1.0	0.9 KB	0.145s	1.0	2.0 KB	0.139s
Cachet	val1	val2	a	b	val3	val4

Test 3: sachs network

Table 1.3: My caption

	ENC1			ENC2		
	Prob	**Memory**	**Runtime**	**Prob**	**Memory**	**Runtime**
Minic2d	0.99707	14.3 KB	0.184s	1.0	14.5 KB	0.154s
Cachet	val1	val2	a	b	val3	val4

Test 4: earthquake network

Table 1.4: My caption

	ENC1			ENC2		
	Prob	**Memory**	**Runtime**	**Prob**	**Memory**	**Runtime**
Minic2d	1.0	0.6 KB	0.137s	1.0	1.0 KB	0.153s
Cachet	val1	val2	a	b	val3	val4

Test 5: survey network

Table 1.5: My caption

	ENC1			ENC2		
	Prob	**Memory**	**Runtime**	**Prob**	**Memory**	**Runtime**
Minic2d	1.0	1.6 KB	0.125s	1.0	2.0 KB	0.125s
Cachet	val1	val2	a	b	val3	val4

Test 6: alarm network

Table 1.6: My caption

	ENC1			ENC2		
	Prob	**Memory**	**Runtime**	**Prob**	**Memory**	**Runtime**
Minic2d	1.0	959.7KB KB	0.268s	1.0	139KB	0.095s
Cachet	val1	val2	a	b	val3	val4

Test 6: andes network

Table 1.7: My caption

	ENC1			ENC2		
	Prob	**Memory**	**Runtime**	**Prob**	**Memory**	**Runtime**
Minic2d	1.0	2.7GB	122.78s	1.0	139KB	0.095s
Cachet	val1	val2	a	b	val3	val4

1.4 Knowledge compilation

Chapter 2

Appendix

2.1 ENC1

Indicator clauses:

$$(\neg\, \lambda_{PollutionLow} \vee \neg\, \lambda_{PollutionHigh}) \wedge (\lambda_{PollutionLow} \vee \lambda_{PollutionHigh}) \wedge (\neg\, \lambda_{SmokerTrue} \vee \neg\, \lambda_{SmokerFalse}) \wedge (\lambda_{SmokerTrue} \vee \lambda_{SmokerFalse}) \wedge (\neg\, \lambda_{CancerTrue} \vee \neg\, \lambda_{CancerFalse}) \wedge (\lambda_{CancerTrue} \vee \lambda_{CancerFalse}) \wedge (\neg\, \lambda_{XrayPositive} \vee \neg\, \lambda_{XrayNegative}) \wedge (\lambda_{XrayPositive} \vee \lambda_{XrayNegative}) \wedge (\neg\, \lambda_{DyspnoeaTrue} \vee \neg\, \lambda_{DyspnoeaFalse}) \wedge (\lambda_{DyspnoeaTrue} \vee \lambda_{DyspnoeaFalse})$$

Parameter clauses:

$$(\neg\, \lambda_{PollutionLow} \vee \theta_{PollutionLow}) \wedge (\lambda_{PollutionLow} \vee \neg\, \theta_{PollutionLow}) \wedge (\neg\, \lambda_{PollutionHigh} \vee \theta_{PollutionHigh}) \wedge (\lambda_{PollutionHigh} \vee \neg\, \theta_{PollutionHigh}) \wedge (\neg\, \lambda_{SmokerTrue} \vee \theta_{SmokerTrue}) \wedge (\lambda_{SmokerTrue} \vee \neg\, \theta_{SmokerTrue}) \wedge (\neg\, \lambda_{SmokerFalse} \vee \theta_{SmokerFalse}) \wedge (\lambda_{SmokerFalse} \vee \neg\, \theta_{SmokerFalse}) \wedge (\neg\, \lambda_{PollutionLow} \vee \neg\, \lambda_{SmokerTrue} \vee \neg\, \lambda_{CancerTrue} \vee \theta_{CancerTrue|PollutionLow,SmokerTrue}) \wedge (\lambda_{PollutionLow} \vee \neg\, \theta_{CancerTrue|PollutionLow,SmokerTrue}) \wedge (\lambda_{SmokerTrue} \vee \neg\, \theta_{CancerTrue|PollutionLow,SmokerTrue}) \wedge (\lambda_{CancerTrue} \vee \neg\, \theta_{CancerTrue|PollutionLow,SmokerTrue}) \wedge (\neg\, \lambda_{PollutionLow} \vee \neg\, \lambda_{SmokerTrue} \vee \neg\, \lambda_{CancerFalse} \vee \theta_{CancerFalse|PollutionLow,SmokerTrue}) \wedge (\lambda_{PollutionLow} \vee \neg\, \theta_{CancerFalse|PollutionLow,SmokerTrue}) \wedge (\lambda_{SmokerTrue} \vee \neg\, \theta_{CancerFalse|PollutionLow,SmokerTrue}) \wedge (\lambda_{CancerFalse} \vee \neg\, \theta_{CancerFalse|PollutionLow,SmokerTrue}) \wedge (\neg\, \lambda_{PollutionLow} \vee \neg\, \lambda_{SmokerFalse} \vee \neg\, \lambda_{CancerTrue} \vee \theta_{CancerTrue|PollutionLow,SmokerFalse}) \wedge (\lambda_{PollutionLow} \vee \neg\, \theta_{CancerTrue|PollutionLow,SmokerFalse}) \wedge (\lambda_{SmokerFalse} \vee \neg\, \theta_{CancerTrue|PollutionLow,SmokerFalse}) \wedge (\lambda_{CancerTrue} \vee \neg\, \theta_{CancerTrue|PollutionLow,SmokerFalse}) \wedge (\neg\, \lambda_{PollutionLow} \vee \neg\, \lambda_{SmokerFalse} \vee \neg\, \lambda_{CancerFalse} \vee \theta_{CancerFalse|PollutionLow,SmokerFalse}) \wedge (\lambda_{PollutionLow} \vee \neg\, \theta_{CancerFalse|PollutionLow,SmokerFalse}) \wedge (\lambda_{SmokerFalse} \vee \neg\, \theta_{CancerFalse|PollutionLow,SmokerFalse}) \wedge (\lambda_{CancerFalse} \vee \neg\, \theta_{CancerFalse|PollutionLow,SmokerFalse}) \wedge (\neg\, \lambda_{PollutionHigh} \vee \neg\, \lambda_{SmokerTrue} \vee \neg\, \lambda_{CancerTrue} \vee \theta_{CancerTrue|PollutionHigh,SmokerTrue}) \wedge (\lambda_{PollutionHigh} \vee \neg\, \theta_{CancerTrue|PollutionHigh,SmokerTrue}) \wedge (\lambda_{SmokerTrue} \vee \neg\, \theta_{CancerTrue|PollutionHigh,SmokerTrue}) \wedge (\lambda_{CancerTrue} \vee \neg$$

$$\theta_{CancerTrue|PollutionHigh,SmokerTrue}) \wedge (\neg \lambda_{PollutionHigh} \vee \neg \lambda_{SmokerTrue} \vee \neg \lambda_{CancerFalse} \vee \theta_{CancerFalse|PollutionHigh,SmokerTrue}) \wedge (\lambda_{PollutionHigh} \vee \neg \theta_{CancerFalse|PollutionHigh,SmokerTrue}) \wedge (\lambda_{SmokerTrue} \vee \neg \theta_{CancerFalse|PollutionHigh,SmokerTrue}) \wedge (\lambda_{CancerFalse} \vee \neg \theta_{CancerFalse|PollutionHigh,SmokerTrue}) \wedge (\neg \lambda_{PollutionHigh} \vee \neg \lambda_{SmokerFalse} \vee \neg \lambda_{CancerTrue} \vee \theta_{CancerTrue|PollutionHigh,SmokerFalse}) \wedge (\lambda_{PollutionHigh} \vee \neg \theta_{CancerTrue|PollutionHigh,SmokerFalse}) \wedge (\lambda_{SmokerFalse} \vee \neg \theta_{CancerTrue|PollutionHigh,SmokerFalse}) \wedge (\lambda_{CancerTrue} \vee \neg \theta_{CancerTrue|PollutionHigh,SmokerFalse}) \wedge (\neg \lambda_{PollutionHigh} \vee \neg \lambda_{SmokerFalse} \vee \neg \lambda_{CancerFalse} \vee \theta_{CancerFalse|PollutionHigh,SmokerFalse}) \wedge (\lambda_{PollutionHigh} \vee \neg \theta_{CancerFalse|PollutionHigh,SmokerFalse}) \wedge (\lambda_{SmokerFalse} \vee \neg \theta_{CancerFalse|PollutionHigh,SmokerFalse}) \wedge (\lambda_{CancerFalse} \vee \neg \theta_{CancerFalse|PollutionHigh,SmokerFalse}) \wedge (\neg \lambda_{CancerTrue} \vee \neg \lambda_{XrayPositive} \vee \theta_{XrayPositive|CancerTrue}) \wedge (\lambda_{CancerTrue} \vee \neg \theta_{XrayPositive|CancerTrue}) \wedge (\lambda_{XrayPositive} \vee \neg \theta_{XrayPositive|CancerTrue}) \wedge (\neg \lambda_{CancerTrue} \vee \neg \lambda_{XrayNegative} \vee \theta_{XrayNegative|CancerTrue}) \wedge (\lambda_{CancerTrue} \vee \neg \theta_{XrayNegative|CancerTrue}) \wedge (\lambda_{XrayNegative} \vee \neg \theta_{XrayNegative|CancerTrue}) \wedge (\neg \lambda_{CancerFalse} \vee \neg \lambda_{XrayPositive} \vee \theta_{XrayPositive|CancerFalse}) \wedge (\lambda_{CancerFalse} \vee \neg \theta_{XrayPositive|CancerFalse}) \wedge (\lambda_{XrayPositive} \vee \neg \theta_{XrayPositive|CancerFalse}) \wedge (\neg \lambda_{CancerFalse} \vee \neg \lambda_{XrayNegative} \vee \theta_{XrayNegative|CancerFalse}) \wedge (\lambda_{CancerFalse} \vee \neg \theta_{XrayNegative|CancerFalse}) \wedge (\lambda_{XrayNegative} \vee \neg \theta_{XrayNegative|CancerFalse}) \wedge (\neg \lambda_{CancerTrue} \vee \neg \lambda_{DyspnoeaTrue} \vee \theta_{DyspnoeaTrue|CancerTrue}) \wedge (\lambda_{CancerTrue} \vee \neg \theta_{DyspnoeaTrue|CancerTrue}) \wedge (\lambda_{DyspnoeaTrue} \vee \neg \theta_{DyspnoeaTrue|CancerTrue}) \wedge (\neg \lambda_{CancerTrue} \vee \neg \lambda_{DyspnoeaFalse} \vee \theta_{DyspnoeaFalse|CancerTrue}) \wedge (\lambda_{CancerTrue} \vee \neg \theta_{DyspnoeaFalse|CancerTrue}) \wedge (\lambda_{DyspnoeaFalse} \vee \neg \theta_{DyspnoeaFalse|CancerTrue}) \wedge (\neg \lambda_{CancerFalse} \vee \neg \lambda_{DyspnoeaTrue} \vee \theta_{DyspnoeaTrue|CancerFalse}) \wedge (\lambda_{CancerFalse} \vee \neg \theta_{DyspnoeaTrue|CancerFalse}) \wedge (\lambda_{DyspnoeaTrue} \vee \neg \theta_{DyspnoeaTrue|CancerFalse}) \wedge (\neg \lambda_{CancerFalse} \vee \neg \lambda_{DyspnoeaFalse} \vee \theta_{DyspnoeaFalse|CancerFalse}) \wedge (\lambda_{CancerFalse} \vee \neg \theta_{DyspnoeaFalse|CancerFalse}) \wedge (\lambda_{DyspnoeaFalse} \vee \neg \theta_{DyspnoeaFalse|CancerFalse})$$

Weights:

$W(\lambda_{PollutionLow}) = 1.00$
$W(\neg\lambda_{PollutionLow}) = 1.00$
$W(\lambda_{PollutionHigh}) = 1.00$
$W(\neg\lambda_{PollutionHigh}) = 1.00$
$W(\lambda_{SmokerTrue}) = 1.00$
$W(\neg\lambda_{SmokerTrue}) = 1.00$
$W(\lambda_{SmokerFalse}) = 1.00$
$W(\neg\lambda_{SmokerFalse}) = 1.00$
$W(\lambda_{CancerTrue}) = 1.00$
$W(\neg\lambda_{CancerTrue}) = 1.00$
$W(\lambda_{CancerFalse}) = 1.00$
$W(\neg\lambda_{CancerFalse}) = 1.00$
$W(\lambda_{XrayPositive}) = 1.00$
$W(\neg\lambda_{XrayPositive}) = 1.00$
$W(\lambda_{XrayNegative}) = 1.00$
$W(\neg\lambda_{XrayNegative}) = 1.00$
$W(\lambda_{DyspnoeaTrue}) = 1.00$
$W(\neg\lambda_{DyspnoeaTrue}) = 1.00$

$\mathrm{W}(\lambda_{DyspnoeaFalse}) = 1.00$
$\mathrm{W}(\neg\lambda_{DyspnoeaFalse}) = 1.00$
$\mathrm{W}(\theta_{PollutionLow}) = 0.90$
$\mathrm{W}(\neg\theta_{PollutionLow}) = 1.00$
$\mathrm{W}(\theta_{PollutionHigh}) = 0.10$
$\mathrm{W}(\neg\theta_{PollutionHigh}) = 1.00$
$\mathrm{W}(\theta_{SmokerTrue}) = 0.30$
$\mathrm{W}(\neg\theta_{SmokerTrue}) = 1.00$
$\mathrm{W}(\theta_{SmokerFalse}) = 0.70$
$\mathrm{W}(\neg\theta_{SmokerFalse}) = 1.00$
$\mathrm{W}(\theta_{CancerTrue|PollutionLow,SmokerTrue}) = 0.03$
$\mathrm{W}(\neg\theta_{CancerTrue|PollutionLow,SmokerTrue}) = 1.00$
$\mathrm{W}(\theta_{CancerFalse|PollutionLow,SmokerTrue}) = 0.97$
$\mathrm{W}(\neg\theta_{CancerFalse|PollutionLow,SmokerTrue}) = 1.00$
$\mathrm{W}(\theta_{CancerTrue|PollutionLow,SmokerFalse}) = 0.00$
$\mathrm{W}(\neg\theta_{CancerTrue|PollutionLow,SmokerFalse}) = 1.00$
$\mathrm{W}(\theta_{CancerFalse|PollutionLow,SmokerFalse}) = 1.00$
$\mathrm{W}(\neg\theta_{CancerFalse|PollutionLow,SmokerFalse}) = 1.00$
$\mathrm{W}(\theta_{CancerTrue|PollutionHigh,SmokerTrue}) = 0.05$
$\mathrm{W}(\neg\theta_{CancerTrue|PollutionHigh,SmokerTrue}) = 1.00$
$\mathrm{W}(\theta_{CancerFalse|PollutionHigh,SmokerTrue}) = 0.95$
$\mathrm{W}(\neg\theta_{CancerFalse|PollutionHigh,SmokerTrue}) = 1.00$
$\mathrm{W}(\theta_{CancerTrue|PollutionHigh,SmokerFalse}) = 0.02$
$\mathrm{W}(\neg\theta_{CancerTrue|PollutionHigh,SmokerFalse}) = 1.00$
$\mathrm{W}(\theta_{CancerFalse|PollutionHigh,SmokerFalse}) = 0.98$
$\mathrm{W}(\neg\theta_{CancerFalse|PollutionHigh,SmokerFalse}) = 1.00$
$\mathrm{W}(\theta_{XrayPositive|CancerTrue}) = 0.90$
$\mathrm{W}(\neg\theta_{XrayPositive|CancerTrue}) = 1.00$
$\mathrm{W}(\theta_{XrayNegative|CancerTrue}) = 0.10$
$\mathrm{W}(\neg\theta_{XrayNegative|CancerTrue}) = 1.00$
$\mathrm{W}(\theta_{XrayPositive|CancerFalse}) = 0.20$
$\mathrm{W}(\neg\theta_{XrayPositive|CancerFalse}) = 1.00$
$\mathrm{W}(\theta_{XrayNegative|CancerFalse}) = 0.80$
$\mathrm{W}(\neg\theta_{XrayNegative|CancerFalse}) = 1.00$
$\mathrm{W}(\theta_{DyspnoeaTrue|CancerTrue}) = 0.65$
$\mathrm{W}(\neg\theta_{DyspnoeaTrue|CancerTrue}) = 1.00$
$\mathrm{W}(\theta_{DyspnoeaFalse|CancerTrue}) = 0.35$
$\mathrm{W}(\neg\theta_{DyspnoeaFalse|CancerTrue}) = 1.00$
$\mathrm{W}(\theta_{DyspnoeaTrue|CancerFalse}) = 0.30$
$\mathrm{W}(\neg\theta_{DyspnoeaTrue|CancerFalse}) = 1.00$
$\mathrm{W}(\theta_{DyspnoeaFalse|CancerFalse}) = 0.70$
$\mathrm{W}(\neg\theta_{DyspnoeaFalse|CancerFalse}) = 1.00$

2.2 ENC2

Indicator clauses

$$(\neg\ \lambda_{PollutionLow} \vee \neg\ \lambda_{PollutionHigh}) \wedge (\lambda_{PollutionLow} \vee \lambda_{PollutionHigh}) \wedge (\neg$$

$$\lambda_{SmokerTrue} \vee \neg\, \lambda_{SmokerFalse}) \wedge (\lambda_{SmokerTrue} \vee \lambda_{SmokerFalse}) \wedge (\neg\, \lambda_{CancerTrue} \vee \neg\, \lambda_{CancerFalse}) \wedge (\lambda_{CancerTrue} \vee \lambda_{CancerFalse}) \wedge (\neg\, \lambda_{XrayPositive} \vee \neg\, \lambda_{XrayNegative}) \wedge (\lambda_{XrayPositive} \vee \lambda_{XrayNegative}) \wedge (\neg\, \lambda_{DyspnoeaTrue} \vee \neg\, \lambda_{DyspnoeaFalse}) \wedge (\lambda_{DyspnoeaTrue} \vee \lambda_{DyspnoeaFalse})$$

Parameter clauses

$$(\neg\, \rho_{PollutionLow} \vee \lambda_{PollutionLow}) \wedge (\rho_{PollutionLow} \vee \lambda_{PollutionHigh}) \wedge (\neg\, \rho_{SmokerTrue} \vee \lambda_{SmokerTrue}) \wedge (\rho_{SmokerTrue} \vee \lambda_{SmokerFalse}) \wedge (\neg\, \lambda_{PollutionLow} \vee \neg\, \lambda_{SmokerTrue} \vee \neg\, \rho_{CancerTrue|PollutionLow,SmokerTrue} \vee \lambda_{CancerTrue}) \wedge (\neg\, \lambda_{PollutionLow} \vee \neg\, \lambda_{SmokerTrue} \vee \rho_{CancerTrue|PollutionLow,SmokerTrue} \vee \lambda_{CancerFalse}) \wedge (\neg\, \lambda_{PollutionLow} \vee \neg\, \lambda_{SmokerFalse} \vee \neg\, \rho_{CancerTrue|PollutionLow,SmokerFalse} \vee \lambda_{CancerTrue}) \wedge (\neg\, \lambda_{PollutionLow} \vee \neg\, \lambda_{SmokerFalse} \vee \rho_{CancerTrue|PollutionLow,SmokerFalse} \vee \lambda_{CancerFalse}) \wedge (\neg\, \lambda_{PollutionHigh} \vee \neg\, \lambda_{SmokerTrue} \vee \neg\, \rho_{CancerTrue|PollutionHigh,SmokerTrue} \vee \lambda_{CancerTrue}) \wedge (\neg\, \lambda_{PollutionHigh} \vee \neg\, \lambda_{SmokerTrue} \vee \rho_{CancerTrue|PollutionHigh,SmokerTrue} \vee \lambda_{CancerFalse}) \wedge (\neg\, \lambda_{PollutionHigh} \vee \neg\, \lambda_{SmokerFalse} \vee \neg\, \rho_{CancerTrue|PollutionHigh,SmokerFalse} \vee \lambda_{CancerTrue}) \wedge (\neg\, \lambda_{PollutionHigh} \vee \neg\, \lambda_{SmokerFalse} \vee \rho_{CancerTrue|PollutionHigh,SmokerFalse} \vee \lambda_{CancerFalse}) \wedge (\neg\, \lambda_{CancerTrue} \vee \neg\, \rho_{XrayPositive|CancerTrue} \vee \lambda_{XrayPositive}) \wedge (\neg\, \lambda_{CancerTrue} \vee \rho_{XrayPositive|CancerTrue} \vee \lambda_{XrayNegative}) \wedge (\neg\, \lambda_{CancerFalse} \vee \neg\, \rho_{XrayPositive|CancerFalse} \vee \lambda_{XrayPositive}) \wedge (\neg\, \lambda_{CancerFalse} \vee \rho_{XrayPositive|CancerFalse} \vee \lambda_{XrayNegative}) \wedge (\neg\, \lambda_{CancerTrue} \vee \neg\, \rho_{DyspnoeaTrue|CancerTrue} \vee \lambda_{DyspnoeaTrue}) \wedge (\neg\, \lambda_{CancerTrue} \vee \rho_{DyspnoeaTrue|CancerTrue} \vee \lambda_{DyspnoeaFalse}) \wedge (\neg\, \lambda_{CancerFalse} \vee \neg\, \rho_{DyspnoeaTrue|CancerFalse} \vee \lambda_{DyspnoeaTrue}) \wedge (\neg\, \lambda_{CancerFalse} \vee \rho_{DyspnoeaTrue|CancerFalse} \vee \lambda_{DyspnoeaFalse})$$

Weights

$\mathrm{W}(\lambda_{PollutionLow}) = 1.00$
$\mathrm{W}(\neg\, \lambda_{PollutionLow}) = 1.00$
$\mathrm{W}(\lambda_{PollutionHigh}) = 1.00$
$\mathrm{W}(\neg\, \lambda_{PollutionHigh}) = 1.00$
$\mathrm{W}(\lambda_{SmokerTrue}) = 1.00$
$\mathrm{W}(\neg\, \lambda_{SmokerTrue}) = 1.00$
$\mathrm{W}(\lambda_{SmokerFalse}) = 1.00$
$\mathrm{W}(\neg\, \lambda_{SmokerFalse}) = 1.00$
$\mathrm{W}(\lambda_{CancerTrue}) = 1.00$
$\mathrm{W}(\neg\, \lambda_{CancerTrue}) = 1.00$
$\mathrm{W}(\lambda_{CancerFalse}) = 1.00$
$\mathrm{W}(\neg\, \lambda_{CancerFalse}) = 1.00$
$\mathrm{W}(\lambda_{XrayPositive}) = 1.00$
$\mathrm{W}(\neg\, \lambda_{XrayPositive}) = 1.00$
$\mathrm{W}(\lambda_{XrayNegative}) = 1.00$
$\mathrm{W}(\neg\, \lambda_{XrayNegative}) = 1.00$
$\mathrm{W}(\lambda_{DyspnoeaTrue}) = 1.00$
$\mathrm{W}(\neg\, \lambda_{DyspnoeaTrue}) = 1.00$
$\mathrm{W}(\lambda_{DyspnoeaFalse}) = 1.00$
$\mathrm{W}(\neg\, \lambda_{DyspnoeaFalse}) = 1.00$
$\mathrm{W}(\rho_{PollutionLow}) = 0.90$

$\mathrm{W}(\neg\ \rho_{PollutionLow}) = 0.10$
$\mathrm{W}(\rho_{SmokerTrue}) = 0.30$
$\mathrm{W}(\neg\ \rho_{SmokerTrue}) = 0.70$
$\mathrm{W}(\rho_{CancerTrue|PollutionLow,SmokerTrue}) = 0.03$
$\mathrm{W}(\neg\ \rho_{CancerTrue|PollutionLow,SmokerTrue}) = 0.97$
$\mathrm{W}(\rho_{CancerTrue|PollutionLow,SmokerFalse}) = 0.00$
$\mathrm{W}(\neg\ \rho_{CancerTrue|PollutionLow,SmokerFalse}) = 1.00$
$\mathrm{W}(\rho_{CancerTrue|PollutionHigh,SmokerTrue}) = 0.05$
$\mathrm{W}(\neg\ \rho_{CancerTrue|PollutionHigh,SmokerTrue}) = 0.95$
$\mathrm{W}(\rho_{CancerTrue|PollutionHigh,SmokerFalse}) = 0.02$
$\mathrm{W}(\neg\ \rho_{CancerTrue|PollutionHigh,SmokerFalse}) = 0.98$
$\mathrm{W}(\rho_{XrayPositive|CancerTrue}) = 0.90$
$\mathrm{W}(\neg\ \rho_{XrayPositive|CancerTrue}) = 0.10$
$\mathrm{W}(\rho_{XrayPositive|CancerFalse}) = 0.20$
$\mathrm{W}(\neg\ \rho_{XrayPositive|CancerFalse}) = 0.80$
$\mathrm{W}(\rho_{DyspnoeaTrue|CancerTrue}) = 0.65$
$\mathrm{W}(\neg\ \rho_{DyspnoeaTrue|CancerTrue}) = 0.35$
$\mathrm{W}(\rho_{DyspnoeaTrue|CancerFalse}) = 0.30$
$\mathrm{W}(\neg\ \rho_{DyspnoeaTrue|CancerFalse}) = 0.70$

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