CS264A: Homework #4

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Problem 1

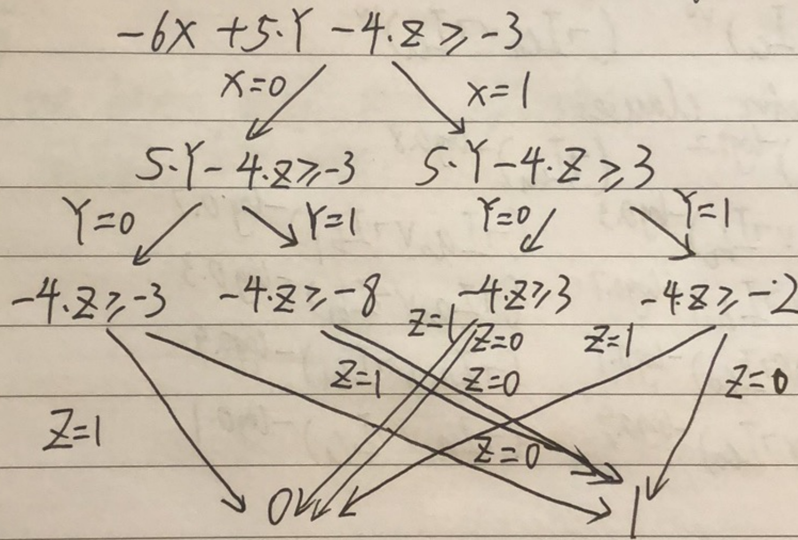
1. **Solution:**

1\.

(1) $f(X,Y,Z) = -4\cdot Z + 2.$

In general, when we have the value of X, Y. $f(X,Y,Z)$ will become a function with only variable Z and some constant.

(2). OBDD: $-6X+5\cdot Y-4\cdot Z+3 \geq 0$ is equivalent to



(3). According to the above OBDD we can find that when $X=1$, $Y=0$, $-4\cdot Z \geq 3$. No matter $Z=0$ or 1 the inequality can't be true. So the value of Z will NOT affect the instance classification.

Problem 2

Solution:

2

(a) Indicator clauses

$(I_{a_0} \vee I_{a_1})^w$ $(\neg I_{a_0} \vee \neg I_{a_1})^w$ $(I_{b_0} \vee I_{b_1})^w$ $(\neg I_{b_0} \vee \neg I_{b_1})^w$

$(I_{c_0} \vee I_{c_1})^w$ $(\neg I_{c_0} \vee \neg I_{c_1})^w$

Parameter clauses.

$(\neg I_{a_0})^{-\log 0.2}$ $(\neg I_{a_1})^{-\log 0.8}$

$(\neg I_{a_0} \vee \neg I_{b_0})^{-\log 0.3}$ $(\neg I_{a_0} \vee \neg I_{b_1})^{-\log 0.7}$

$(\neg I_{a_1} \vee \neg I_{b_0})^{-\log 0.7}$ $(\neg I_{a_1} \vee \neg I_{b_1})^{-\log 0.3}$

$(\neg I_{a_0} \vee \neg I_{c_0})^{-\log 0.1}$ $(\neg I_{a_0} \vee \neg I_{c_1})^{-\log 0.9}$

$(\neg I_{a_1} \vee \neg I_{c_0})^{-\log 0.9}$ $(\neg I_{a_1} \vee \neg I_{c_1})^{-\log 0.1}$

(b) evidence $B = b_1$

$(I_{b_1})^w$ hard clause will be added to the above CNF

2 (c).

when we have $B = b_1$ as evidence, the optimal instantiation for min penalty is:

$\Gamma = I_{b_1}\ \neg I_{b_0}\ I_{a_1}\ \neg I_{a_0}\ I_{c_0}\ \neg I_{c_1}$

$\text{Penalty}(\Gamma) = -\log 0.8 - \log 0.7 - \log 0.9 = -\log(0.504) = -\log(\Pr(a_1 b_1 c_0))$

$\text{weight}(\Gamma) = 7W - \log 0.2 - \log 0.7 - \log 0.3 - \log 0.3 - \log 0.9 - \log 0.1 - \log 0.1$

$= 7W - \log(0.0002646)$

1.

Problem 3

1. **Solution:**

3.

$\bar{w}\bar{x}\bar{y}\bar{z} + \bar{w}\bar{x}\bar{y}z + \bar{w}\bar{x}y\bar{z} + w\bar{x}\bar{y}\bar{z} + w\bar{x}y\bar{z} + w\bar{x}yz + wxy\bar{z} + wxyz$

apply concensus method on all possible combination:

$\bar{w}\bar{x}\bar{y} + \bar{w}\bar{x}\bar{z} + \bar{x}\bar{y}\bar{z} + w\bar{x}\bar{z} + w\bar{x}y + \bar{x}y\bar{z} + wyz + wy\bar{z} + wxy$

apply concensus method on all possible combination:

$\bar{x}\bar{z} + wy$

The only term that is not subsumed by $\bar{x}\bar{z}$ or wy is $\bar{w}\bar{x}\bar{y}$.

Therefore, we have three prime implicants:

$\bar{w}\bar{x}\bar{y}$, $\bar{x}\bar{z}$, wy.

Problem 4

Solution:

4.

(a). The decision is Yes on this instance

(b). We need to compute all of its sufficient reasons

(E, F, G)

(E, $\bar{F}$, W)

(E, G, R)

(E, R, W)

(G, R, W)

therefore only (E, G, R) is the sufficient reason

(c).

According to the theorem, Decision is biased iff each of its sufficient reasons contains at least one protect feature. i.e. is R.

However, two of the sufficient reasons don't have R, so the decision is not biased.

1.