Grundlagen der Wissensverarbeitung

Blatt 7

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Exercise 1.2: (CSI Stellingen)

Introduction to Diagnosis: A Murder Investigation.
The question is: "Who is the murderer?"
First, we assign symbols (atoms) to the clues:

g : gardener is murderer
b : butler is murderer
a : gardener was working in the garden all day
r : butler was working in the garage all day
d : gardener has dirt on his hands
i : butler has dirt on his hands

Next we rewrite the clues inside these symbols, and logical operators:
Knowledge Base:
Assumables:
$a \rightarrow \neg g$
$r \rightarrow \neg b$
Observations:
$\neg d$
i
Rules:
$a \rightarrow d$
$r \rightarrow i$
Integrity Constraints:
$d \vee \neg d$
$i \vee \neg i$
From observation $\neg d$ and rule $a \rightarrow d$ we deduce with integrity constraint $d \vee \neg d$ that $\neg a$.
From $\neg a$ and assumable $a \rightarrow \neg g$ we deduce g. So the gardener is the murderer.
Minimal conflict:
{a,g}
Minimal diagnosis:
{a}, {r}

Exercise 1.3: (Diagnosis)

Representing the car engine environment:
propositions:
full-battery.
turned-key.
working-regulation.
noise1-starter.
noise3-engine.
unclogged-filter.
noise2-pump.
full-tank.

inferences:
on-battery $\leftarrow$ turned-key $\wedge$ working-regulation
noise1-starter $\leftarrow$ turned-key $\wedge$ noise3-engine
turned-key $\leftarrow$ on-battery $\wedge$ working-regulation $\wedge$ noise1-starter
noise3-engine $\leftarrow$ noise1-starter $\wedge$ unclogged-filter
working-regulation $\leftarrow$ on-battery $\wedge$ turned-key $\wedge$ noise2-pump
unclogged-filter $\leftarrow$ noise3-engine $\wedge$ noise2-pump
noise2-pump $\leftarrow$ working-regulation $\wedge$ unclogged-filter $\wedge$ full-tank
full-tank $\leftarrow$ noise2-pump

diagnosis:
for all 4 cases:
$\neg$full-battery $\vee$ $\neg$turned-key $\vee$ $\neg$working-regulation $\vee$ $\neg$noise1-starter $\vee$ $\neg$noise3-engine $\vee$ $\neg$unclogged-filter $\vee$ $\neg$noise2-pump $\vee$ $\neg$full-tank

Because of the dependencies between the grey boxes, each part of the car relies to another and so the source of error could be everything at anytime.
Minimal diagnosis is subsets of fault possibilities: (full-battery), (turned-key), (noise1-starter, noise2-pump), etc. Here, because of 8 sources of error: 2^8 sets.