Solutions for Bayesian networks and decision graphs (second edition)

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Solution for exercise 11.1

Myopic: see the Hugin network. Initially we can read that the value of the initial situation is $V(P(Pr)) = -12.35, P(BT) = (0.57, 0.43), P(UT) = (0.65, 0.35)$. We can use the network to calculate the expected utility of the optimal acion after each possible outcome of a test. We get

- $V(P(Pr|BT = y)) = -2.29$
- $V(P(Pr|BT = n)) = -25.7$.

Hence the expected value $EV(BT) = -12.35$. No change, and it does not pay to perform a blood test. The same holds for the urine test. There is an easy way to see this: enter the possible test outcomes and see if the optimal action is changed. If the optimal action the same regardless of the outcome, there is no reason to perform the test.

Non-myopic: the best information basis will be to have both tests performed. If still the optimal action is the same regardless of the outcomes of the two tests, then no test sequence can make me change the current optimal action (to wait). The best indication for repeating the insemination is a negative test result from both tests. Insert this to the model an notice that the optimal action is to wait.

Solution for exercise 11.2

Consider the Hugin network. From this network we get that V(P(S)) = 20 (drill), and P(T)=(0.24(c),0.35(o),0.41(n)). When calculating the expected utility of the best possible action conditioned on the various test outcomes we get:

- $V(P(S|c)) = 87.5$
- $V(P(S|o)) = 32.86$

- $V(P(S|n)) = 0$

The expected value is:

$$EV(T) = 87.5 * 0.24 + 32.86 * 0.35 + 0 * 0.41 = 32.5,$$

and the expected profit is therefore 22.5, i.e., we should perform the test: If the test result is either closed or open we should drill, otherwise we should not.

Solution for exercise 11.3

You shouldn't take the offer as $EU(\text{Take offer?} = \text{yes}) = 0.65$ and $EU(\text{Take offer?} = \text{no}) = 0.75$. See the network.

Solution for exercise 11.4

In Figure 9.23 the required past for FV_4 is $\text{req}(FV_4) = \{T_1, FV_1, T_2, FV_2, T_3, FV_3, T_4\}$ and in Figure 9.24 the required past for FV_4 is $\text{req}(FV_4) = \{T_3, FV_3, T_4\}$.

Solution for exercise 11.5

For decision D_2 the relevant future is G, I, L, D_4 and for D_1 the relevant future consists of all the variables except B (which constitute the required past for D_1).

Solution for exercise 11.6