Bayesian Networks in Epistemology and Philosophy of Science
Exercise Set 2

1. Determine all conditional independence relations that hold in the Bayesian Networks characterizing the situation before and after a reduction. Which independencies hold before the reduction, but not afterwards?

2. Let's consider the situation before the reduction. We assume that E confirms T_F and that E confirms T_P. What does this imply for $\alpha, \beta, \gamma, \delta, t_F$ and t_P?

3. Calculate $P_2(\mathrm{T_P})$, i.e. the probability of the phenomenological theory after the reduction? Is it reasonable to assume that $P_2(\mathrm{T_P}) = P_1(\mathrm{T_P}) = t_P$?

4. What changes, if one changes the direction of the arrows from $T_F \to T_F^* \to T_P^* \to T_P$ to $T_P \to T_P^* \to T_F^* \to T_F$ in the situation after the reduction?

5. Critically discuss the proposed probabilistic modeling of the bridge law. Which alternative models come to mind? Explore their consequences.

6. In the talk, three acceptance criteria were discussed: the prior probability of $\mathrm{T_F}, \mathrm{T_P}$, the posterior probability of $\mathrm{T_F}, \mathrm{T_P}$ (given $\mathrm{E}, \mathrm{E_F}, \mathrm{E_P}$) and the difference measure of confirmation, which is the difference of the posterior and the prior probability. In the latter case, a purported reduction is accepted if the difference of posterior and prior is greater after the reduction than before. For details, see the paper (http://philsci-archive.pitt.edu/archive/00005324/). Check whther the obtained results are stable if other measures of confirmation (such as the ratio measure and the log-likelihood measure) are used.

7. It is tempting to speculate that the whole system of believes (including the evidence) is more coherent after the reduction than before. Explore this claim using Shogenji's coherence measure. This is defined as follows:

$$coh_S(\mathrm{A_1}, \ldots, \mathrm{A_n}) = \frac{P(\mathrm{A_1}, \ldots, \mathrm{A_n})}{P(\mathrm{A_1}) \cdots P(\mathrm{A_n})}$$