Principles of Knowledge Representation and Reasoning

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Exercise Sheet 11

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Exercise 11.1 (Full-meet Base Revision, 6)

Consider the following description:

> Bob is organizing a birthday party. Mary and Tom said they will come together. Peter said he won't come if Mary is here and Jim said he will come if and only if Peter is here.
>
> At the last minute, Mary learns that she is unable to come because her mother is ill.

Propose a formalization of this description within propositional logic and perform a full-meet base revision (i.e., a PMBR with one priority class).

Exercise 11.2 (Cut Base Revision, 6)

Let $A = A_1 \cup \cdots \cup A_n$ a belief set and let the *cut base revision* of A by ϕ be defined as:

$$(A \otimes \phi) \stackrel{\text{def}}{=} Cn\left(\bigcup\{A_j \mid 1 \leq j \leq n \wedge \bigcup_{i=j}^{n} A_i \not\models \neg\phi\}\right) + \phi.$$

Show that the problem of whether a formula ψ belongs to $A \otimes \phi$ is P^{NP}-complete.
Hint: You can prove hardness by reduction from $\mathsf{MAX\text{-}SAT\text{-}ASG}_{odd}$ (Wagner, 1987)[1], which can be defined as follows:

> Given a propositional formula χ in conjunctive normal-form (or a set of clauses) over the propositional varibles $p_1, \ldots, p_n$ and a weight function W over truth assignments $\alpha : \{p_1, \ldots, p_n\} \rightarrow \{0, 1\}$ defined by $W(\alpha) \stackrel{\text{def}}{=} \sum_i \alpha(p_1) \times 2^{i-1}$, has the truth-assignment that satisfies χ with a maximal weight an *odd* weight value?

[1] Klaus W. Wagner. More complicated questions about maxima and minima, and some closures of NP. Theoretical Computer Science , 51:53–80, 1987.