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# Knowledge Representation and Reasoning

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## Exercises 8

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### Problem 1.

The relation  $\Sigma \vdash \phi$  between sets of propositions and propositions is defined by: there is derivation with conclusion  $\phi$  and with all hypotheses in  $\Sigma$ .

We say that  $\phi$  is derivable from  $\Sigma$ .

### Prove that:

If  $\Sigma$  is maximally consistent, then  $\Sigma$  is closed under derivability (i.e.  $\Sigma \vdash \phi \Rightarrow \phi \in \Sigma$ ).

### Problem 2.

Consider the definition of a setup in four-valued logic. Complete the mapping for the case where an atomic formula  $p$  is denied.

- If the current value of the atomic formula  $p$  is **None**, it is mapped **F**.
- If the current value of the atomic formula  $p$  is **Both**, it is mapped **Both**.
- If the current value of the atomic formula  $p$  is **T**, it is mapped **Both**.
- If the current value of the atomic formula  $p$  is **F**, it is mapped **F**.

### Problem 3.

Show that  $*$  is not commutative, i.e., there are  $\mathcal{B}, \alpha, \beta$  such that:

$$(\mathcal{B} * \alpha) * \beta \neq (\mathcal{B} * \beta) * \alpha \quad (1)$$

### Problem 4.

Recall the fourth postulate for contraction:

$$(\mathcal{B} \dot{-} 4) : \text{If } \varphi \in \mathcal{B}, \text{ then } \mathcal{B} \subseteq (\mathcal{B} \dot{-} \varphi) + \varphi. \quad (2)$$

This so-called recovery postulate can be seen as the most debated postulate of belief change.

1. Can you think of an intuitive example that validates the recovery postulate?
2. Can you think of an example that illustrates that it does not hold in general?