Multi-Agent Systems

B. Nebel, R. Bergdoll, T. Engesser
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University of Freiburg
Department of Computer Science

Exercise Sheet 10

Due: January 17, 2020

Exercise 10.1 (Deontic Logic: Proofs, 3)

Prove or disprove the following theorems and discuss their appropriateness in the context of modeling epistemic/normative concepts:[1]

- $\models_{\text{SDL}} O(\phi \wedge \psi) \rightarrow O\psi$
- $\models_{\text{SDL}} P(\phi \vee \psi) \rightarrow (P\phi \wedge P\psi)$
- $\models_{\text{LKA}} O\phi \rightarrow P\phi$

Exercise 10.2 (Deontic Logic: Verification, 2+2+2+3)

Consider the following situation you are asked to formalize within the Leibnizian-Kangerian-Andersonian logic (LKA):

> There is an autonomous car that is on a collision course with a pedestrian. If an evasive action is taken, the pedestrian will stay alive, but it is possible (yet not necessary) that the passenger dies. If no action is taken, the pedestrian will die and the passenger will survive with certainty. The car's decision algorithm decides that the evasive action is obligatory. The legislator's specification for situations like this is that the car oughts to make sure that neither the passenger nor the pedestrian will die with certainty.

(a) Formalize the car's situation as LKA-formulas.

(b) Formalize the car's decision as LKA-formulas.

(c) Formalize the legislator's specification as LKA-formulas.

(d) Prove that the car's decision fulfills the specification.

[1] Recall: Standard Deontic Logic (SDL): **KD**, Leibniz-Kanger-Anderson reduction (LKA): **KT**