

Logics and categories for software engineering and artificial intelligence

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Exercise Sheet 9

Due: July 6, 2009

Exercise 9.1 (Specification morphisms)

Let SP_1, SP_2 be two specifications. Show that for any signature morphism $\sigma : \text{Sig}(SP_1) \rightarrow \text{Sig}(SP_2)$, the following are equivalent:

- (a) $\sigma : SP_1 \rightarrow SP_2$ is a specification morphism
- (b) $\text{Mod}(SP_2 \text{ hide } \sigma) \subseteq \text{Mod}(SP_1)$
- (c) $\text{Mod}(SP_2) \subseteq \text{Mod}(SP_1 \text{ with } \sigma)$

Exercise 9.2 (Models of specifications)

Show that the following statements are not equivalent. Provide counterexamples for both implications.

- (a) $\text{Mod}(SP_1) \subseteq \text{Mod}(SP_2 \text{ hide } \sigma)$
- (b) $\text{Mod}(SP_1 \text{ with } \sigma) \subseteq \text{Mod}(SP_2)$

Exercise 9.3 (Algebraic laws for specifications)

Check which of the following algebraic laws hold:

- (a) $SP \text{ and } SP \equiv SP$
- (b) $SP_1 \text{ and } SP_2 \equiv SP_2 \text{ and } SP_1$
- (c) $(SP \text{ with } \sigma_1) \text{ with } \sigma_2 \equiv SP \text{ with } \sigma_2 \circ \sigma_1$
- (d) $(SP_1 \text{ and } SP_2) \text{ with } \sigma \equiv (SP_1 \text{ with } \sigma) \text{ and } (SP_2 \text{ with } \sigma)$
- (e) $(SP \text{ hide } \sigma_2) \text{ hide } \sigma_1 \equiv SP \text{ hide } \sigma_2 \circ \sigma_1$
- (f) $(SP_1 \text{ and } SP_2) \text{ hide } \sigma \equiv (SP_1 \text{ hide } \sigma) \text{ and } (SP_2 \text{ hide } \sigma)$
- (g) $(SP \text{ with } \sigma) \text{ hide } \sigma \equiv SP$
- (h) $(SP \text{ hide } \sigma) \text{ with } \sigma \equiv SP$

The exercise sheets may and should be worked on in groups of two (2) students. Please write both names on your solution.