Logics, Categories, and Colimits for Artificial Intelligence

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Exercise Sheet 12

Due: January 30, 2009

Exercise 12.1 (Functor categories)

Given categories $\mathbf{C}$ and $\mathbf{D}$, prove that $[\mathbf{C}, \mathbf{D}]$ (functors from $\mathbf{C}$ to $\mathbf{D}$ as objects and natural transformations as morphisms) indeed forms a category.

Exercise 12.2 (Institution comorphisms I)

Spell out the definition of institution comorphisms in terms of the "institutions as functors" definition $I : \mathbf{Sign} \to \mathbf{Room}$.

Exercise 12.3 (Institution comorphisms II)

Define a model-expansive institution comorphism $\quad \text{Propositional} \to \mathcal{ALC}$.

Exercise 12.4 (Satisfaction relations as natural transformations)

Show that the satisfaction relation in an institution is a natural transformation $\models : \mathrm{Gr} \circ \mathrm{Sen} \to \overline{\mathrm{Gr}} \circ U^{\mathrm{op}} \circ \mathrm{Mod}^{\mathrm{op}}$, where $\mathrm{Gr} : \mathbf{Set} \to \mathbf{Rel}$ and $\overline{\mathrm{Gr}} : \mathbf{Set}^{\mathbf{op}} \to \mathbf{Rel}$ map a function to its graph.

Exercise 12.5 (Comorphisms in Hets)

Experiment with Hets: Translate theories that you have used along comorphisms.

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