

# Logics, Categories, and Colimits for Artificial Intelligence

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## Exercise Sheet 7

**Due: December 12, 2008**

**Exercise 7.1** (Initial and terminal objects)

What are the initial and terminal objects in the following categories?

- (a) The category of propositional signatures and signature morphisms
- (b) The category of propositional theories and theory morphisms
- (c) The category of propositional theories and conservative theory morphisms
- (d) The category of propositional models for the signature  $\{p, q\}$
- (e) The category of satisfaction systems

**Exercise 7.2** (Uniqueness of initial objects)

Prove that any two initial objects are isomorphic and that any two terminal objects are isomorphic.

**Exercise 7.3** (Isomorphic theories)

What does it mean that two theories are isomorphic?

**Exercise 7.4** (Graphic depiction of categories)

There are different ways to realise a category with two objects and four arrows. Draw all the possible shapes that such a category can have (in the drawing, please use a different style for the identity arrows, or even omit them). Specify at least two different composition laws (if existing) for each shape.

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