Homework Assignment 5

October 16, 2013

1 Implement the syntax and semantics of *L*₀ in Haskell

Consider the L_0 logical system introduced in ch. 2 of Dowty et al. (1981) (*Intro to Montague Semantics*). Implement the syntax and semantics of this logical system in Haskell.

In particular, implement the following slightly modified definition of L_0 syntax:

- (1) L_0 syntax:
 - a. Basic expressions:
 - i. Names: Dick, Noam, John, Muhammad
 - ii. One-place predicates: HasMustache, IsBald
 - iii. Two-place predicates: Knows, Loves
 - b. Formulas:
 - i. If δ is a one-place predicate and α is a name, then $\delta \alpha$ is a formula. Make sure that you display such a formula as $\delta(\alpha)$ by appropriately defining *show*.
 - ii. If γ is a two-place predicate and α and β are names, then $\gamma \beta \alpha$ is a formula. Make sure that you display such a formula as $\gamma(\alpha, \beta)$ by appropriately defining *show*.
 - iii. If φ is a formula, then $\sim \varphi$ (the negation of φ) is a formula.
 - iv. If φ and ψ are formulas, then $\varphi \land \psi$ (the conjunction of φ and ψ) is a formula.
 - v. If φ and ψ are formulas, then $\varphi \lor \psi$ (the disjunction of φ and ψ) is a formula.

Also, implement a more general version of the semantics of L_0 as follows:

- assume that all models have 4 entities *Nixon*, *Chomsky*, *Mitchell* and *Ali*, i.e., the domain of entities is [*Nixon*, *Chomsky*, *Mitchell*, *Ali*]
- assume that the semantic values of the four names *Dick*, *Noam*, *John*, *Muhammad* are fixed in the obvious way: *Dick* denotes (Richard) *Nixon*, *Noam* denotes *Chomsky*, *John* denotes *Mitchell* and *Muhammad* denotes *Ali*
- generate all possible models that satisfy the above two constraints, i.e., generate all possible (combinations of) appropriate denotations for the one-place and two-place predicates listed above;
- in particular, one-place predicates should denote subsets of the domain of entities [*Nixon, Chomsky, Mitchell, Ali*] and two-place predicates should denote sets of pairs of entities, i.e., subsets of [(x, y) | x ← [*Nixon, Chomsky, Mitchell, Ali*], y ← [*Nixon, Chomsky, Mitchell, Ali*]]
- given all these models, define tautologies, satisfiability, contradictions, entailment and Context Set updates just as we did in the lecture notes on propositional logic