Indian Institute of Technology, Jodhpur
B.Tech.(CSE) 3rd Year, II (Fall) 2015
32002: Artificial Intelligence Assignment # 2

M.M.: 10

1. Prove or disprove the followings:

   (a) If S is a first-order formula, then S is valid iff $S \rightarrow \perp$ is contradiction.

   (b) If S is a first-order formula and x is a variable, then S is contradiction iff $\exists x S$ is a contradiction.

2. Consider a FOPL which uses two 1-place predicates namely Big and $Small$. The set of object constants is given by a, b. Enumerate all possible models for this. For each of the following sentences identify the models in which the given sentence is true.

   (a) $Big(a) \wedge Big(b)$

   (b) $Big(a) \vee Big(b)$

   (c) $\forall x Big(x) \vee Small(x)$

   (d) $\forall x Big(x) \Rightarrow \neg Small(x)$

3. Find out the clauses for the following FOPL formulas.

$$\exists x \forall y \exists z (P(x) \Rightarrow (Q(y) \Rightarrow R(z)))$$

4. Determine whether the expression p and q unify with each other in each of the following cases. If so, give the *mgu*, if not justify it. The lowercase letters are variables, and upper are predicate, functions, and literals.

   (a) $p = F(x, F(u, x)); \quad q = (F(F(y, A), F(z, F(B, z))))$

   (b) $p = F(G(v), H(u, v)); \quad q = F(w, J(x, y))$

5. Let Γ is knowledge-base and α is inference from Γ. Give a comparison among the following inferences, in terms of their performances:

   (a) Proof by Resolution, i.e., $\Gamma \vdash \alpha$,

   (b) Proof by Modus poenes, i.e., $\Gamma \vdash \alpha$,

   (c) Proof by Resolution Refutation, i.e., $\Gamma \cup \{\neg \alpha\} \vdash \phi$.

6. For each pair of atomic sentences, give the most general unifier if it exists:

   (a) $P(A, B, B)$ and $P(x, y, z)$

   (b) $knows(Father(y), y)$ and $knows(x, x)$

   (c) $\{f(x, g(x)) = y, h(y) = h(v), v = f(g(z), w)\}$

Note: Submission deadline 2nd Feb. 2015, 23:59 hrs (IST). Assignment shall be submitted online only at email id kr.chowdhary at iitj dot ac dot in, with subject marked as AI-HW2-rollno. Format: pdf, prepared through latex or word.