CSE 4/563 Knowledge Representation
Professor Shapiro
Homework 6
Maximum Points: 12
Due: 10:30 AM, **Monday, March 2, 2009**

February 25, 2009

Put your answers in a file named hw6.*ext*, for an appropriate value of *ext*. **Include your name at the top of the file.** Submit that file by executing the Unix command

```
submit_cse463 hw6.ext
```
or
```
submit_cse563 hw6.ext
```
whichever is appropriate for you. The file can be a text file, or produced by some word processing software, but it must be formatted so it is easy to read.

Substitution Application Write the value of applying the given substitution to the given expression. Assume, as usual, that a, b, c, and d are individual constants, that f and g are function symbols, and that x, y, and z are variables.

1. (1) $P(x, y, a)\{b/x, f(c)/y\}$
2. (1) $P(x, f(x, y), a)\{g(z)/x, f(b, c)/y\}$
3. (1) $P(x, f(y, z), a)\{g(z)/x, f(b, c)/z\}$
4. (1) $\forall x[[\exists y P(x, f(y, z), a)] \Rightarrow Q(x, y, z)]\{g(b)/x, f(a, c)/y, g(d)/z\}$

Substitution Composition Write the substitution that is the value of the given substitution composition. Assume, as usual, that a, b, and c are individual constants, that f and g are function symbols, and that u, v, x, y, and z are variables.

1. (1) $\{f(u)/x, g(a, v)/y\} \circ \{b/u, x/v\}$
2. (1) $\{f(u)/x, g(a, x)/y\} \circ \{g(y)/u, v/x\}$

Unification If the two expressions unify, give an mgu (most general unifier); if not write "Fail" and give the reason. Assume, as usual, that a, b, c, and d are individual constants, that f, g, and h are function symbols, and that u, v, x, y, and z are variables.

1. (1) $P(x, f(b, y), c)$ and $P(a, f(u, d), v)$
2. (1) $P(x, f(a, y), b)$ and $P(c, f(d, u), v)$
3. (1) $P(a, f(b, x), y)$ and $P(u, f(v, u), v)$
4. (1) $P(x, f(b, h(y)), c)$ and $P(a, f(u, g(d)), v)$
5. (1) $P(b, f(x, y), x)$ and $P(u, f(g(v), h(d)), v)$

Translation

1. (1) Translate the following wff into one that Propositional Logic model-finders can use, assuming that the domain consists of the individuals Tom, Betty, and Sally, denoted by the individual constants `Tom`, `Betty`, and `Sally`, respectively.

$$(\texttt{exists x (forall (y) (Drives x y)))}$$