

CSE 4/563 Knowledge Representation
Professor Shapiro
Homework 6
Maximum Points: 45
Due: 10:30 AM, Wednesday, March 21, 2007

March 7, 2007

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 are individual constants, and that x, y, z are variables.

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

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

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

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, d are individual constants, and that u, v, x, y are variables.

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

Translation Into Clause Form You may, but needn't show your steps.

1. (3) Translate $\neg(A \wedge (B \vee C))$ into clause form.
2. (3) Translate $\forall x(A(x) \Rightarrow (B(x) \vee C(x)))$ into clause form.

Predicate Logic Resolution Refutation

1. (3) Use resolution refutation to prove the following. Show all your steps.

$$\begin{aligned} & \forall x(Home(x) \Rightarrow (Asleep(x) \vee Active(x))), \\ & \forall x(Active(x) \Rightarrow (Studying(x) \vee Watching(x, TV))), \\ & \forall x(Home(x) \vee Out(x)), \\ & \neg Out(Tom), \\ & \neg Asleep(Tom) \\ & \models (Home(Tom) \wedge (Studying(Tom) \vee Watching(Tom, TV))) \end{aligned}$$