National University of Singapore
School of Computing
CS3234 — Logic and Formal Systems
Semester I, 2004/2005

Tutorial 5

1. Unify the following pairs of atomic formulas, if possible.

$p(a, x, f(g(y)))$ and $p(y, f(z), f(z))$
$p(x, g(f(a)), f(x))$ and $p(f(a), y, y)$
$p(x, g(f(a)), f(x))$ and $p(f(y), z, y)$
$p(a, x, f(g(y)))$ and $p(z, h(z, u), f(u))$

2. Given the logic program

$$p(a, b)$$
$$p(c, b)$$
$$p(x, y) \leftarrow p(x, z), p(z, y)$$
$$p(x, y) \leftarrow p(y, x)$$

and the goal $\leftarrow p(a, c)$, show that if any clause is omitted from the program, then there is no refutation. From this, prove that if a depth first search rule is used with any fixed order of the clauses, there is no refutation no matter what computation rule is used.

3.

(a) Write a Prolog predicate that takes a list of integers and splits it into two lists containing the odd-ranked, and the even-ranked elements of the original list, respectively.

Sample call:

```
?- split([10,2,3,7,5,1],A,B).
```

Answer: `A=[10,3,5] B=[2,7,1]`

(b) Write a Prolog predicate that takes two *sorted* lists of integers and merges them into a sorted list containing all the elements of the two lists.

Sample call:

```
?- merge([3,5,10],[1,2,7],A).
```

Answer: `A=[1,2,3,5,7,10]`

(c) Using the `split` and `merge` predicates, write a Prolog predicate that sorts a list of integers using the *mergesort algorithm*.

Sample call:

```
?- mergesort([10,2,3,7,5,1],A).
```

Answer: `A=[1,2,3,5,7,10]`