COMP219: Artificial Intelligence
Lab Exercise 4 - To be carried out in Week 5

1. Create a new Prolog program file in your Prolog programs directory and call it *lab4.pl*. Add to it the definition of `tlength` given in Lecture 12. See what results you get for the following queries:

   (a) tlength([1,2,3,4,5],Y)
   (b) tlength([l,a,b,o,r,a,t,o,r,y],Z)
   (c) tlength([],Z)
   (d) tlength(a,Z)

   Trace your solutions to see how the results are produced (– see lab 2 for details on how to perform a trace).

2. Download the program `nqueens2.pl` from the COMP219 website. This is a slightly modified version of the program discussed in the fourth Prolog lecture (Lecture 12). The main difference is the addition of a second solution template. In the first template neither the X nor the Y co-ordinates are fixed. In the second template, the X co-ordinates are fixed, which constrains the choice, making the search quicker and easier. Use trace to get an idea of how the program works. Solutions can be found with

   template1(X),tqueensolution(X).

   template2(X),tqueensolution(X).

   The first one will take a long time, so you may wish to terminate the execution before you have all the solutions.

3. Modify the program to compute the 4-queens problem. You will need to change the first two lines containing 'member' and the solution templates. This program should finish in reasonable time.

4. In your *lab4.pl* file, type in the example programs with 'cut' from the fourth Prolog lecture (the tax example). Use trace to see how 'cut' works.

5. Type up a program that contains the following code to compute the maximum of two numbers, where the third argument is the max

   ```
   max(X,Y,X) :- X >= Y.
   max(X,Y,Y) :- X < Y.
   ```

   Test the program with some appropriate queries.

   Now alter the program to the following, which tries to capture the reasoning that if the first rule fails, then the second must succeed.

```
max(X,Y,X) :- X >= Y, !.
max(X,Y,Y).
```

Does the program still produce the desired results? In answering this question
try out a query such as `max(5,1,1)`.

Change the first rule to the following: `max(X,Y,Max) :- X >= Y, !, X == Max.`

Does this resolve the issue, and why?