CSC 351L – Comparative Programming Languages Lab
Project 3 – Prolog Generate & Test
Due: March 4, 2021 at 11:59 pm

Purpose:

To explore the "generate and test" paradigm in Prolog.

Description:

The eight queens problem is a classic in computer science. It is frequently used to illustrate recursion and backtracking. In general, this problem is known as the N queens problem where the task is to place N queens on an N by N chessboard so that no two queens attack each other. This problem is solvable for values of N greater than 3.

For this project, you will create a Prolog program to solve the N queens problem. Let's begin by exploring this problem in a little more detail. A chess queen attacks all squares that are on the horizontal, vertical, and diagonal lines from where it sits. Because of the horizontal and vertical attacks, we know that there can be at most one queen per row and column of the chessboard. This means we can represent the position of the queens as a permutation of the numbers from 1 to N to indicate the columns where the queens are positioned. For example, the list [3, 1, 4, 2] represents the solution:

		Q	
Q			
			Q
	Q		

We only need to check for diagonal attacks either above or below each queen, but not both ways. If we checked both ways, we would find a pair of attacking queens twice. You should also see that for a queen at (X, Y), the diagonal elements below it are at (X+1, Y-1), (X+1, Y+1), (X+2, Y-2), (X+2, Y+2), etc.

The generate portion of this project will create permutations of the numbers between 1 and N, and the test portion will check to see if these permutations are a solution. In class, we looked at permutation sort, which you can use as the basis for generating the permutation. To complete this project, you need to write predicates that will check to see if a board is safe (in other words, no queen is attacked) and write predicates that will output the solution. Your output can just be the queens in properly aligned positions with vertical bars and horizontal dashes to make the spacing clearer.

Steps:

1) Copy the file (it contains the permutation code and the code to generate a list of numbers in the proper range) found at:

```
~mcconnel/CSC351/Prolog/Project3/queens.pl
```

2) Write the definition of the `safe` predicate, which will probably be easiest if you also create and use another predicated called `attacked`.

3) Write the definition of the predicates necessary to output the queens on a "chessboard."

Deliverables:

When you complete the program, you will prepare two things: a project report and a zip file containing all of your code.

The project report must use the format given in the sample file on D2L. This report can be prepared as a text file, MS Word document, or PDF. The project report should not be included in the zip file.

The zip file should include all prolog files. You can create the zip file in one of two ways – using zip on brahe or on your own computer.

The two items must be uploaded to the Project 3 drop box on D2L. No other form of submission will be accepted.