CS 480 – Artificial Intelligence: Planning and Control

Homework: Constraint Satisfaction

Attached is Python code for solving N-queens using simple backtracking, assigning the queen columns row-by-row. You may start with this code for the assignment, or you may translate it into another (normal) programming language.

Make sure your code is clear and well-documented (see the guidelines posted on Blackboard). Points will be deducted for poorly-structured, undocumented, or impossible-to-read code.

1. (20 points) Modify the code to count the total number of assignments attempted during a solution run and print them out.
    a. How many assignments are made solving 8-queens? 10-queens? 15-queens? 20-queens?
    b. Can you solve 100-queens in a reasonable amount of time? If so, how many assignments are made?
2. (40 points) Modify the code to include the least-constraining-value heuristic for determining which order to check new column assignments in.
    a. How many assignments are made solving 8-queens? 10-queens? 15-queens? 20-queens?
    b. Can you now solve 100-queens in a reasonable amount of time? If so, how many assignments are made?
    c. What is the largest problem you can solve in less than a minute? How many assignments are made?
3. (40 points) Incorporate arc-consistency checking into the program. (You will need an extra data structure to remember the allowable values for each row.)
    a. How many assignments are made solving 8-queens? 10-queens? 15-queens? 20-queens?
    b. Can you now solve 100-queens in a reasonable amount of time? If so, how many assignments are made?
    c. What is the largest problem you can solve in less than a minute? How many assignments are made?
4. (20 points extra credit) Implement min-conflicts local search.
    a. How does the time to solve 8, 10, 15, 20, 100 (or more) queens compare with the backtracking search?
    b. What is the largest problem you can solve in less than a minute?