CS 480 – Artificial Intelligence: Planning and Control

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Homework: Constraint Satisfaction

1. 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?
    Solution:

    Assignments made to solve:
    8- Queens: 113
    Time taken: 15.581607818603516

    10-Queens: 102
    Time taken: 15.621185302734375

    15-Queens: 1359
    Time Taken: 15.623807907104492

    20-Queens: 199635
    Time Taken: 3547.7921962738037

    b. Can you solve 100-queens in a reasonable amount of time? If so, how many assignments are made?
    No,
    Its not possible to solve 100- queen in a reasonable amount of time. using backtracking.

2. 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?
    Solutions:
    8- Queens: 140
    10-Queens: 183
    15-Queens: 15500
    20-Queens: 72000

    b. Can you now solve 100-queens in a reasonable amount of time? If so, how many assignments are made?
    No,

    c. What is the largest problem you can solve in less than a minute? How many assignments are made?
    The largest problem that can be solved using least-constraining-value heuristic is around 23 queens.

3. 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?

       Solution:
       8-queen: 26
       10- queens:23
       15-queens:
       20:queens:

    b. Can you now solve 100-queens in a reasonable amount of time? If so, how many assignments are made?
       No

    c. What is the largest problem you can solve in less than a minute? How many assignments are made?
       20

4. 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?

Number of Queens	Search Using backtracking	Min-conflicts local search
8 - queens	0.009 seconds	0.002 seconds
10-queens	0.004 seconds	0.08 seconds
15-queens	0.039 seconds	0.03 seconds
20-queens	9.75 seconds	0.059 seconds
100-queens	----	2.802 seconds

    b. What is the largest problem you can solve in less than a minute?
       Solution:
       The largest problem that we can solve under a minute is the problem that has 310 Queens