CMPT 310 - Artificial Intelligence Survey

Assignment 2

Due date: October 31, 2016
10 marks

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October 11, 2016

Important Note: Students must work individually on this, and other CMPT 310, assignments. You may not discuss the specific questions in this assignment, nor their solutions with any other student. You may not provide or use any solution, in whole or in part, to or by another student.

You are encouraged to discuss the general concepts involved in the questions in the context of completely different problems. If you are in doubt as to what constitutes acceptable discussion, please ask!

Write a program in an imperative language (like Python, C++, Java, etc.) that solves instances of map colouring problems. A map colouring problem is made up of a set of vertices (representing regions), edges (representing adjacency), and a set of colours, or values for variables represented by vertices. A solution is an assignment of colours to vertices such that every vertex has a colour and no two adjacent vertices have the same colour.

Assume for n vertices that the vertices are numbered 1 through n; similarly m colours are numbered 1 through m. Input will consist of a list where the first element is the number of vertices, the second element is the number of colours, and the rest of the list is made up of lists of vertices, where $(v_1\ v_2 \ldots v_n)$ means that v_1 is connected to each of $v_2 \ldots v_n$. (That is, except for the first two elements, the input is an adjacency list specifying the graph.) For example

(5 3 (1 2 3) (2 1 3) (3 1 2) (4 5) (5 4))

describes a problem with a graph with 5 vertices made up of two disjoint subgraphs, which is to be 3-coloured. You can assume that the graph is undirected and that the input is correct (i.e. don't bother with error checking). Note that since edges are undirected, each edge is given twice.

For this assignment, implement basic backtracking search along with the MRV, degree, and least constraining value heuristice. In your documentation, make sure that you describe your program at a high level and discuss any interesting aspects of your program. Test data is in a separate file, asking for a 4-colouring of 10 countries. Run your program on this data, as well as trying for a 3-colouring (which will fail). As well, optionally, test your program with and without using the heuristics, and report on the improvement (or lack of improvement) obtained.

If you want to try your program out on more complex graphs, take a look at

http://mat.gsia.cmu.edu/COLOR/instances.html

(though the graphs are given in a different format). If you do this, please report your results.