Artificial Intelligence Assignment

Constraint Satisfaction Problem

Submission Deadline - August 24, 2017 11:55pm

You need to submit a .pdf file containing your solutions for the following problems. Mention your name and Roll No. on the top of the document. The file name should be <Roll No>_assignment2_ th.pdf. For eg. 13CS30009_assignment2_th.pdf.

Q1) Consider assigning colors to a checkerboard so that squares that are adjacent vertically or horizontally do not have the same color. We know that this can be done with only two colors, say red (R) and black (B). We will limit our discussion to five squares on a 3x3 board, numbered as follows:

1 | 2 | 3
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4 | 5 |

  | |

We consider the CSP formulation of this problem. Let the squares be the variables and the colors be the values. All the variables have domains { R, B }.

(a) If we run full constraint propagation on the initial state, what are the resulting domains of the variables?

(b) Say, instead, the initial domain of variable 5 is restricted to { B }, with the other domains as before. If we now run full constraint propagation, what are the resulting domains of the variables?

(c) If in the initial state (all variables have domains { R, B }), we assign variable 1 to R and do forward checking, what are the resulting domains of the other variables?

(d) Assume that during backtracking we first attempt assigning variables to R and then to B. Assume, also, that we examine the variables in numerical order, starting

with 1. Also, let the domain of variable 5 be { B }, the other domains are { R, B }. Draw the pure backtracking tree that will be generated.

(e) If we use backtracking with forward checking in this same situation, give a list of all the assignments attempted, in sequence. Use the notation variable = color for assignments, for example, 1=R.

Q2) Explain why it is a good heuristic to choose the variable that is most constrained but the value that is least constraining in a CSP search.

Q3) Consider the CSP with

Variables = A,B, C
Domains = {1,2,3,4}
Constraints = A<B, B<C

Using the Arc Consistency Algorithm, determine the new domains for A,B and C when the algorithm terminates with all consistent arcs. Show detailed steps.

Q4) Give precise formulations for each of the following as constraint satisfaction problems:

(a) 8 queens problem: The eight queens puzzle is the problem of placing eight chess queens on an 8×8 chessboard so that no two queens threaten each other. Thus, a solution requires that no two queens share the same row, column, or diagonal

(b) Class scheduling: There is a fixed number of professors and classrooms, a list of classes to be offered, and a list of possible time slots for classes. Each professor has a set of classes that he or she can teach.