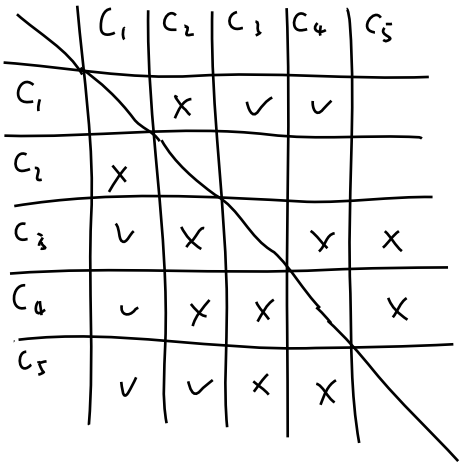
50.021 Artificial Intelligence

Constraint Satisfaction Problem

Suppose you are in charge in scheduling for ISTD classes that happen on Mondays, Tuesdays, and Thursdays. There are 5 classes that happen on these days and 3 professors who will be teaching these classes. Each professor can only teach one class at a time.

The classes are:

1. **C1**: Introduction to Algorithm, 8:00AM - 9:00AM
2. **C2**: Introduction to Artificial Intelligence, 8:30AM - 9:30AM
3. **C3**: Networks and Security, 9:00AM - 10:00AM
4. **C4**: Graphics, 9:00AM - 10:00AM
5. **C5**: Machine Learning, 9:30AM - 1030AM

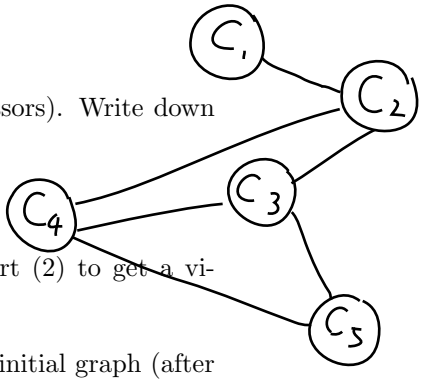


The professors are:

M 1. Professor Moriarty, who can teach classes C3 and C4

X 2. Professor X, who can teach classes C2, C3, C4, and C5

D 3. Professor Dumbledore, who can teach classes C1, C2, C3, C4, and C5



(1) Assume that there is one variable per-class, each with a domain (professors). Write down these variables, domains, and constraints.

(2) Draw the constraint graph associated with the CSP in part (1).

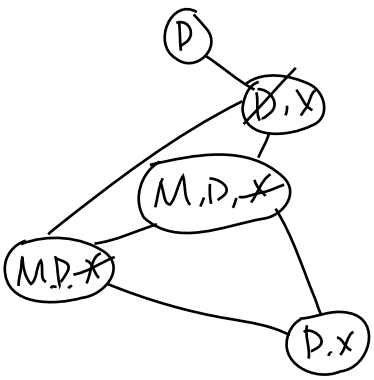
(3) Perform vanilla backtracking search (no pruning) on your graph in part (2) to get a viable solution. Show your steps.

(4) Show the domains of the variables after running arc-consistency on this initial graph (after having already enforced any unary constraints).

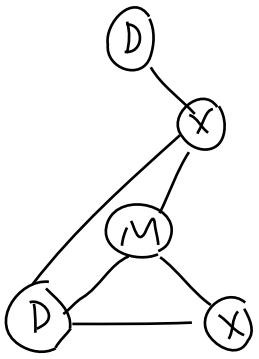
(5) Perform backtrack search with arc consistency from the initialization after arc-consistency in (4). Show your steps.

(6) The constraint graph in part (2) has an *almost tree* structure. Choose a variable such that when intializing it with a value, the remaining graph would have no cycles. There might be more than one choice. M or D
Then initialize your chosen variable with a value, run tree CSP and see if it finds a solution, if no solution is found, try out all possible values for this variable until you find a solution. Show your steps.

1D
1D, 2D
1D, 2X
1D, 2X, ..
⋮
1D, 2X, 3M 4D, 5X



Prune



$C_3 = \{X\}$