University of St. Thomas, Saint Paul, Minnesota
Computer and Information Sciences Department

CISC440: Artificial Intelligence and Robotics

Quiz 3: Constraint Satisfaction Problem

Instruction:

1. Work with you team member and solve the quiz.
2. You both can submit one solution.
3. Please write names of both team members.

Names: SOLUTION

Total points: 20

You are scheduling five lower-level CISC courses for the spring that have three professors available to teach them. A professor can teach more than one course, but only if the times don't overlap. The courses and the times when they meet are:

Course 1: CISC130, 8:00-9:00am

Course 2: CISC230, 8:30-9:30am

Course 3: CISC231, 9:00-10:00am

Course 4: CISC440, 9:00-10:00am

Course 5: CISC450, 9:30-10:30am

The professors are:

Prof. A, who is available to teach Courses 3 and 4

Prof. B, who is available to teach Courses 2, 3, 4 and 5

Prof. C, who is available to teach Courses 1, 2, 3, 4 and 5.

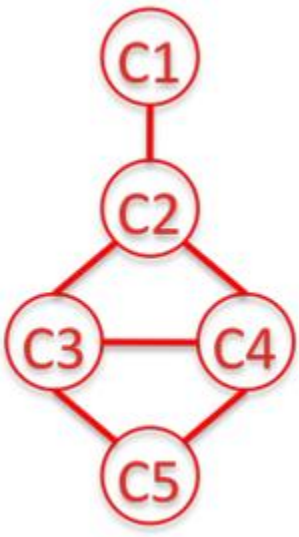
a. (3 points) Formulate this as a CSP problem with one variable per course and give the initial domain (i.e., set of possible values) after applying the unary constraints (i.e., which Courses a professor can teach).

Variable	Initial domain after applying unary constraints
C1	{C}
C2	{B,C}
C3	{A,B,C}
C4	{A,B,C}
C5	{B,C}

b. List all the constraints between the variables

C1 ≠ C2, C2 ≠ C3, C3 ≠ C4, C4 ≠ C5, C2 ≠ C4, C3 ≠ C5

c. Draw the constraint graph associated with your CSP.



d. Show the domains of the variables after C3=B assignment on this graph (after having already enforced any unary constraints). Consider this as your first assignment.

C1: {C}, C2: {C}, C3: {B}, C4: {A,C}, C5: {C}

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

C1: {C}, C2: {B}, C3: {A,C}, C4: {A,C}, C5: {B,C}
Note that while C5 can't be C, arc consistency doesn't rule it out.

f. Give one solution to this CSP.

Two solutions are possible:

- C1 = C, C2 = B, C3 = C, C4 = A, C5 = B
- C1 = C, C2 = B, C3 = A, C4 = C, C5 = B

g. What could a reasonable minimum cut-set? And what could be a possible solution?

C3 could be considered as minimum cut-set.

Now we will assign C3 = A and take it from all the other variables domain who have constraint with C3. Now using the unary constraints for C1 and follow the tree we will assign the values.

C1 = C

C2= B

C3 = A

C4 = C

C5 = B