

CSE 414 Section 5

April 28, 2016

Consider a graph of colored vertices and undirected edges where the vertices can be red, green, blue. In particular, you have the relations

$\text{Vertex}(x, \text{color})$

$\text{Edge}(x, y)$

The Edge relation is symmetric in the if (x, y) is in Edge, then (y, x) is in Edge. Your goal is to write a datalog program to answer each of the following questions.

1. Find all green vertices.

$\text{GreenV}(x) :- \text{Vertex}(x, \text{'green'})$

2. Find all pairs of blue vertices connected by one edge.

$\text{BluePairs}(x) :- \text{Vertex}(x, \text{'blue'}), \text{Vertex}(y, \text{'blue'}), \text{Edge}(x, y)$

3. Find all triangles where all the vertices are the same color. Output the three vertices and their shared color.

$\text{Triangle}(x, y, z, a) :- \text{Vertex}(x, a), \text{Vertex}(y, a), \text{Vertex}(z, a),$
 $\text{Edge}(x, y), \text{Edge}(y, z), \text{Edge}(z, x)$

4. Find all vertices that don't have any neighbors.

WRONG ANSWER (UNSAFE)

$\text{LonleyV}(x) :- \text{not Edge}(x, -)$

WRONG ANSWER (UNSAFE)

$\text{LonleyV}(x) :- \text{Vertex}(x, -), \text{not Edge}(x, -)$

RIGHT ANSWER (SAFE)

$\text{OnlyX}(x) :- \text{Edge}(x, -)$

$\text{LonleyV}(x) :- \text{Vertex}(x, -), \text{not OnlyX}(x)$

5. Find all vertices such that they only have red neighbors.

$\text{BlueV}(x) :- \text{Vertex}(x, -), \text{Edge}(x, y), \text{Vertex}(y, \text{'blue'})$

$\text{GreenV}(x) :- \text{Vertex}(x, -), \text{Edge}(x, y), \text{Vertex}(y, \text{'green'})$

$\text{RedV}(x) :- \text{Vertex}(x, -), \text{not BlueV}(x), \text{not GreenV}(x)$

6. Find all vertices such that they only have neighbors with the same color. Return the vertex and color.

$\text{SameColor}(x, y, a) :- \text{Vertex}(x, a), \text{Vertex}(y, a)$

$\text{NotSameNeigh}(x) :- \text{Vertex}(x, -), \text{Edge}(x, y), \text{Edge}(x, z), \text{not SameColor}(y, z)$

$\text{OnlySameNeigh}(x, a) :- \text{Vertex}(x, a), \text{not NotSameNeigh}(x)$

OR

$\text{Neigh}(x, y, a) :- \text{Edge}(x, y), \text{Vertex}(y, a)$

$\text{DifferentNeigh}(x) :- \text{Neigh}(x, y, a), \text{Neigh}(x, z, b), a \neq b$

$\text{OnlySameNeigh}(x, a) :- \text{Vertex}(x, a), \text{not DifferentNeigh}(x)$

7. (Optional) For some vertex v , find all vertexes connected to v by blue vertexes (this one require recursion).

$\text{ConnectedTo}(x) :- \text{Vertex}(x, \text{'blue'}), \text{Edge}(x, v)$

$\text{ConnectedTo}(x) :- \text{Vertex}(x, \text{'blue'}), \text{Edge}(x, y), \text{ConnectedTo}(y)$