PI-hw 3
Trevor Davis

Homework Assignment 3: Logic Programming

Submission Instruction: there are following 2 files need to be submitted

(a) Answers to problem 1 - 6 of this assignment should be saved as pdf or word file.

(b) For Problem 6, put (a) facts and (b) rules into one text file ready to run for grading. It is very important that your file name is your name with .pl extension.

1. (4 %) Complete the following sentences:

(a) Logic programming systems are also called <u>Deductive</u> databases.

(b) The process of pattern matching to make statements identical is called <u>Unification</u>.

2. (12%) Give a concise answer to each question below:

(a) What are the differences between procedural programming and logic programming?

Some differences between procedural programming and logic programming islogic programming specifies relations between objects where in procedural programming specific data types are used. Logic programming is declarative where procedural programming is not.

(b) What are the deficiencies of Prolog?

Some deficiencies of prolog are resolution order control where prolog always matches in the same order in which the user can control the ordering. Another problem is that anything not stated in the database is assumed to be false. Lastly negation is difficult to represent in prolog as there is no NOT in prolog.

(c) What are the motivations for Logic programming?

Some motivation behind logic programming is that it is used for fault diagnosis, planning, natural language processing and machine learning. It can be used to verify the correctness of a programmer as well as transform logic programs to be more efficient. It can reduce the programming burden.

3. (9%) Use the set notation to describe resolution as a refutation system.

{S} U {¬G}

This is inconsistent if {S} U {G} is consistent.

4. (25%) Give deduction trees of resolution (a) using (1) and (5); (b) using (2) and (5) -- Sample solution is in Canvas as "UnificationEx2"

for the following set of clauses. Show each level of unification with instantiation (for example {m|Y}).

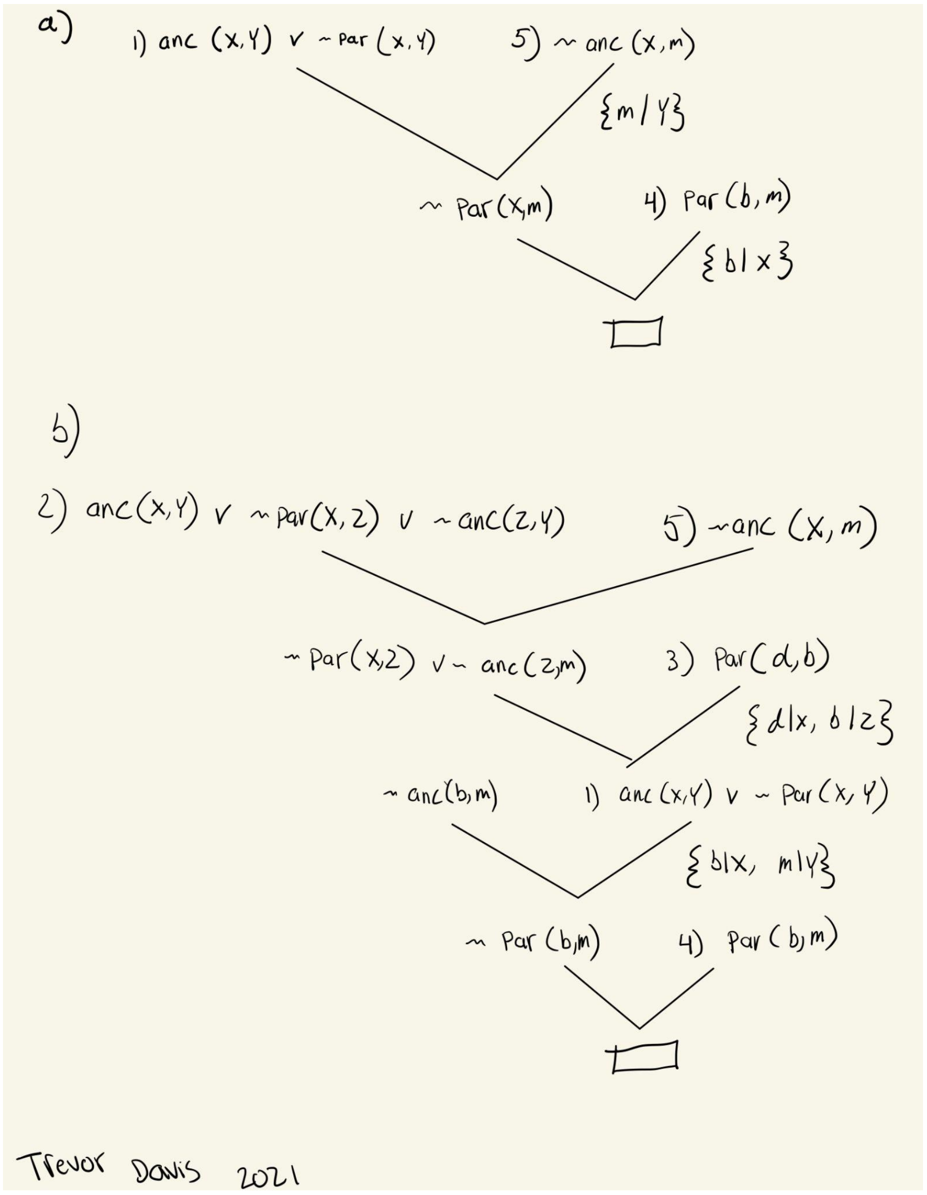
(1) anc (X, Y) ∨ ~par (X, Y)

(2) anc(X, Y) ∨ ~par (X, Z) ∨ ~anc (Z, Y)

(3) par (d, b)

(4) par (b, m)

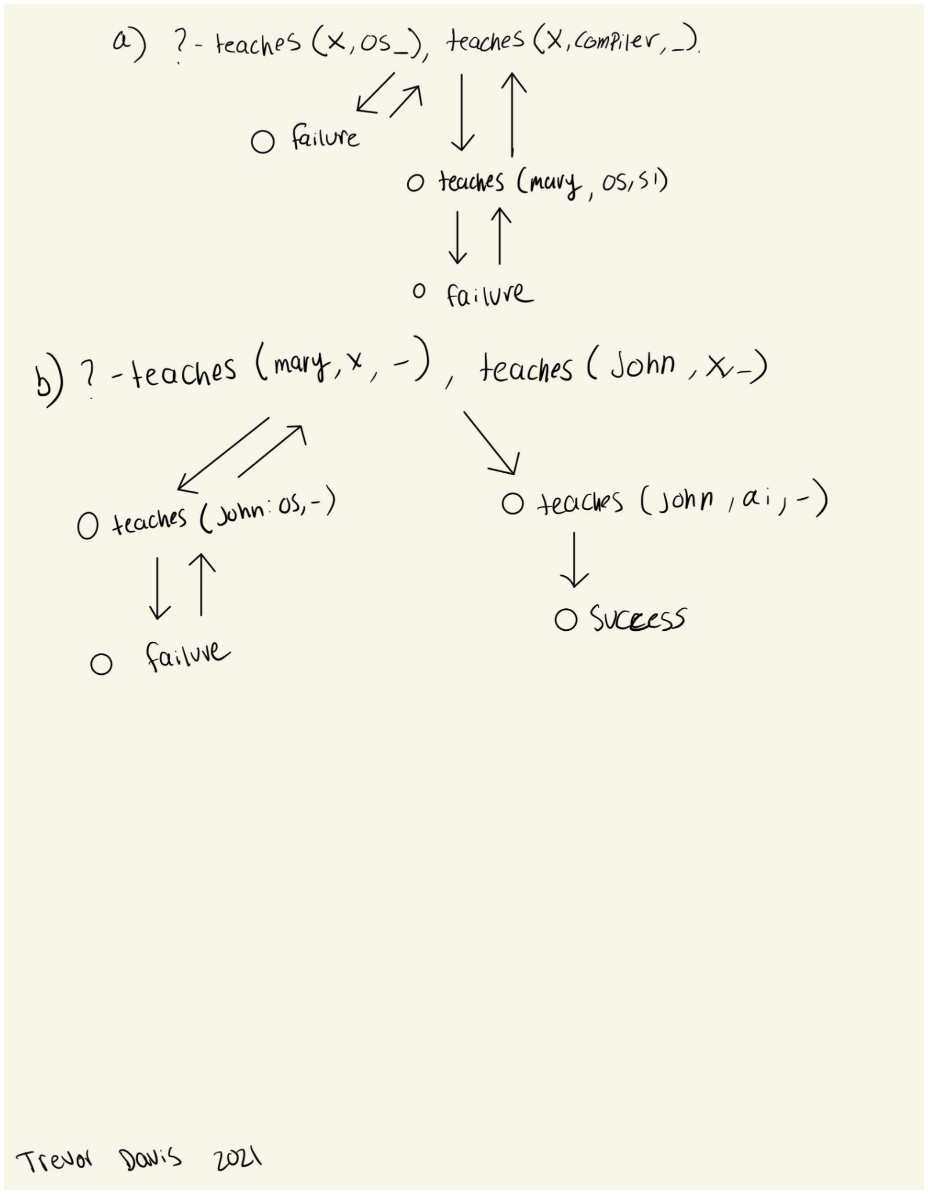
(5) ~anc (X, m)



5. (20%) Conjunctions and Backtracking. Using the example of "Who teaches what" (see LogicProglecture page 20 in Canvas),

(a) try to trace through search process for Query 2;

(b) try to trace through Query 1, but with sub-goals reversed.



Answers to following part (problem 6) of this assignment should be also posted at your course Web site to share with the class:

6. **(30%) Exercise problem contribution.** Using the Example "Every scientist is logician" (see Canvas ExecofProlog example) as a guide, to create a problem with following 4 parts and then give solution to your own problem. **Post** your **problem** ((a) - (c)) and **solution** ((d) - (e)) **at your website** to share with your classmates. (Note: You may scan/take a picture of hand drawn deduction tree or draw it with a tool digitally)

(a) (5%) Write a PROLOG representation of the following facts: (your at least 5 facts in English);

plays(Trevor, baseball)	Trevor plays baseball
likes(Trevor, coffee)	Trevor likes coffee
likes(Trevor, games)	Trevor likes games
friend(zach, trevor)	Zach is friend of Trevor
boss(bob, trevor)	Bob is boss of Trevor

(b) (6%) Write a PROLOG representation of the following rule: (your at least 2 rules in English);

game (X,Y):- plays(X,Y)

coworker(X,Y):- boss(X,Y)

(c) (4%) Write two PROLOG goal statements to search for answers: (also give 2 W questions in English), and at least one of your goal statements should be a conjunction of two subgoals;

Q1) ?-boss(Z, Trevor) Who is the boss of Trevor?

Z=Trevor

Q2) ?-likes(X, coffee), likes(X, games) Who likes coffe and games?

X = Trevor

(d) (10%) Run each given query in (c) using Prolog and then **post the interactive sessions as part of your solution at your website**;

(e) (5%) Show deduction tree that deducing the answer for one of the W (Who, What, Which, What) questions above according to Prolog search strategy (**a picture to pos**t).

Resources:

Logic Programming courseware for CSC 135. This is a very useful tool for you to learn SWI Prolog quickly with examples and step by step instruction.

Prolog (a nice introdution by Michel Loiseleur and Vigier Nicolas). Look at sections 1 to 5.

Prolog Wikibook (Cuts and Negation).

SWI-Prolog -- this is the site you can download a free Prolog system to your own machine and run prolog programs.