CSC520 Spring 2020 Assignment 4

Due 31/03/2020 at 11:59pm

This assignment includes conceptual and code questions. It must be completed individually. You may not collaborate with other students or exchange partial answers. Questions about your work must be emailed to the instructor or TAs, or discussed during office hours.

You must submit your code as a single self-contained zip file called Assign4.zip. This file must contain all code necessary to run along with a **README** file that specifies how to build and execute the code. Your grade will be based upon the execution of your code and on its compilation, clarity, and documentation. Your answers to the written questions should be uploaded as a single pdf file called "Assign4_<unity_id>.pdf". This will be graded on the completeness, correctness, coherence, and readability of your answers.

1. Prolog

Here is a database of facts and rules. Write a simple Prolog-style database which contains facts and rules representing this information.

Creatures come in two types: humans and birds.
One type of human is a man.
One type of bird is a turkey.
Louis is a man.
Albert is a man.
Frank is a turkey.

1. (5 pts.) Draw this taxonomy as a graph, with "creature" at the root, and label the edges with AKO or ISA, whichever is appropriate.

2. (10 pts.) Suppose these facts were represented by seven FOPL facts of the form edge(<sourceNode>, <linkType>, <destinationNode>). Implement these facts as Prolog facts. Using as a toplevel rule head the syntax rel(SourceNode, RelationshipType, DestinationNode) and any other predicates you need, write a set of one or more rules to allow the inference that:
    1. Louis is a man, Louis is a human, and Louis is a creature.
    2. Albert is a man, Albert is a human, and Albert is a creature.
    3. Frank is a turkey, Frank is a bird, and Frank is a creature.
3. Your rules should follow strict Prolog syntax, and should allow inference over hierarchies of **any** depth, not just the depth in this example.
4. (5 pts.) Now add nodes and edges to the network to represent the knowledge that humans normally have two legs and birds can normally fly, but Louis has one leg and turkeys cannot fly. Using fact syntax such as property(<node>, legs, two) and property(<node>, fly, no), indicate which new facts will be necessary, and show in your network sketch from Part (a) where they should be added.
5. (10 pts.) Add rule(s) to allow inference that (i) Frank cannot fly, (ii) Albert has two legs. and (iii) Louis has one leg. Your new rules will need to use the new facts from Part (c).

2. Plan graph

For this question consider the following problem description:
Suppose today is your spouse's birthday. You plan to cook dinner and prepare a wrapped present for her. You also want to clean up your apartment for the party. Thus, at the beginning, you have garbage in your apartment, your hand is clean, and the room is very quiet. You need to cook with your clean hand to make dinner. You need to be quiet to wrap present. You can carry the garbage, it will remove the garbage but you hand will be not clean. You can dolly the garbage, it will remove the garbage but the room won't be quiet.

a. Provide a PDDL representation of the above problem specification.

b. Apply the Graphplan algorithm to solve this problem showing the complete steps, mutex links, and the final plan. All levels, actions, variables and mutex links must be clearly labeled and their types shown. Draw the graph and the plan.