Homework Assignment 1

Submit Assignment

Due Feb 19 by 11:59pm   **Points** 100   **Submitting** a text entry box or a file upload

The goal of this homework assignments is to provide you additional practice problems on top of the ones available in the textbook and provided during the class lectures. In order to properly learn the concepts, you must attempt solving as many problems as you can find so just doing the homework is not enough to master the AI concepts. The goal of Homework Assignment 1 is to provide you a chance to practice writing in various knowledge representation languages discussed in class.

1. The goal of this question is to provide you some practice in using proposition logic as a knowledge representation scheme for solving an AI problem. (30 points)

   A. Translate the following into propositional logic. Use truth table construction to try to prove that Curiosity killed the cat logically follows from the given facts.

   > Either I am not here or Jane has a cat named Patty.
   >
   > Either Jane does not have a cat named Patty or John has a dog named Curiosity.
   >
   > Either John does not have a dog named Curiosity or Curiosity killed the cat
   >
   > I am here.

   B. Translate the propositional logic sentences you created in part a into CNF clauses and attempt the proof using resolution. Show all your proof steps.

   C. Translate the propositional logic sentences you created in part a into INF clauses. Translate these clauses into Prolog statements. Type them into a file and have SWI prolog read the file and type the query to see if the conclusion, "Curiosity killed the cat" logically follows. To get full marks for this question, show all of your work. Document the mapping from sentences to propositions by showing which proposition corresponds to which sentence.

2. The goal of this question is to provide you a chance to practice using predicate logic as a knowledge representation scheme to solve an AI problem. This questions uses Blocksworld. Blocksworld is a single agent deterministic and fully observable world. The world consists of a number of blocks. The goal is to design an intelligent agent that can either stack and unstack the blocks. The agent can only move one block at a time following the rules below: (50 points)

   o The agent can move a block as long as that block is clear (i.e., it does not have a block on top of it). Unclear blocks (i.e., blocks with other blocks on top of them) cannot be moved until they are

      cleared (by removing blocks from top of them)
- the table doesn't have to be clear. A block can always be moved onto the table even when there already are one or more blocks on the table.
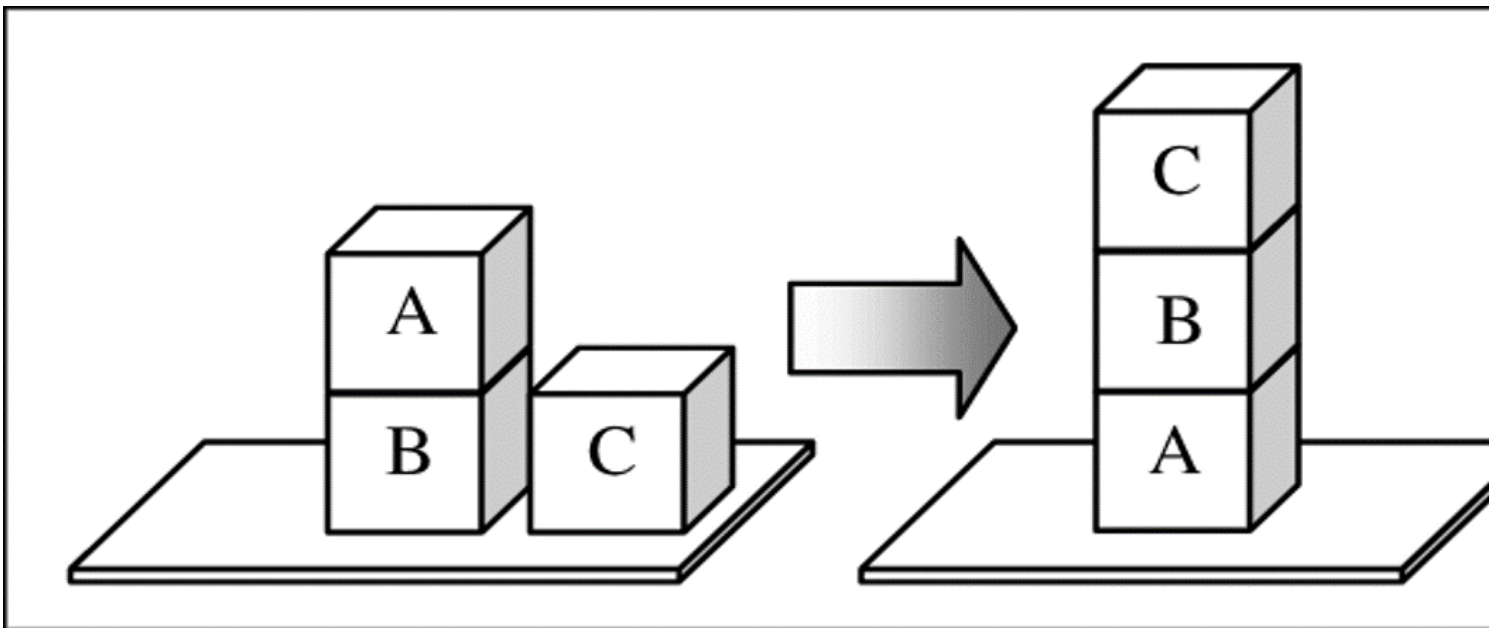
A. Translate the Blocksworld rules specified above into Predicate Logic.

B. Translate the predicate logic sentences from Part A into Prolog statements.

C. Consider the following Blocksworld problem.

    Initial State: on(a, b)

                                       on(b, table)

                                       on(c, table)

    Goal State: on(c, b)

D. Translate the initial state into Prolog clauses and add them to the program you wrote in part b. For this problem, you can also assume that the world only has three blocks in it: a, b, and c (remember object names are represented in lower case in Prolog. Upper case letters are reserved for variables).

E. Read the program you wrote into a Prolog compiler and ask the goal as a query. Your program should return True if the goal state can be achieved and False if it cannot be. Your program should also print all the moves that are needed to transform the Blocksworld from the initial state to the goal state.

3. The goal of this question is to provide you some practice in using Bayesian Belief Networks as a knowledge representation scheme for solving an AI problem. (20 points).

knowledge representation scheme for solving an AI problem. (20 points)

A. Please represent the problem of diagnosing Covid-19 using the following knowledge. CDC and other health officials have associated a number of symptoms with Covid-19 including fever, runny nose, soar throat, fatigue, and cough. Assume that at any given time 10% of the population we're interested in modeling has these symptoms.

Two types of tests available to test for Covid-19. The rapid (Antigen) test and the PCR test. The rapid test is said to be more accurate for people who have symptoms while presence/absence of symptoms has no impact on the PCR test. Assume that 40% of the people who have symptoms test positive for the rapid test and only 10% of the non-symptomatic people test positive for the rapid test. Assume that 90% of people who take the PCR-test test negagive.

Assume that 100% of the people who test positive on both tests have Covid and 99% of the people who test negative on both types of tests do not have it. Since the PCR test is more accurate than the rapid test, 90% of those who test positive on PCR and negative on the rapid test have Covid while only 5% of those who test positive on the rapid test and negative on the PCR test have it.

Please use Netica or Hugin-lite to build a Bayesian Belief Network to model this problem. Compile your network, take a screenshot and submit it.

B. Imagine that you develop the symptoms, what is the probability that you have Covid?