IT5005 Artificial Intelligence

Tutorial 4

1. Rewrite the following clauses in CNF. Which clauses are Horn Clauses, which are Definite Clauses, and which are neither?

   a. $p \leftrightarrow q \vee r$
   b. $q \vee r \rightarrow s$
   c. $p \wedge q \rightarrow p \vee q$

2. Recall the "Spectacle Problem" from lecture 2, reproduced here for your convenience:

   a. If I was reading the newspaper in the kitchen, then my glasses are on the kitchen table.
   b. If my glasses are on the kitchen table, then I saw them at breakfast.
   c. I did not see my glasses at breakfast.
   d. I was reading the newspaper in the living room or I was reading the newspaper in the kitchen.
   e. If I was reading the newspaper in the living room then my glasses are on the coffee table.

   Let

   - *RK* = I was reading the newspaper in the kitchen.
   - *GK* = My glasses are on the kitchen table.
   - *SB* = I saw my glasses at breakfast.
   - *RL* = I was reading the newspaper in the living room.
   - *GC* = My glasses are on the coffee table.

   i. Write out the statements in propositional logic.
   ii. Convert the statements into CNF form.
   iii. Use resolution to prove that the glasses are on the coffee table.

3. In the mythical country of `Fiveohohfive Land, a person can hold a taxi license if the person has at least five years of driving experience, has obtained a certificate in public transport safety and possesses a certificate of merit. A person can possess a certificate of safety if the person passes the certification exam. A person can obtain a certificate of merit if a person is accident free and has not committed a traffic offence for the past five years.

   A person who has a merit certificate has been driving for at least 5 years.

   Use the following predicates to answer the questions below:

   CanHasLicense(x1): x1 can to hold a taxi operator license.
   FiveYears(x2): x2 has five years of driving experience.
   Certificate(x3): x3 has a certificate in public transport safety.
   Merit(x4): x4 has a certificate of merit.
   PassedExam(x5): x5 passed the certificate exam.
   AccidentFree(x6): x6 has been accident free for the past 5 years
   OffenceFree(x7): x7 has been traffic offence free for the past 5 years.

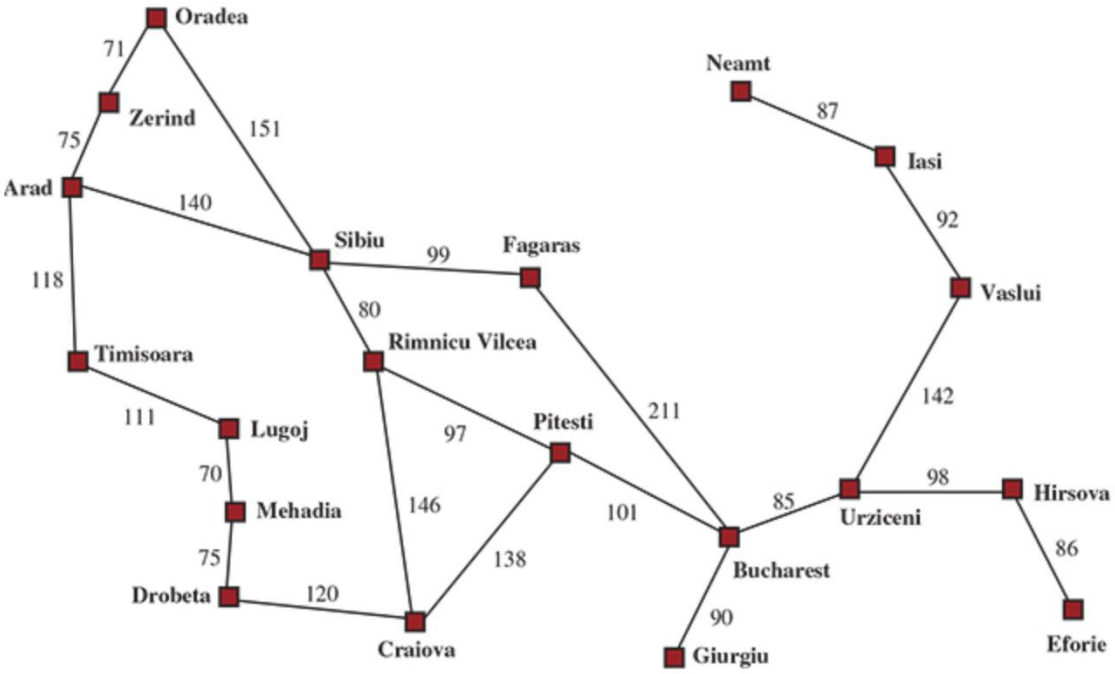
   a. Write out the full set of rules as stated above using the predicates given.
   b. Suppose we know:

      PassedExam(Bob)
      AccidentFree(Bob)
      OffenceFree(Bob)

      Use unification and forward-chaining to prove that Bob is qualified to hold a taxi operator license. Show all the unification and inference steps.

   c. Rewrite the rules in CNF, and use unification and resolution to prove that Bob is qualified to hold a taxi operator license.

4. We come back to our Romanian Problem, where we want to get from Arad to Bucharest using the map shown below:



Apply Depth First Search, Breadth First Search and Dijkstra's Algorithm to produce a route from Arad to Bucharest, showing the distance of the route for each algorithm.