KRE/t8

Tutorial Exercises for March 2nd/6th

1. Show that the rational numbers (numbers of the form m/n, with m, n integers), together with the usual order relation p < q, do not give a discrete order, by showing that between any two rationals, there is always another rational.

Thus it does not make sense to talk of the *next* time point, if we model time with rational numbers.

- 2. Give a three valued truth table for \rightarrow , extending the usual truth table, for values true, false, unknown. This should mimic the usual two values, and keep as much information as possible in other cases.
- 3. Suppose time points are given by a list of integers for

[month, day, year, hours, minutes, seconds].

Assuming that the integers lie in sensible ranges, show how to compute in Prolog the properties

Here arguments labelled with "+" are input, and "?" indicates an argument that may be input or output

The cases should be treated distinctly.

4. Suppose we have defined the procedures in 3.

Belief lists are represented as

```
b(A,Pred,[[Time1,t],[Time2,f],[Time3,t]]).
```

meaning that: agent A started to believe Pred1 at Time1, believes that Pred1 turns false at Time2, and is true again for all times after Time3. Before Time1, Agent1 has no belief about Pred1.

Define a predicate

add_to_bel_list(+OldLabel,+Time,+TruthVal,-NewLabel)

as follows: Suppose first time in old label is T1 and new time is TN.

- If TN is less than T1, add new pair to front;
- If TN is same as T1, replace first pair with new pair;
- Otherwise keep first pair as first, and call recursively.

The base case is the empty list of pairs — simply insert the new pair to make a list with one pair.

- 5. Your solution should have the property that the sequence of times in the label are strictly increasing, and the agent's beliefs are always consistent, i.e. at any point in time, and for any statement P, the agent does not belief P and also $\neg P$. Explain why these hold.
- 6. Implement a query for beliefs of negation-free queries.

```
no_nots_believes(+Agent,[?Time,?Belief],?TruthVal).
```

There may be no belief label for the agent present; if there is, find the label, and then for time t look at the cases:

- when t is ground
 - when list is empty
 - when t is not less than first label time
 - otherwise
- when time t is a (Prolog) variable.