Artificial Intelligence – Exercise 5

Task 1: First-order resolution (ii)

Peter loves muffins, especially blueberry muffins. He also wants to prove that and has therefore developed a complex formula (square brackets are for better clarity).

$$\forall x\ Yummy(x) \implies [\exists p\ Person(p) \wedge Liebt(p,x)] \tag{1}$$

1. Help Peter convert the above formula to the conjunctive normal form.
2. Can $Loves(Peter, Blueberrymuffin)$ be deduced from the above formula and $Yummy(Blueberrymuffin)$ using first-order logic resolution?

Task 2: PDDL

In order to get from a starting point to a destination in a city, the following actions are available

- Walk
- Cycle
- Drive Car
- Use the bus

Walking and cycling are possible directly from start to finish. When driving, you can only drive from parking lot to another parking lot (a car has to be available at the starting parking lot). Using the bus, you can only travel from stop to stop and you have to walk or cycle the rest of the way.

1. Think about reasonable preconditions and results of the actions and specify the actions in PDDL. You can assume that all variables describe locations.
2. State a valid plan for a person, that travels to the Computer Science building either
   (a) by walking
   (b) by bike
   (c) using the bus
   (d) by driving a car

Task 3: Knowledge questions

1. When planning, people usually do backward-state search, i.e. search from destination to start. In artificial intelligence, however, forward-state search methods have established themselves. Why?
2. In hierarchical planning, the use of plan libraries on a high level of abstraction already results in an enormous reduction in the search space. This can be improved considerably if you can check whether an HLA description (high level action) can be carried out. What approaches exists to achieve this?
3. How can the following concepts be representated? Give an example for each!
   (a) Categories of objects (e.g. medical diagnoses)
   (b) Relations between categories of objects (e.g. connections between diagnoses and therapies)
   (c) Events (e.g. a lecture hour in presence and as a web lecture)
   (d) Physical objects that can change in terms of place and time (e.g. a nation)
   (e) Knowledge of the knowledge of other agents