G53KRR answers to informal exercise on descripton logic.

- State a definition of a concept C which is: a person who has a daughter and a son. Assume that you have concepts $Person$, $Female$ and a role $child$.

  Answer. $Person \sqcap \exists child.Female \sqcap \exists child.\neg Female$ (I translated a son as a non-female child).

- Translate the following definitions and inclusion statements into ALC, using atomic concepts $Vegetarian$, $Person$, $Meat$, $Fish$, $Animal$, $Vegan$, and roles $eats$ and $productOf$:

  1. A vegetarian is a person who does not eat meat and does not eat fish
  2. A vegan is a person who does not eat animal products
  3. The concepts of non-vegetarian and vegan are disjoint
  4. Everyone who eats meat also eats animal products

  Answers

  1. $Vegetarian \doteq Person \sqcap \neg\exists eats.Meat \sqcap \neg\exists eats.Fish$
  2. $Vegan \doteq Person \sqcap \neg\exists eats.\exists productOf.Animal$
     ($Vegan \doteq Person \sqcap \forall eats.\forall productOf.\neg Animal$ is also fine)
  3. $\neg Vegetarian \sqcap Vegan \sqsubseteq \bot$ or $\neg Vegetarian \sqsubseteq \neg Vegan$. $\bot$ (false) can be defined as $C \sqcap \neg C$.
  4. $\exists eats.Meat \sqsubseteq \exists eats.\exists productOf.Animal$

- Is it always true that $\exists r.C \sqsubseteq \forall r.C$?

  Answer. No. $\exists r.C$ describes objects which have an r-edge to some object which is in C. For example, $\exists child.Female$ describes people who have a daughter. $\forall r.C$ describes objects where all r-links (if they exist) lead to a C object. For example, $\forall child.Female$ describes people who only have female children, if they have any children at all. Clearly the set of people who have a daughter (and maybe sons as well) is not included in the set of people who only have female children.

- Is it always true that $\exists r.(C_1 \sqcap C_2) \sqsubseteq \exists r.C_1$?

  Answer. Yes. If an object has an r-link to something in C_1 and in C_2, then it has (the same) link to something which is in C_1.