COMP718: Ontologies and Knowledge Bases
Answers Lecture 6—foundational ontologies

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Part-whole relations

1. N/A. We will discuss this later, after having analysed the answers you submitted.

2. This sample ontology is available at http://www.meteck.org/teaching/ontologies/pwEx2.owl.

   No, Human is unsatisfiable.

   Reason: Human $\sqsubseteq$ ED (EnDurant), it has a property hasPart (to Brain), which has declared as domain PD (PerDurant), but ED $\sqsubseteq \neg$PD (endurant and perdurant are disjoint), hence, Human cannot have any instances.

3. This is a generalisation of the previous exercise and the example we did during the lecture.

   (a) The ontologies and their inferences are shown in Table 1.

   (b) Thus, there are differences in the deductions. For $\mathcal{O}_1$, the only way to have the ontology consistent is to classify $\mathsf{Ed_1}$ as a subclass of PED, which is possible because PED is a subclass of ED. In the second case, there are several issues (following the reasoner and logic-based explanation): $\mathsf{Ed_2}$ is assumed to be correctly a subclass of AS, but this then runs into problems with $\mathsf{Ed_1} \sqsubseteq \exists \mathsf{S}.\mathsf{Ed_2}$, because S $\sqsubseteq$ R and the range of R is PED and therefore also the range of S is PED (or a subclass thereof), which is disjoint from AS, hence the "$\exists \mathsf{S}.\mathsf{Ed_2}$"-part doesn't work (cannot be instantiated), and therefore $\mathsf{Ed_1}$ cannot be instantiated.

   (c) We fix the defect by revising the ontology such that the object property hierarchy satisfies the RBox Compatibility service, i.e., the domain and range of S have to be equal or a subclass of the domain and range of R.

Table 1: Sample ontologies to illustrate the OWL reasoners and explanation (based on Protégé's explanation feature).

$\mathcal{O}_1$	**OPEs**	**CEs**	**Inferred, with explanation**
	R $\sqsubseteq$ PED $\times$ PED S $\sqsubseteq$ ED $\times$ ED S $\sqsubseteq$ R	OWLized DOCLE taxonomy, $\mathsf{Ed_1} \sqsubseteq$ ED, $\mathsf{Ed_2} \sqsubseteq$ ED, $\mathsf{Ped_1} \sqsubseteq$ PED, $\mathsf{Ped_2} \sqsubseteq$ PED, $\mathsf{Ed_1} \sqsubseteq \exists \mathsf{S}.\mathsf{Ed_2}$, $\mathsf{Ped_1} \sqsubseteq \exists \mathsf{R}.\mathsf{Ped_2}$	$\mathsf{Ed_1} \sqsubseteq$ PED: because $D_R =$ PED and S $\sqsubseteq$ R
$\mathcal{O}_2$	**OPEs**	**CEs**	**Inferred, with explanation**
	as $\mathcal{O}_1$	as $\mathcal{O}_1$, but with $\mathsf{Ed_2} \sqsubseteq$ AS (and PED $\sqsubseteq \neg$AS still holds)	$\mathsf{Ed_1}$ inconsistent: 1. AS $\sqsubseteq \neg$PED, 2. $\mathsf{Ed_1} \sqsubseteq \exists \mathsf{S}.\mathsf{Ed_2}$, 3. $\mathsf{Ed_2} \sqsubseteq$ AS, 4. $R_R =$ PED and 5. S $\sqsubseteq$ R

ODPs

1. The description of the n-ary ODP can be found in the NeON deliverable D2.5.1 on pp67-68. Also, you may wish to inspect the draft ODPs that have been submitted to the ODP portal (at `http://www.ontologydesignpatterns.org`, in case you had not found it already).

2. Recollect that the whole ontology can be accessed from the Moodle and is available at `http://www.meteck.org/teaching/ontologies/adolena.owl`.

3. One could make a Content ODP out of it: for each AssistiveDevice that is added to the ontology, one also has to record the Disability it ameliorates, it requires some Ability to use/operate the device, and performs a certain Function. With that combination, one even can create some sort of an 'input form' for domain experts and administrators, which can then hide all the logic entirely, yet as long as they follow the pattern, the information gets represented as intended.

   Another one that may be useful is the Architectural OP: `adolena.owl` now contains some bits and pieces of both DOLCE (endurant, perdurant, and some of their subclasses) and some terms from BFO (realizable), neither of the two ontologies were imported. The architectural ODP can help cleaning this us and structuring it.