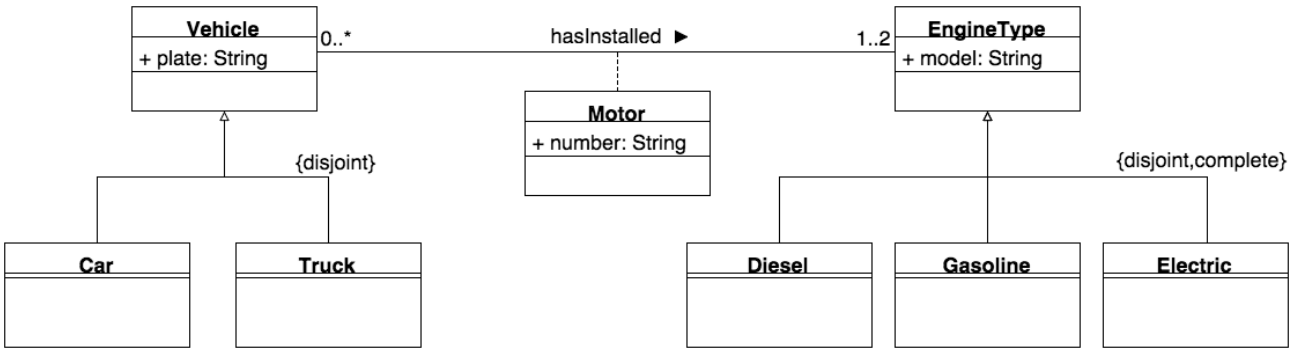
Group 1

Consider the following UML class diagram representing a simplified model of a car seller company.



1a) Translate the UML class diagram into an appropriate Description Logic.

1b) Express in Description Logic (in the fragment you think is more appropriate) the following knowledge about the car domain, where if necessary new concepts and roles may be introduced:

i. All trucks only have installed diesel engines;
ii. An hybrid vehicle is defined as a vehicle which has installed an electric engine, as well as a non-electric one;
iii. All vehicles having at most 3 wheels are dangerous vehicles;
iv. All bicycles have 2 wheels and do hot have installed engines.

Group 2

Consider the following ontology encoded in Description Logic ALCH.

$\text{Person} \sqsubseteq (\exists \text{hasFather}.\top) \sqcap (\exists \text{hasMother}.\top) \sqcap (\forall \text{hasParent}.\text{Person})$
$\text{Person} \equiv \text{Man} \sqcup \text{Woman}$
$\text{Woman} \sqsubseteq \neg \text{Man}$

$\text{hasFather} \sqsubseteq \text{hasParent}$
$\text{hasMother} \sqsubseteq \text{hasParent}$

2a) Translate the ontology into first-order logic axioms.

2b) Check whether $\text{Person} \sqsubseteq (\exists \text{hasParent}.\text{Person})$ is a conclusion of the ontology, using first-order theorem proving from the theory obtained in 2a).

Group 3

Consider the following TBox T of an ontology

¬Person ⊑ ¬Adult ⊓¬Teenager
Adult ⊑ ¬Teenager
∃driverLicense.T ⊑Adult
Rich ⊑ ∃owns.Car
YoungBand ⊑ (∃member.T) ⊓ (∀member.(Rich ⊓Teenager))

3a) Suppose that furthermore the ontology has the ABox containing the following assertions

john: ∃member^{-}. YoungBand,
john: (>= 2 owns Car)
(mary,garfield):owns

Present a model of the given TBox and ABox (don't forget to define the domain and corresponding interpretation of individuals, atomic classes and roles), if possible, and show the result of interpreting the expression (concept) Person ⊓ ∀owns. ¬Car in the model you've defined.

3b) Using tableaux algorithms check if it is possible to conclude from the given TBox T plus the axiom ∃owns.Car ⊑ ∃driverLicense.T that all rich people are adults, i.e.

$$T \cup \{ \exists owns.Car \sqsubseteq \exists driverLicense.T \} \models Rich \sqsubseteq Adult$$

THE END