Types of questions and axiom prerequisites

Yes/No Questions These questions expect yes or no as answer, for which we have defined three different types:

Yes/No Questions with two classes and one property. Using *[Thing]* or any of its subclasses, a question "Does a X OP a Y?" can be generated, if $\mathsf{X} \sqsubseteq \exists \mathsf{OP}.\mathsf{Y}$ (Answer: Yes), or if $\mathsf{X} \sqsubseteq \neg\exists \mathsf{OP}.\mathsf{Y}$ (Answer: No). Examples of templates for this type of questions are as follows:
Type A template: *Does a [Thing] [ObjectProperty] a [Thing]?*
Type B template: *Does a [Endurant] [ObjectProperty] a [Thing]?*
Type C template: *Does a [Animal] [ObjectProperty] a [Thing]?*
Type D templates: *Does a [T_NOUN] [OP_VERB] a [T_NOUN]?*
Does a [T_NOUN] [OP_VERB_PREP] a [T_NOUN]?
where for Type D, the OP_VERB means that the name of the OP is a verb and OP_VERB_PREP indicates it also has a preposition (explained further below).

Yes/No Questions with two classes, one property and a quantifier. For example, "*Does a [Thing] [ObjectProperty] [Quantifier] [Thing]*". Consider the question pattern: "Does a X OP some Y?". This can be generated and results in "Yes" if $\mathsf{X} \sqsubseteq \exists \mathsf{OP}.\mathsf{Y}$, and "No" if $\mathsf{X} \sqsubseteq \neg\exists \mathsf{OP}.\mathsf{Y}$. Moreover, the question "Does a X OP only Y?" results in "Yes" if $\mathsf{X} \sqsubseteq \forall \mathsf{OP}.\mathsf{Y}$ and "No" if $\mathsf{X} \sqsubseteq \neg\forall \mathsf{OP}.\mathsf{Y}$. Examples of templates for this type of questions are as follows:
Type A template: *Does a [Thing] [ObjectProperty] [quantifier] [Thing]?*
Type B template: *Does a [Endurant] [ObjectProperty] [quantifier] [Thing]?*
Type C template: *Does a [Animal] [ObjectProperty] [quantifier] [Thing]?*
Type D templates: *Does a [T_NOUN] [OP_VERB] [quantifier] [T_NOUN]?*
Does a [T_NOUN] [OP_VERB_PREP] [quantifier] [T_NOUN]?
where the token *[quantifier]* can be either "some" ($\exists$) or "only" ($\forall$).

Yes/No Questions with one Endurant and one Perdurant. Generating instances of this question type requires "participate-in" relation within the ontology since DOLCE is the foundational ontology of the project and has the "participate-in" relation. "*Does a [Endurant] [Perdurant]?*" is an example of template. The question: "Does a X Y?" can be generated if $\mathsf{X} \sqsubseteq \exists \mathsf{participate\text{-}in}.\mathsf{Y}$ (Answer: Yes), or if $\mathsf{X} \sqsubseteq \neg\exists \mathsf{participate\text{-}in}.\mathsf{Y}$ (Answer: No).

True/False Questions The expected answers to these questions are either "True" or "False". Once again, we take into consideration that the ontology operates under Open Word Assumption (OWA). Hence, the answer to a question is false if the ontology explicitly says so. The DL prerequisites for this group of questions are the same as for the Yes/No Questions.

True/False Questions with two classes and one property. For example, *A [Thing] is [ObjectProperty] a [Thing]. True or false?*

True/False Questions with additional quantifier. Some of the templates are:

A *A [Thing] is [ObjectProperty] [Quantifier] [Thing]. True or false?*
C *A [Animal] is [ObjectProperty] [Quantifier] [Thing]. True or false?*
D *A [T_NOUN] is [OP_IS_NOUNS_PREP] [Quantifier-some] [T_NOUN]. True or false?*
A [T_NOUN] is [OP_IS_PARTICIPLE_BY] [Quantifier-only] a [T_NOUN]. True or false?

Equivalence Questions This case is possible provided there is an equivalence relation between X and Y. For example,

B *Are there any differences between a [Endurant] and a [Endurant]?*
C *Are there any differences between a [Plant] and a [Plant]?*

The question "Are there any differences between a X and a Y?" can be generated and results in "Yes" if $\mathsf{X} \equiv \neg\mathsf{Y}$, and "No" if $\mathsf{X} \equiv \mathsf{Y}$ under the OWA.

Subclass Identification Questions These questions can be seen as "Which" questions. We considered the three following cases.

Subclass identification questions with two classes and one property. This is an example of a template: *Which [Thing] [ObjectProperty] a [Thing]?* The question "Which X OP Y?" can be generated if there is a class Z that satisfies the axiom $\mathsf{Z} \sqsubseteq \mathsf{X} \sqcap \mathsf{OP}.\mathsf{Y}$.

Subclass identification question with additional quantifier. This is an example: *Which [Thing] [ObjectProperty] [Quantifier] [Thing]?* The question "Which X OP some Y?" can be generated if there is a class Z that satisfies the axiom $\mathsf{Z} \sqsubseteq \mathsf{X} \sqcap \exists\mathsf{OP}.\mathsf{Y}$. Then, the question "Which X OP only Y?" can be generated if there is a class Z that satisfies the axiom $\mathsf{Z} \sqsubseteq \mathsf{X} \sqcap \forall\mathsf{OP}.\mathsf{Y}$.

Subclass identification questions with one class and one property. Specified templates include:

B *What does a [Endurant] [ObjectProperty]?*
C *What does a [Animal] [ObjectProperty]?*
D *What does a [T_NOUN] [OP_VERB]?*

The question "What does a X OP?" can be generated if there is a class Y such that $\mathsf{X} \sqsubseteq \exists\mathsf{OP}.\mathsf{Y}$.

Narrative Questions These questions can also be seen as definition questions. Some of the templates are: *Define [Thing].* and *What is [Thing]?* A class in an ontology can be "defined" in this context if it satisfies one of the following criteria: 1) it is annotated with a definition; 2) it has at least one equivalent class; 3) it has at least one superclass, at least one subclass or a combination of both. Therefore, a question such as "Define X." can have either an annotated definition, an equivalent class, or its relations to its super and subclasses as answer.