DL Reasoning

Consider the knowledge base made of the following axioms

TBox

Student ⊆ Person
Student ≡ studies **some** Discipline
Professor ⊆ Person

Physics ⊆ Discipline

University ≡ (hasMember **some** Professor) **and** (hasMember **some** Student)
University ⊆ Institution,
University ⊆ hasMember **only** (Professor **or** Student)

Bicycle ⊆ hasOwner **only** Person
ElectricBicycle ⊆ Bicycle

Abox

	RDF equivalent
University(UNIGE)	UNIGE rdf:type University
ElectricBicycle(flyer01)	flyer01 rdf:type ElectricBicycle
hasOwner (flyer01, UNIGE)	flyer01 rdf:hasOwner UNIGE

1. What will be the inferred members (if any) of the classes *Bicycle*, *Institution*, and *Person*? Briefly justify your answers.

flyer01 is a member of Bicycle Bicycle(flyer01)
because ElectricBicycle(flyer01)
and ElectricBicycle ⊆ Bicycle

UNIGE is a member of Institution Institution(UNIGE)
because University(UNIGE)
and University ⊆ Institution

UNIGE is a member of Person Person(UNIGE)
because flyer01 rdf:hasOwner UNIGE
and Bicycle(flyer01)
and Bicycle ⊆ hasOwner **only** Person

2. If we add the following axioms to define classes *X*, *Y*, and *Z*, what would be the inferred superclasses of *X*, *Y*, and *Z*? Briefly justify your answers.

X ≡ (hasMember **min** 2 Professor) **and** (hasMember **min** 3 Student)

hasMember **min** 2 Professor $\subseteq$ hasMember **some** Professor
hasMember **min** 3 Student $\subseteq$ hasMember **some** Student
X $\subseteq$ (hasMember **some** Professor) **and** (hasMember **some** Student)
Since University ≡ (hasMember **some** Professor) **and** (hasMember **some** Student)
X $\subseteq$ University

Y ≡ (hasMember **some** (studies **some** Physics))
and (hasMember **min** 2 Professor)

hasMember **some** (studies **some** Physics) $\subseteq$ hasMember **some** (studies **some** Discipline)
Since Student ≡ studies **some** Discipline
hasMember **some** (studies **some** Physics $\subseteq$ hasMember **some** Student
hasMember **min** 2 Professor $\subseteq$ hasMember **some** Professor
Since University ≡ (hasMember **some** Professor) **and** (hasMember **some** Student)
Y $\subseteq$ University

Z ≡ (hasMember **only** Professor) **or** (hasMember **only** Student)
Z $\subseteq$ Thing
Z $\not\subset$ University
because
(hasMember **only** Professor) **or** (hasMember **only** Student) $\not\subset$ hasMember **some** Professor) **and** (hasMember **some** Student
moreover
(hasMember **only** Professor) **or** (hasMember **only** Student) $\not\subset$ Institution