Exercise 1

The following sentences are ambiguous. Explain the source of the ambiguity, and propose, *when it is possible*, the two distinct representations that can be associated with those two sentences.

(1) a. Every student is reading an article.
b. Sam likes wild cats and dogs.
c. All the participants did not enjoy the meal.
d. Paul should be in Buenos Aires.

....Answer..

Answers given in class.

Exercise 2

Translate as precisely as possible the following sentences intro predicate logic. Please make sure that each formula has as many pairs of parentheses as there are binary operators.

(2) a. No nurse appreciate a surgeon.
b. Everyone is looking for something that not everyone finds.
c. Exactly two persons came.
d. All students should declare their intership if they take one.

....Answer..

(2-a) *No nurse appreciate a surgeon.*
That is a typical case where there might be a scope ambiguity between the two quantified NPs. The formula for the congruent analysis (higher scope for the universal negative) is (3-a). *No nurse* can also be represented with a universal quantifier, the corresponding formula would then be (3-b). An inverse scope reading would be represented as (3-c).
The formula (3-d) expresses that for each nurse there is a surgeon that she does not appreciate. It does not seem to be a possible reading of (2-a).

(3) a. $\neg\exists x\ (Nx \wedge \exists y\ (Sy \wedge Axy))$
b. $\forall x\ (Nx \rightarrow \neg\exists y\ (Sy \wedge Axy))$
c. $\exists y\ (Sy \wedge \neg\exists x\ (Nx \wedge Axy))$
d. $\forall x\ (Nx \rightarrow \exists y\ (Sy \wedge \neg Axy))$

(2-b) *Everyone is looking for something that not everyone finds.*
The first possible reading would be that *there is a unique thing that everyone is looking for and that not everyone finds*, and it can be represented by (4-a). Note that this reading is not congruent with the syntactic structure, since it gives wide scope to *something*. A more syntactically congruent reading would have that the things that people look for may be different for each person. Something like (4-b). But we need then to make clear how to interpret the last part of the sentence. A straightforward reading would be that it's never the case that everyone finds a thing that some person is looking for : (4-c). This reading is probably the easiest to get compositionaly.

However, another interpretation could probably be found : an interpretation according to which everyone has a thing that they are looking for, and not everyone finds the thing(s) that they look for. But this is not precise enough : is it the case that some people don't find any of the things they look for (4-d) ? or is it the case that some people don't find all the things they look for (but only maybe some of them) (4-e) ? Depending on the answer to this question, the final formula will the conjunction of (4-b) and (4-d) or (4-e).
The formula (4-f) was often proposed. It means that for every person there are things that they search for and that they don't find. I don't think it is a possible interpretation of (2-b).

(4) a. $\exists x\,(Tx \wedge \forall y\,(Py \rightarrow Lyx) \wedge \neg\forall y\,(Py \rightarrow Fyx))$
b. $\forall y\,(Py \rightarrow \exists x\,(Tx \wedge Lyx))$
c. $\forall y\,(Py \rightarrow \exists x\,(Tx \wedge Lyx \wedge \neg\forall z\,(Pz \rightarrow Fzx)))$
d. $\neg\forall z\,(Pz \rightarrow \forall x\,((Tx \wedge Lzx) \rightarrow \neg Fzx))$
e. $\neg\forall z\,(Pz \rightarrow \neg\forall x\,((Tx \wedge Lzx) \rightarrow Fzx))$
f. $\forall x\,(Px \rightarrow \exists y\,(Ty \wedge Lxy \wedge \neg Fxy))$

(2-c) *Exactly two persons came.*
To refer to exactly two (different) entities we have to use the equal sign in the language.

(5) a. $\exists x\exists y\,(Px \wedge Py \wedge x \neq y \wedge Cx \wedge Cy \wedge \neg\exists z\,(Pz \wedge z \neq x \wedge z \neq y \wedge Cz))$

(2-d) *All students should declare their intership if they take one.*
This is a typical donkey sentence. Assuming Dxy for x should declare y, a compositional treatment would lead to a formula like (6-a) where a variable is free. There is however a way to account for the truth conditions of the sentence, with the formula (6-b) or (6-c) which is equivalent.

(6) a. $\forall x\,(Sx \rightarrow (\exists y\,(Iy \wedge Txy) \rightarrow Dxy))$
b. $\forall x\forall y\,(Sx \rightarrow ((Iy \wedge Txy) \rightarrow Dxy))$
c. $\forall x\forall y\,((Sx \wedge Iy \wedge Txy) \rightarrow Dxy))$

Exercise 3

The following sentences are characterized by the fact that the indefinite, under the scope of a universal quantification, is interpreted as universal. This situation is not surprising when one remembers the equivalence between $\forall x(\varphi \rightarrow \psi)$ and $(\exists x\varphi \rightarrow \psi)$ (if ψ does not contain free occurrences of x). On the basis of this equivalence, propose for each of the following sentence two translations in fol.

(7) a. Paul gets upset as soon as someone is noisy.
b. Everybody gets upset if someone is noisy.
c. All the tourists who visit Paris are rich.
d. All the tourists who visit Paris love it.
e. All the tourists who visit a city are rich.
f. All the tourists who visit a city love it. .
g. If a farmer owns a donkey, he beats it.
h. Everyone is marked by an unrequited love.

.... Answer ....
See discussion in class about "*donkey sentences*".