Structures for Semantics: first assignment

[You may e-mail your work until March 6 to r.a.m.vanrooij@uva.nl, or hand it in at that date. In case you have any questions about the exercises, please contact me (Robert van Rooij, room 213, phone 525-4551, r.a.m.vanrooij@uva.nl)]

1 Lambda's and types

1.1 Lanbda's

Let us assume the following type declarations:
x, y, z are variables of type e
P, Q are variables of type $\langle e, t\rangle$
R is a variable of type $\langle e, \langle e, t\rangle\rangle$ & M is a variable of type $\langle\langle e, t\rangle, \langle e, t\rangle\rangle$
m is a variable of type t n is a variable of type $\langle t, t\rangle$

(a) Which of the following expressions are well-formed?

1. $\lambda x \lambda R(M(R(x) = Q))$
2. $(\lambda Q \lambda P(P = Q)(Q))(M(Q))$
3. $(\lambda n(n(\exists y(P(y) \wedge n(z = y))))(\lambda m \neg m))$

(b) Which of the preceding well-formed expressions can be simplified by λ- conversion. How?

(c) Which of the following expressions are equivalent:

1. $(\lambda x\ \forall z(\neg P(z) \leftrightarrow z = x)(z))$
2. $(\lambda x\ \forall y(P(y) \vee y = x)(z))$
3. $\neg P(z) \wedge \neg\exists y(\neg P(y) \wedge z \neq y)$
4. $(\lambda n\ (n(\exists y(n(P(y)) \wedge n(z = y))))(\lambda m \neg m))$

1.2 Types

- If a and b are expressions of type e, what is the type of g in the following expression: $(g((g(b))(a))(b))$? And what is the type of the whole expression?

- Is it possible to assign types to α, β and γ such that both $(\alpha(\beta))(\gamma)$ and $(\alpha(\beta(\gamma))$ are well-formed expressions?

2 Extending MG (forget about the intensional part here)

2.1 ... with three place verbs

Extend the grammar given in 'A crash course in Montague Grammar' with a three place verb like *give*, so that it generates sentences like *Every girl gives Mary a book.* Illustrate how your extension works by giving a full derivation and translation of the two readings of this sentence.

2.2 ... with only

Add a term modifier *only* to the fragment, that is, an expression of category T/T
What is the corresponding type?
Assign a translation to *only* such that it produces appropriate interpretations of sentences like *Only John walks*, and *John loves only Mary* (Again, think of what the desired result must be, and then reconstruct how you can obtain that, given that, e.g. *John* translates as $\lambda P.P(j)$.)

Does your translation of *only* still work if you apply it to a conjunction of proper names, as in *Only [John and Mary]*? If it doesn't, sketch why.