Semantiek – end exam – 4.11.08  

Student number: ____________________  

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Instructions:  
1. Please fill in your answers on the exam sheets (4 pages).  
2. Exam duration: 2.5 hours  
3. You can use any pre-prepared material.  
4. Please do not forget to write down your student number on the top of the exam sheet.  

Good luck!  

Question 1 (25=6+4+10+5 points)  

Consider the following sentences, with the assumed constituency:  
(1.1) [John walked]  
(1.2) [John [walked slowly]]  
(1.3) [John [walked [extremely slowly]]]  

a. Assuming that John is of type e and that walked is of type et, write down the types for the words slowly and extremely.  
slowly: _______________  
extremely: _______________  

b. Write down all entailment relations between sentences (1.1), (1.2) and (1.3):  

_________________________________________________  

c. What would be the assumptions we need to adopt about the denotations of slowly and extremely that would account for the entailments you described in your answer to b? Complete the following statements:  
slowly must denote a function f that satisfies for each argument A of type _____:  

_________________________________________________  
extremely must denote a function g that satisfies for each argument B of type _____:  

_________________________________________________  

d. Rewrite your answer for c using the generalized inclusion operator of HW3, exercise 7. Make your answer as short as possible:  
\[ \forall A: \text{________________________} \text{ (a condition on } f) \]  
\[ \forall B: \text{________________________} \text{ (a condition on } g) \]  

Question 2 (25=5+10+10 points)  

Consider the following sentence:  
(2.1) [Every boy] [[gave [his mother]] [his shoe]].  

Assume the following types and denotations for the words and expressions in (2.1):  
every – (et)((et)t) – every = \( \lambda Ae_\text{et}. \lambda B e_\text{et}. \forall x[A(x) \rightarrow B(x)] \)  
boy – et – boy  
gave – e(e(et)) – give  
his mother – e^e – his_mother  
his shoe – e^e – his_shoe  

We introduce a new operator, called ZZ:
ZZ = \lambda R. \lambda f. \lambda g. \lambda x. ((R(f(x)))(g(x)))(x)

Sentence (2.1) is analyzed using the ZZ operator as follows:

\((\text{every(boy)})(((ZZ(\text{give}))(\text{his\_mother}))(\text{his\_shoe}))\)

a. Write down the proper type for ZZ: ________________________

b. Simplify the above analysis of (2.1) using \(\lambda\)-conversions as much as possible, and write down the resulting formula:

________________________________________________

c. Write down three \(\lambda\)-terms that describe readings of (2.1) that are different from the reading analyzed above, as well as from each other. Complete the following types and formulas.

reading 1: type: \(t^e\)
\(\lambda\)-term: \(\text{λ}_x.e.\) __________________________________________

reading 2: type: \(t^e\)
\(\lambda\)-term: \(\text{λ}_x.e.\) __________________________________________

reading 3: type: _____
\(\lambda\)-term: __________________________________________

Question 3 (25=4+4+5+4+3+5 points)

Consider the following lexicon, with sentences (3.1) and (3.2) in the grammar it describes:

<table>
<thead>
<tr>
<th>word</th>
<th>category</th>
<th>denotation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tweety</td>
<td>s/(np\ s)</td>
<td>(\lambda A_{ct}.A(tweety))</td>
</tr>
<tr>
<td>bird</td>
<td>n</td>
<td>(\text{bird}_{ct})</td>
</tr>
<tr>
<td>penguin</td>
<td>n</td>
<td>(\text{penguin}_{ct})</td>
</tr>
<tr>
<td>is</td>
<td>(s/(np\ s))/(s/(np\ s))</td>
<td>(\lambda Q_{ct}(\text{is}<em>{ct}).\lambda x_x.\lambda y_y.\lambda z_z.Q(\text{is}</em>{ct})(y = z))</td>
</tr>
<tr>
<td>a</td>
<td>(s/(np\ s))/(s/(np\ s))/(s/(np\ s))</td>
<td>(\lambda A_{ct}.\lambda B_{ct}.\lambda x_x.\lambda y_y.\lambda z_z.[A(x) \land B(x)])</td>
</tr>
<tr>
<td>some</td>
<td>(s/(np\ s))/(s/(np\ s))/(s/(np\ s))/(s/(np\ s))</td>
<td>(\lambda A_{ct}.\lambda B_{ct}.\lambda x_x.\lambda y_y.\lambda z_z.[A(x) \land B(x)])</td>
</tr>
<tr>
<td>no</td>
<td>(s/(np\ s))/(s/(np\ s))/(s/(np\ s))/(s/(np\ s))/(s/(np\ s))</td>
<td>(\lambda A_{ct}.\lambda B_{ct}.\lambda x_x.\lambda y_y.\lambda z_z.[A(x) \land B(x)])</td>
</tr>
<tr>
<td>blue</td>
<td>n</td>
<td>(\lambda A_{ct}.\lambda B_{ct}.\lambda x_x.\lambda y_y.\lambda z_z.[A(x) \land B(x)])</td>
</tr>
</tbody>
</table>

(3.1) Tweety is a bird.

(3.2) Tweety is a blue bird.

a. For sentence (3.1) complete the syntactic derivation below using the given lexicon and the AB-calculus:

\[
\begin{align*}
\text{Tweety} & \quad \text{is} \quad \text{a} \quad \text{bird} \\
\hline
s/(np\ s) & \quad (np\ s)/(s/(np\ s)) & \quad (s/(np\ s))/n & \quad n
\end{align*}
\]

b. What is the semantic analysis of sentence (3.1) that is obtained using this derivation?

-----------------------------------------------------------------
c. Simplify this semantic analysis of sentence (3.1) as much as possible:

__________________________


d. Repeat your analysis and simplification in b and c for sentence (3.2), obtained using the same kind of derivation in a in the given lexicon and the AB-calculus.

Derived analysis of (3.2):

__________________________

Simplification:

__________________________

To check your answers, you can verify (to yourself) that the analysis of (3.2) formally entails (3.1), in agreement with the entailment (3.2) ⇒ (3.1).

e. Erase what is untrue in the underlined text, which analyzes the entailment from (3.2) to (3.1).

The determiner *a* (as in e.g. *a bird*) is upward/downward monotone on its first argument. As a result, the generalized quantifier denoted by the noun phrase *a bird contains/is contained by* the generalized quantifier denoted by the noun phrase *a blue bird*. The entailment (3.2) ⇒ (3.1) follows from this monotonicity together with the upward/downward monotonicity of the verb *is* in the above lexicon.

f. Describe the monotonicity of the verb *is* in the above lexicon by completing the following text:

for every _____________ , the following relation holds: ________________

To check your answer, you can verify (to yourself) that this statement is true.

**Question 4 (25=4+15+6 points)**

Consider the following sentence:

(4.1) Less than one third of the tall students walked quickly.

a. Write down the denotation of the determiner expression *less than one third of the*:

For every two sets A and B:

\[
\text{less_than_one_third_of_the}(A)(B) = 1 \iff \quad \text{__________________________}
\]

b. Mark the correct completion (1 or 2) of the following statement, and justify your choice by completing the text below it.

On its **right** argument, the determiner function denoted by *less than one third of the* is:

1) **DOWNWARD-MONOTONE**

   **Justification:** show a sentence (4.2) that sentence (4.1) must entail in order for *less than one third of the* to be downward-monotone on its right argument:

   (4.2) ________________

2) **NON-MONOTONE**

   **Justification:** First, show a sentence (4.2) that sentence (4.1) does not entail because of the non-monotonicity of *less than one third of the* on its right argument:

   (4.2) ________________

Second, show denotations of the arguments for the determiner *less than one third of the* in (4.1) (i.e. *tall students* and *walked quickly*), as well as for its arguments in (4.2), which make (4.1) true but (4.2) false. Complete the following –
denotation of *tall students* (left argument in (4.1)): _____________________
denotation of *walked quickly* (right argument in (4.1)): _____________________
denotation of _______ (left argument in (4.2)): _____________________
denotation of _______ (right argument in (4.2)): _____________________

c. Mark the correct completion (1 or 2) of the following statement, and justify your choice by completing the text below it.

On its left argument, the determiner function denoted by *less than one third of the* is:

1) DOWNWARD-MONOTONE
   
   **Justification:** show a sentence (4.3) that sentence (4.1) must entail in order for *less than one third of the* to be downward-monotone on its left argument:
   
   (4.3)  _______________________________________ _______________

2) NON-MONOTONE
   
   **Justification:** First, show a sentence (4.3) that sentence (4.1) does not entail because of the non-monotonicity of *less than one third of the* on its left argument:
   
   (4.3)  _______________________________________ _______________

   Second, show denotations of the arguments for the determiner *less than one third of the* in (4.1) (i.e. *tall students* and *walked quickly*), as well as for its arguments in (4.3), which make (4.1) true but (4.3) false. Complete the following –

   denotation of *tall students* (left argument in (4.1)): _____________________
denotation of *walked quickly* (right argument in (4.1)): _____________________
denotation of _______ (left argument in (4.3)): _____________________
denotation of _______ (right argument in (4.3)): _____________________

d. Consider now the following sentences:

   (4.4) *Less than one third of the tall students in the class walked quickly to any park.*
   
   (4.5) *Less than one third of the tall students in any class walked quickly to the park.*

   Consider the following version of the Ladusaw-Fauconnier Generalization from lecture 4:

   *Negative polarity items occur within arguments of downward monotone functions but not within arguments of functions that are not downward monotone.*

   From your answer to b and c, and from this version of the Ladusaw-Fauconnier generalization, which of the two sentences (4.4) and (4.5) do you expect to be acceptable?

   Mark the correct answer:

   - Both (4.4) and (4.5) are expected to be acceptable
   - (4.4) is expected to be acceptable but (4.5) is expected to be unacceptable
   - (4.5) is expected to be acceptable but (4.4) is expected to be unacceptable
   - Both (4.4) and (4.5) are expected to be unacceptable

   **Note** – this question is **not** about your actual judgments on the English sentences (4.4) and (4.5)!