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 <u>all</u> 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:

∀A: ________________________ (a condition on *f*)

∀B: ________________________ (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** = $\lambda A_{et}. \lambda B_{et}. \forall x[A(x) \rightarrow B(x)]$
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 = λR. λf. λg. λx. ((R(f(x)))(g(x)))(x)

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

(**every**(**boy**))(((ZZ(**give**))(**his_mother**))(**his_shoe**))

a. Write down the proper type for ZZ: ________________________

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

____

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

reading 1: type: t^e
λ-term: λx_e.____

reading 2: type: t^e
λ-term: λx_e.____

reading 3: type: ____
λ-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:

word	category	denotation
Tweety	s/(np\s)	$\lambda A_{et}.A(\mathbf{tweety}'_e)$
bird	n	$\mathbf{bird}'_{et}$
penguin	n	$\mathbf{penguin}'_{et}$
is	(np\s)/(s/(np\s))	$\lambda Q_{(et)t}.\lambda x_e.Q(\lambda y_e.y = x)$
a	(s/(np\s))/n	$\lambda A_{et}.\lambda B_{et}.\exists x_e[A(x) \wedge B(x)]$
some	(s/(np\s))/n	$\lambda A_{et}.\lambda B_{et}.\exists x_e[A(x) \wedge B(x)]$
no	(s/(np\s))/n	$\lambda A_{et}.\lambda B_{et}.\neg\exists x_e[A(x) \wedge B(x)]$
blue	n/n	$\lambda A_{et}.\lambda x_e.A(x) \wedge \mathbf{blue}'_{et}(x)$

(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:

```
Tweety          is                  a                bird
---------       ------------------  --------------   -----
s/(np\s)        (np\s)/(s/(np\s))   (s/(np\s))/n     n
                                    ----------------------------
                                         [          ]
                ------------------------------------------------
                    [          ]
--------------------------------------------------------------
                [          ]
```

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. *<u>a</u> bird*) is <u>upward/downward</u> monotone on its first argument. As a result, the generalized quantifier denoted by the noun phrase *a bird* <u>contains/is contained by</u> the generalized quantifier denoted by the noun phrase *a blue bird*. The entailment (3.2)⇒(3.1) follows from this monotonicity together with the <u>upward/downward</u> 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:

less_than_one_third_of_the(A)(B)=1 iff ____________________________

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

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

1) DOWNWARD-MONOTONE

<u>Justification</u>: 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

<u>Justification</u>: First, show a sentence (4.2) that sentence (4.1) does <u>not</u> 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)!