GÖTEBORGS UNIVERSITET

Masters Programme in Language Technology

INTRODUCTION TO FORMAL LINGUISTICS LT2112

AUTUMN SEMESTER 2014

Thursday, 30th October 2014, 8:00am–11:00am

Viktoriagatan 30, Göteborg

Course responsible: Simon Dobnik (Tel. 0721927949)

Instructions

Write your name and personnummer clearly below.

Candidate number: _____

Name: _____

Personnummer: _____

Write your answers on blank sheets of paper. Start each part on a new sheet of paper and mark clearly the number of the question that you are answering. On each page write your candidate number in the top right corner. To ensure that the examination is anonymous do not include any other personal information on the answer sheets.

Answer all questions from all parts.

Do not turn over until told that you may do so.

PART 1: PHONETICS AND PHONOLOGY

1. Describe epigrammatically the speech chain, i.e., all the steps that are taking place so that two human beings can communicate with spoken language. (15%)

2. Mention the differences between spoken and written language. (10%)

3. What is the fundamental frequency? What is pitch? Is there any difference between these two? (15%)

4. What does the vowel quadrilateral show? How much information can we gain by just observing it? (10%)

5. Describe shortly the differences between the disciplines of phonetics and phonology. (10%)

6. Describe the notion of "minimal pair" and give one example. (4%)

7. Variant pronunciations of a phoneme are called its _____. (3%)

8. Is there any difference between phonemes and phones? If yes, please describe shortly. If no, please explain why. (10%)

9. You observe the frequency of a sound wave to be 0.05 cycles per millisecond. (8%)
   a) How many cycles are there in 2 milliseconds?
   b) How many cycles are there in 10 seconds?
   c) How many cycles are there in 0.01 seconds?

10. There is a working microphone inside a jar. A pump is used to create a vacuum inside the jar, i.e., all air is pushed out of the jar. A cell phone rings one meter outside the jar. Does the microphone record any sound? Please, explain your answer. (15%)

PART 2: MORPHOLOGY AND LEXICON

This part of the exam gives a maximum of 30 points.

For **pass/godkänt** you should have a minimum of 17 points.
For **exellent/väl godkänt** you should have a minimum of 25 points.

Good luck!

Karin Friberg Heppin

Section I: Morphology

M1)
Make a morphological analysis of the fragment of Swahili shown below by identifying the morphological constituents and their meanings. Show the analysis in a table which clearly shows the structure of the words and the positions of the different categories of morphemes in the words.

In the first column of the table you should write the Swahili words below, each on a separate row. The following columns should all have a heading which describes the morpheme category in the column (for example: verb stem). In the squares below each heading you should write the corresponding substring and an English morphological description of this morpheme.

State explicitly if there are any allomorphs. If so, explain what conditions the use of the different allomorphs. (8 p)

ninakusikia	I hear you (sg)
ninamsikia	I hear him
ninakisikia	I hear it
ninawasikia	I hear them
anakusikia	he hears you (sg)
anamsikia	he hears him
anawasikia	he hears them
anatusikia	he hears us
unanisikia	you (sg) hear me
unawasikia	you (sg) hear them
tunakisikia	we hear it
wanakusikia	they hear you (sg)
ninakujibu	I answer you (sg)
nitakujibu	I will answer you (sg)
nilikujibu	I answered you (sg)
unamjibu	you (sg) answer him
utamjibu	you (sg) will answer him
ulimjibu	you (sg) answered him
mnanisikia	you (pl) hear me
mtatusikia	you (pl) will hear us
mlikisikia	you (pl) heard it

M3)
Show the morphological structure of the words below using a tree structure. Indicate which morpheme is the root of the word. For each branching in the structure, explain what is the morphological process at hand and which is the resulting part of speech at that point. (4 p)

a) *chess players*

b) *compositionality*

M4)
Name two differences between *inflection* and *derivation*. Explain and give examples. (2 p)

M5)
How many words are there in the following text?

I am walking with Peter. Peter takes a walk with me down an empty walk.

Give two different answers. Explain, using morphological terminology, how you have counted and why you get different answers. (2 p)

Section 2: Lexicon

L1)
Give pairs of words which stand in the following relations to each other. Also give a short explanation of what each relation implies. (3 p)

a) complementary antonymy
b) homonymy
c) co-hyponymy

2) Write two sentences which both contain a word which is an example of 'regular polysemy'. It should be the same polysemous word in both sentences, but with different meanings. Describe the relationship between these two meanings. (2 p)

L2)

Give a short description of the terms below. (3 p)

a) concordance
b) thesaurus
c) synchronic dictionary

L3)
On the following page you will find the definition of the FrameNet frame `Revenge`. The most important frame elements are also described. Use this description of `Revenge` frame to annotate the sentences at the bottom of the page. The lexical unit evoking the frame should be annotated with the tag [LU] and the frame elements should be annotated with the tags given in the descriptions. For example:

[A We] took [LU revenge].

Note: If a preposition phrase constitutes a frame element, the preposition is always included in the frame element. You do not have to tag auxiliary verbs like 'would'. All words will not be annotated. (6 p)

Revenge

Definition:

This frame concerns the infliction of punishment in return for a wrong suffered. An AVENGER performs a PUNISHMENT on an OFFENDER as a consequence of an earlier action by the OFFENDER, the INJURY. The AVENGER inflicting the PUNISHMENT need not be the same as the INJURED_PARTY who suffered the INJURY, but the AVENGER does have to share the judgment that the OFFENDER's action was wrong. The judgment that the OFFENDER had inflicted an INJURY is made without regard to the law.

Core frame elements:

AVENGER [A]
The AVENGER exacts revenge from the OFFENDER for the INJURY.

INJURED_PARTY [IP]
This frame element identifies the constituent that encodes who or what suffered the INJURY at the hands of the OFFENDER. Sometimes, an abstract concept such a person's honour or their blood is presented as the element that has suffered the INJURY. These also constitute instances of INJURED_PARTY.

INJURY [IN]
The INJURY is the injurious action committed by the OFFENDER against the INJURED_PARTY. This Frame Element need not always be realized, although it is conceptually necessary.

OFFENDER [O]
The OFFENDER has committed the earlier INJURY for which the AVENGER seeks revenge.

PUNISHMENT [P]
The AVENGER carries out a PUNISHMENT in order to exact revenge on the OFFENDER.

Annotate the following sentences with frame elements listed above:

b) To revenge him , his widow joined the independent French section .

a) Have you come to revenge yourself on me for failing you ?

a) The retribution exacted by Constantius on the Britons is recorded by Ammianus .

PART 3: SYNTAX

1. Assign each word in the following sentences the appropriate lexical category using the / notation and the tagset from Penn Treebank, for example *likes/VBZ* (for a list of tags see Table 1). Discuss any problems you may have encountered.

   In the 1960s, researchers unearthed two gigantic dinosaur arms. For decades, scientists have speculated about what kind of beast they belonged to. Its name Deinocheirus mirificus means unusual, horrible hands.

2. What is Chomsky hierarchy and how does it relate to the study of syntax of natural language?

3. Provide a syntactic parse for the following sentences. You may use either bracketing or trees. Discuss any problems you may have encountered.

   (a) Lydia said George sang the aria with passion.

   (b) The tired tiger kicked a box of cereal from New Delhi to Gothenburg.

   (c) Many cats have claimed bottled milk quenches thirst best.

4. What is the result of unifying these two feature structures?

$$\begin{bmatrix} \text{Agreement} & \begin{bmatrix} \text{Number} & \text{sing} \end{bmatrix} & \\ \text{Subject} & \begin{bmatrix} \text{Agreement} & \begin{bmatrix} \text{Number} & \text{sing} \\ \text{Person} & 3 \end{bmatrix} \end{bmatrix} & \\ \text{Object} & \begin{bmatrix} \text{Agreement} & \begin{bmatrix} \text{Case} & \text{acc} \end{bmatrix} \end{bmatrix} & \end{bmatrix} \sqcup \begin{bmatrix} \text{Agreement} & \boxed{1} \begin{bmatrix} \text{Number} & \text{sing} \end{bmatrix} \\ \text{Subject} & \begin{bmatrix} \text{Agreement} & \boxed{1} \end{bmatrix} \\ \text{Object} & [] \end{bmatrix}$$

5. What is the difference between the following sentences? What challenges it may present to computational processing of language? Can you find the same difference in a language other than English that you know?

   (a) George seems to be quite smart.

   (b) George wanted to meet in the garden.

Table 1: Penn Treebank Tags

Number	Tag	Description
1.	CC	Coordinating conjunction
2.	CD	Cardinal number
3.	DT	Determiner
4.	EX	Existential there
5.	FW	Foreign word
6.	IN	Preposition or subordinating conjunction
7.	JJ	Adjective
8.	JJR	Adjective, comparative
9.	JJS	Adjective, superlative
10.	LS	List item marker
11.	MD	Modal
12.	NN	Noun, singular or mass
13.	NNS	Noun, plural
14.	NNP	Proper noun, singular
15.	NNPS	Proper noun, plural
16.	PDT	Predeterminer
17.	POS	Possessive ending
18.	PRP	Personal pronoun
19.	PRP$	Possessive pronoun
20.	RB	Adverb
21.	RBR	Adverb, comparative
22.	RBS	Adverb, superlative
23.	RP	Particle
24.	SYM	Symbol
25.	TO	to
26.	UH	Interjection
27.	VB	Verb, base form
28.	VBD	Verb, past tense
29.	VBG	Verb, gerund or present participle
30.	VBN	Verb, past participle
31.	VBP	Verb, non-3rd person singular present
32.	VBZ	Verb, 3rd person singular present
33.	WDT	Wh-determiner
34.	WP	Wh-pronoun
35.	WP$	Possessive wh-pronoun
36.	WRB	Wh-adverb

PART 4: SEMANTICS

1. For each group of sentences, say whether sentences in (a) entail the sentence in (b). If necessary, justify your answers.

   (1) a. Either Smith, Jones or Anderson signed the contract.

   b. If Smith and Anderson did not sign the contract, Jones signed the contract.

   (2) a. Every Italian man wants to be a great tenor.
   Some Italian men are great tenors.

   b. There are Italian men who want to be a great tenor.

   (3) a. Smith wrote to a representative every week.

   b. There is a representative that Smith wrote to every week.

   (4) a. No one who starts gambling seriously stops until he is broke.

   b. Everyone who starts gambling seriously continues until he is broke.

2. Explain the difference between *sense/intension* and *reference/extension*.

3. Evaluate $\forall x_1[cat(x_1) \rightarrow prowl(x_1)]$ in $\mathcal{M}_2$ with respect to g_2. If applicable, for each evaluation step assert which rule have you applied in that step and on which previous step, for example "By step (3) and rule(b)."

1. The model $\mathcal{M}_2 = \langle U_2, V_2 \rangle$

1. U_2 = {George, Lydia, Daisy, Ubi, Alex}
2. $V_2(g)$ = George
3. $V_2(l)$ = Lydia
4. $V_2(d)$ = Daisy
5. $V_2(u)$ = Ubi
6. $V_2(a)$ = Alex
7. $V_2(cat)$ = {George, Daisy, Ubi}
8. $V_2(human)$ = {Lydia, Alex}
9. $V_2(prowl)$ = {Ubi, Daisy, Alex}

10. $V_2(sees) = \{\langle$George,Alex$\rangle$, $\langle$Lydia,Ubi$\rangle$, $\langle$Daisy,Lydia$\rangle$, $\langle$Lydia,Daisy$\rangle\}$

2. Evaluation function g_2

$$g_2 = \begin{bmatrix} x_1 & \rightarrow & \text{Lydia} \\ x_2 & \rightarrow & \text{Daisy} \\ x_3 & \rightarrow & \text{Alex; where } n \geq 3 \end{bmatrix}$$

3. Interpretation rules

If A is either a predicate or a constant, then $[\![A]\!]^{\mathcal{M}_2,g_2} = V_2(A)$.

If A is a variable, $[\![A]\!]^{\mathcal{M}_2,g_2} = g_2(A)$.

For any formulae A, B, any $\text{Pred}_n R$, and any terms $t_1, \ldots, t_n$,

a. $[\![R(t_1, \ldots, t_n)]\!]^{\mathcal{M}_2,g_2} = 1$ iff $\langle [\![t_1]\!]^{\mathcal{M}_2,g_2}, \ldots, [\![t_n]\!]^{\mathcal{M}_2,g_2} \rangle \in [\![R]\!]^{\mathcal{M}_2,g_2}$

b. $[\![A \wedge B]\!]^{\mathcal{M}_2,g_2} = 1$ iff $[\![A]\!]^{\mathcal{M}_2,g_2} = 1$ and $[\![B]\!]^{\mathcal{M}_2,g_2} = 1$

c. $[\![A \vee B]\!]^{\mathcal{M}_2,g_2} = 1$ iff $[\![A]\!]^{\mathcal{M}_2,g_2} = 1$ or $[\![B]\!]^{\mathcal{M}_2,g_2} = 1$

d. $[\![A \rightarrow B]\!]^{\mathcal{M}_2,g_2} = 1$ iff $[\![A]\!]^{\mathcal{M}_2,g_2} = 0$ or $[\![B]\!]^{\mathcal{M}_2,g_2} = 1$

e. $[\![A \leftrightarrow B]\!]^{\mathcal{M}_2,g_2} = 1$ iff $[\![A]\!]^{\mathcal{M}_2,g_2} = [\![B]\!]^{\mathcal{M}_2,g_2}$

f. $[\![\neg A]\!]^{\mathcal{M}_2,g_2} = 1$ iff $[\![A]\!]^{\mathcal{M}_2,g_2} = 0$

g. $[\![t_1 = t_j]\!]^{\mathcal{M}_2,g_2} = 1$ iff $[\![t_1]\!]^{\mathcal{M}_2,g_2}$ is the same as $[\![t_j]\!]^{\mathcal{M}_2,g_2}$

h. $[\![A]\!]^{\mathcal{M}_i,g_i[u/x_n]}$ stands for a donation of A where u is assigned to every occurrence of x_n in A.

i. $[\![\forall x_n A]\!]^{\mathcal{M}_2,g_2} = 1$ iff for all $u \in U$, $[\![A]\!]^{\mathcal{M}_2,g_2[u/x_n]} = 1$, where $g_1[u/x_n] = g_1$, except that $g_1[u/x_n](x_n) = u$

j. $[\![\exists x_n A]\!]^{\mathcal{M}_2,g_2} = 1$ iff for some $u \in U$, $[\![A]\!]^{\mathcal{M}_2,g_2[u/x_n]} = 1$