University of Haifa
Department of Computer Science

Natural language processing
Spring 2002

Home Assignment 4

1. Which of the following feature structures subsumes the other?

$$A = \begin{bmatrix} \text{F}: & \boxed{3}\begin{bmatrix} \text{F}: & \boxed{3} \end{bmatrix} \end{bmatrix}, \qquad B = \boxed{2}\begin{bmatrix} \text{F}: & \boxed{2} \end{bmatrix}$$

2. Let:

$$\begin{aligned}
A &= \begin{bmatrix} \text{F}: & a \end{bmatrix} \\
B &= \begin{bmatrix} \text{G}: & \begin{bmatrix} \text{F}: & a \end{bmatrix} \end{bmatrix} \\
C &= \begin{bmatrix} \text{F}: & a \\ \text{G}: & \begin{bmatrix} \text{F}: & a \end{bmatrix} \end{bmatrix} \\
D &= \begin{bmatrix} \text{F}: & a \\ \text{G}: & \boxed{1}\begin{bmatrix} \text{F}: & a \end{bmatrix} \end{bmatrix} \\
E &= \begin{bmatrix} \text{F}: & \boxed{1}\begin{bmatrix} \text{F}: & a \end{bmatrix} \\ \text{G}: & \boxed{1} \end{bmatrix} \\
F &= \begin{bmatrix} \text{F}: & \boxed{1} \\ \text{G}: & \boxed{1} \end{bmatrix}
\end{aligned}$$

   Which of the following holds?

   (a) $A \sqcup B = C$
   (b) $A \sqcup C = D$
   (c) $A \sqcup F = C$
   (d) $A \sqcup F = E$
   (e) $B \sqcup F = E$
   (f) $C \sqcup D = D$
   (g) $C \sqcup D = E$
   (h) $D \sqcup D = E$
   (i) $E \sqcup F = E$

3. Following is a CFG generating Hebrew noun phrases. Augment it with feature structures to enforce agreement on definiteness between the noun and the adjectives:

   kaddur gadol hitgalgel
   ha-kaddur ha-gadol hitgalgel
   *kaddur ha-gadol hitgalgel
   *ha-kaddur gadol hitgalgel

$$\begin{aligned}
&NP \rightarrow NP\ ADJP \\
&NP \rightarrow N \mid D\ N \\
&ADJP \rightarrow ADJ \mid D\ ADJ \\
&N \rightarrow kaddur \mid tappux \\
&ADJ \rightarrow gadol \mid \text{'}adom \\
&D \rightarrow ha\text{-}
\end{aligned}$$

4. Extend G_2, the unification grammar for E_0, such that transitive verbs with a sentential object are accounted for, too. The grammar must generate also the following sentences:

Rachel thinks that the sheep sleep
Rachel knows that Jacob loves her
Laban knows that Rachel thinks that Jacob loves her

5. Design a unification grammar for the (formal) language $L = \{a^n b^m c^n d^m \mid 0 \leq m, n\}$.

Submission is individual. Answeres should be fully argued.

Submission date: 15.6.02

Good Luck!