Homework Assignment 8
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Due on Dec. 6, 2004 by 1pm

1 Exercise 1

The context-free grammar G5 has the following rules:

\[ S \rightarrow NP \ VP \]
\[ NP \rightarrow (Det) \ N' \]
\[ N' \rightarrow Adj^* \ N' \ PP^* \]
\[ N' \rightarrow N \]
\[ VP \rightarrow V_{\text{trans}} \ NP \]
\[ VP \rightarrow V_{\text{intrans}} \]
\[ PP \rightarrow P \ NP \]
\[ Det \rightarrow \text{the} \mid \text{my} \mid \text{a} \]
\[ N \rightarrow \text{friend} \mid \text{woman} \mid \text{man} \mid \text{apple} \mid \text{Italy} \]
\[ Adj \rightarrow \text{former} \mid \text{best} \mid \text{vegetarian} \mid \text{brunette} \mid \text{blond} \mid \text{leftmost} \mid \text{red} \]
\[ V_{\text{trans}} \rightarrow \text{met} \mid \text{picked} \]
\[ V_{\text{intrans}} \rightarrow \text{run} \]
\[ P \rightarrow \text{from} \]

Give all the possible trees that G5 generates for the sentences below, paying special attention to the modifiers (Adj and PP) of the category N'. Then, paraphrase the reading of each tree (several trees may converge into the same meaning, of course). Are there some readings—and hence some trees—that G5 produces but that do not correspond to any actual reading of the sentences? Explain.

My former best friend met a brunette woman from Italy.
The vegetarian blond man picked the leftmost red apple.

2 Exercise 2

Define the semantic rule for combining a 3-place verb like send with its first (= most embedded) argument. Then, spell out the semantic computation of the sentence below for an arbitrary world, in as much detail as in the lecture notes.

\[ [ \begin{array}{c} V_3 \\ NP \end{array} ]^w = \]

Jon sent Fumi to Maribel
3 Exercise 3

The semantics of natural language determiners like every, some, no, etc. operates on two sets of individuals $A$ and $B$. Set $A$ comes from the sister of the Determiner in the syntactic tree, while set $B$ is contributed by the rest of the sentence as a whole, as schematized below. (First order) determiner meanings can be simulated using deterministic FSA in the following way. For any $\text{Det}(A, B)$, you place yourself at the start state. Then, you go through the list of elements in $A$, so that, for each $a \in A$: if $a \in A \cap B$ you move through the 1 line, and if $a \notin A \cap B$ you move through the 0 line. Each element in $A$ is evaluated exactly once and, for each such element, you go through exactly one line. Once you have exhausted the set $A$, if you find yourself in an accept state, then $\text{Det}(A, B) = \text{TRUE}$; if you find yourself not in a accept state, then $\text{Det}(A, B) = \text{FALSE}$.

Example: every

Your task is to define FSA that simulate the semantics of the following determiners:

- some
- no
- at least three
- at most five
- not all
- some but not all