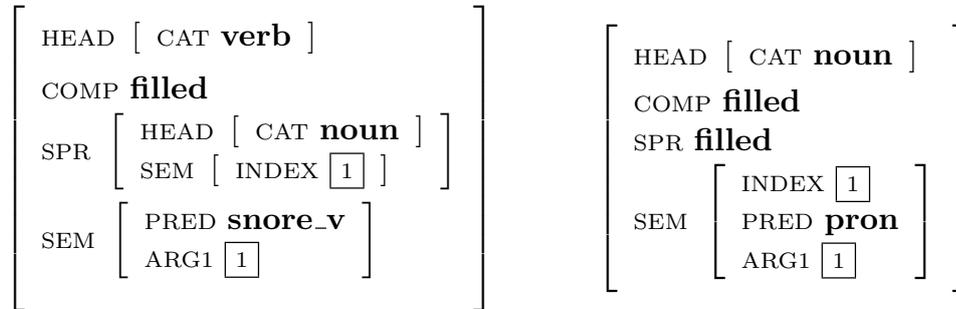# 2005 Paper 9 Question 14

Natural Language Processing

(a) The Figure below shows feature structures corresponding to lexical entries for *snores* and *he*.

$$
\begin{bmatrix}
\text{HEAD} \begin{bmatrix} \text{CAT} & \textbf{verb} \end{bmatrix} \\
\text{COMP } \textbf{filled} \\
\text{SPR} \begin{bmatrix} \text{HEAD} \begin{bmatrix} \text{CAT} & \textbf{noun} \end{bmatrix} \\ \text{SEM} \begin{bmatrix} \text{INDEX} & \boxed{1} \end{bmatrix} \end{bmatrix} \\
\text{SEM} \begin{bmatrix} \text{PRED} & \textbf{snore\_v} \\ \text{ARG1} & \boxed{1} \end{bmatrix}
\end{bmatrix}
\qquad
\begin{bmatrix}
\text{HEAD} \begin{bmatrix} \text{CAT} & \textbf{noun} \end{bmatrix} \\
\text{COMP } \textbf{filled} \\
\text{SPR } \textbf{filled} \\
\text{SEM} \begin{bmatrix} \text{INDEX} & \boxed{1} \\ \text{PRED} & \textbf{pron} \\ \text{ARG1} & \boxed{1} \end{bmatrix}
\end{bmatrix}
$$

These structures can be combined using a grammar rule to give a feature structure corresponding to the phrase *he snores* with a semantic structure equivalent to $\text{pron}(x) \wedge \text{snore\_v}(x)$. Give this grammar rule as a feature structure and show the results of applying the rule to the structures in the Figure. [7 marks]

(b) Syntactically the verb *rains* takes the pleonastic pronoun *it* as subject but semantically it has no arguments. Give possible feature structures for *rains* and pleonastic *it*. Show how ungrammatical sentences such as *he rains* are avoided, mentioning any modifications to the lexical entries in the Figure that might be necessary. [6 marks]

(c) Selectional restrictions can be used to block parses of semantically anomalous sentences such as:

> The pebble snores.
> The pebble wrote a book.
> The dog wrote a book.

Describe how selectional restrictions might be encoded in a feature structure grammar. [7 marks]