# Computational Semantics (UE 903, EC2)

Consider the following abstract syntax together with its associated Montague-like semantics:

$$
\begin{array}{lcl}
\textsc{everybody} & : & \mathrm{NP} \\
\textsc{somebody} & : & \mathrm{NP} \\
\textsc{need} & : & \mathrm{NP} \to \mathrm{NP} \to \mathrm{S} \\
\textsc{trace} & : & \mathrm{NP_X} \\
\textsc{move} & : & (\mathrm{NP} \to \mathrm{NP} \to \mathrm{S}) \to \mathrm{NP_X} \to \mathrm{NP} \to \mathrm{S_X} \\
\textsc{qr} & : & \mathrm{NP} \to \mathrm{S_X} \to \mathrm{S}
\end{array}
$$

$$
\begin{array}{lcl}
[\![\mathrm{NP}]\!] & = & (\mathrm{e} \to \mathrm{t}) \to \mathrm{t} \\
[\![\mathrm{S}]\!] & = & \mathrm{t} \\
[\![\mathrm{NP_X}]\!] & = & \mathrm{e} \to (\mathrm{e} \to \mathrm{t}) \to \mathrm{t} \\
[\![\mathrm{S_X}]\!] & = & \mathrm{e} \to \mathrm{t}
\end{array}
$$

$$
\begin{array}{lcl}
[\![\textsc{everybody}]\!] & = & \lambda p.\, \forall x.\, (\mathbf{human}\, x) \to (p\, x) \\
[\![\textsc{somebody}]\!] & = & \lambda p.\, \exists y.\, (\mathbf{human}\, y) \wedge (p\, y) \\
[\![\textsc{need}]\!] & = & \lambda o s.\, s\, (\lambda x.\, o\, (\lambda y.\, \mathbf{need}\, x\, y)) \\
[\![\textsc{trace}]\!] & = & \lambda x k.\, k\, x \\
[\![\textsc{move}]\!] & = & \cdots \\
[\![\textsc{qr}]\!] & = & \lambda n v.\, n\, v
\end{array}
$$

where:

$$
\begin{array}{lcl}
\mathbf{human} & : & \mathrm{e} \to \mathrm{t} \\
\mathbf{need} & : & \mathrm{e} \to (\mathrm{e} \to \mathrm{t})
\end{array}
$$

**1**. Compute the semantic representation of the sentence *everybody needs somebody*, the abstract syntax of which is given by the following term:

$$(\textsc{need somebody})\ \textsc{everybody}$$

**2**. Assume that:

$$\textsc{move need} \twoheadrightarrow_\beta \lambda q s z.\, s\, (\lambda x.\, q\, z\, (\lambda y.\, \mathbf{need}\, x\, y))$$

Compute another semantic representation of the sentence *everybody needs somebody*, the alternative abstract syntax of which is given by the following term:

$$\textsc{qr somebody}\ (\textsc{move need trace everybody})$$

**3**. Assign an appropriate semantic interpretation to MOVE such that:

$$\textsc{move need} \twoheadrightarrow_\beta \lambda q s z.\, s\, (\lambda x.\, q\, z\, (\lambda y.\, \mathbf{need}\, x\, y))$$

**4**. Discuss the difference between the two interpretations you have obtained for the sentence *everybody needs somebody*.