Continuation-Passing Style

Syntax

$$\begin{array}{llll}
x & \text{identifiers} & & \\
e,\ K & ::= & & \text{terms} \\
 & \mid & t & \\
 & \mid & s & \\
 & & & \\
t & ::= & & \text{trivial terms, } \textit{i.e.} \text{ values} \\
 & \mid & x & \\
 & \mid & \lambda x.e \quad \textsf{bind } x \textsf{ in } e & \\
 & & & \\
s & ::= & & \text{serious terms, } \textit{i.e.} \text{ computations} \\
 & \mid & e_0\, e_1 &
\end{array}$$

Transformation

Call-by-value

$$\begin{array}{lcl}
[\![x]\!]\ K & = & K\ x \\
[\![\lambda x.\ e]\!]\ K & = & K\ (\lambda x\ k.\ [\![e]\!]\ k) \\
[\![t_0\ t_1]\!]\ K & = & [\![t_0]\!]\ [\![t_1]\!]\ K \\
[\![t_0\ s_1]\!]\ K & = & [\![s_1]\!]\ (\lambda x_1.\ [\![t_0]\!]\ x_1\ K) \\
[\![s_0\ t_1]\!]\ K & = & [\![s_0]\!]\ (\lambda x_0.\ x_0\ [\![t_1]\!]\ K) \\
[\![s_0\ s_1]\!]\ K & = & [\![s_0]\!]\ (\lambda x_0.\ [\![s_1]\!]\ (\lambda x_1.\ x_0\ x_1\ K))
\end{array}$$

Call-by-name

$$\begin{array}{lcl}
[\![x]\!]\ K & = & K\ x \\
[\![\lambda x.\ e]\!]\ K & = & K\ (\lambda x\ k.\ [\![e]\!]\ k) \\
[\![t_0\ e_1]\!]\ K & = & [\![t_0]\!]\ [\![e_1]\!]\ K \\
[\![s_0\ e_1]\!]\ K & = & [\![s_0]\!]\ (\lambda x_0.\ x_0\ [\![e_1]\!]\ K)
\end{array}$$