CS101 (Fall 2005) Special Topics in Computer Science

Language-Based Security

References in λ-Calculus

Type Checking

$$\frac{\Gamma \vdash e \in t}{\Gamma \vdash \texttt{ref}\, e \in \texttt{ref}\, t}\ (\textit{Ref}) \qquad \frac{\Gamma \vdash e \in \texttt{ref}\, t}{\Gamma \vdash \texttt{deref}\, e \in t}\ (\textit{Deref}) \qquad \frac{\Gamma \vdash e_1 \in \texttt{ref}\, t \quad \Gamma \vdash e_2 \in t}{\Gamma \vdash (e_1 := e_2) \in \texttt{unit}}\ (\textit{Assign})$$

Operational Semantics

$$\begin{array}{rcl} E & ::= & \cdot \\ & | & E\ e \\ & | & v\ E \\ & | & \texttt{ref}\, E \\ & | & \texttt{deref}\, E \\ & | & E := e \\ & | & v := E \end{array}$$

$$\begin{array}{l} \langle \sigma, E[(\lambda x.e)\ v] \rangle \ \rightarrow_1\ \langle \sigma, E[e[v/x]] \rangle \\ \langle \sigma, E[\texttt{ref}\, v] \rangle \ \rightarrow_1\ \langle \sigma[v/L], E[L] \rangle \quad (L \text{ fresh}) \\ \langle \sigma, E[\texttt{deref}\, L] \rangle \ \rightarrow_1\ \langle \sigma, E[\sigma(L)] \rangle \\ \langle \sigma, E[L := v] \rangle \ \rightarrow_1\ \langle \sigma[v/L], E[()] \rangle \end{array}$$