

























Free Variables of an Expression $FV(x) = \{x\}$ $FV(E_1 E_2) = FV(E_1) \cup FV(E_2)$ $FV(A_x.E) = FV(E) - \{x\}$ $FV(let S in E) = FVS(S) \cup FV(E) - BVS(S)$ $FVS(\varepsilon) = \{\}$ $FVS(x = E; S) = FV(E) \cup FVS(S)$ $BVS(\varepsilon) = \{\}$ $BVS(\varepsilon) = \{\}$ $BVS(\varepsilon) = \{\}$ $BVS(x = E; S) = \{x\} \cup BVS(S)$

















Lifting Rules (let S' in e') is the α -renamed (let S in e) to avoid name conflicts in the following rules: x = let S in $e \rightarrow x = e'$; S' $let S_1$ in (let S in e) $\rightarrow let S_1$; S' in e' (let S in e) $e_1 \rightarrow let S'$ in e' e_1 Cond((let S in e), e_1, e_2) $\rightarrow let S'$ in Cond(e', e_1, e_2) $PF_k(e_1, \dots (let S in e), \dots e_k)$ $\rightarrow let S'$ in PF_k($e_1, \dots e', \dots e_k$) $\rightarrow let S'$ in PF_k($e_1, \dots e', \dots e_k$)

Confluenence and Letrecs







