Syntax

| | | |
|---|---|---|
| Literals | $lit$ | $::= None \mid True \mid False \mid \ldots \mid 1 \mid \ldots$ |
| Expression | $Exp$ | $::= lit@(\overline{A}) \mid Exp.id \mid Exp_1\ BinOp\ Exp_2$ |
| | | $\mid id_{Fun}(\overline{Exp}) \mid Exp.id_{Fun}(\overline{Exp}) \mid id_{Cls}@(\overline{A}).(\overline{Exp})$ |
| | $id_{Fun}$ | $::= f \mid g \mid \ldots$ |
| | $id_{Cls}$ | $::= C \mid D \mid \ldots$ |
| Assign Op. | $AsgOp$ | $\in \{\texttt{=}, \texttt{+=}, \texttt{-=}, \texttt{*=}, \texttt{/=}, \texttt{\%=}, \texttt{//=}\}$ |
| Binary Op. | $BinOp$ | $\in \{\texttt{||}, \texttt{\&\&}, \texttt{|}, \texttt{\&}, \texttt{==}, \texttt{!=}, \texttt{<}, \texttt{>}, \texttt{<=}, \texttt{>=}, \texttt{+}, \texttt{-}, \texttt{*}, \texttt{/}, \texttt{\%}, \texttt{**}\}$ |

Projection To Python

$$(Exp)\quad (\!|lit@(\overline{B})|\!)^A = \begin{cases} lit & \text{if } A \in \overline{B} \\ \texttt{Unit.id} & \text{otherwise} \end{cases}$$

$$(\!|Exp.id|\!)^A = \begin{cases} (\!|Exp|\!)^A.id & \text{if } A \in \text{rolesOf}(Exp.id) \\ \text{absent} & \text{otherwise} \end{cases}$$

$$(\!|id_{Fun}(\overline{Exp})|\!)^A = \begin{cases} id_{Fun}(\overline{(\!|Exp|\!)^A}) & \text{if } A \in \text{rolesOf}(id_{Fun}(\overline{Exp})) \\ \texttt{Unit.id}_{\texttt{Fun}}(\overline{(\!|Exp|\!)^A}) & \text{otherwise} \end{cases}$$

$$(\!|Exp.id_{Fun}(\overline{Exp})|\!)^A = \begin{cases} (\!|Exp|\!)^A.id_{Fun}(\overline{(\!|Exp|\!)^A}) & \text{if } A \in \text{rolesOf}(Exp) \\ \texttt{Unit.id}_{\texttt{Fun}}((\!|Exp|\!)^A, \overline{(\!|Exp|\!)^A}) & \text{otherwise} \end{cases}$$

$$(\!|id_{Cls}@(\overline{B})(\overline{Exp})|\!)^A = \begin{cases} (\!|id_{Cls}@(\overline{B})|\!)^A(\overline{(\!|Exp|\!)^A}) & A \in \overline{B} \\ \texttt{Unit.id}_{\texttt{Cls}}(\overline{(\!|Exp|\!)^A}) & \text{otherwise} \end{cases}$$

$$(\!|Exp_1\ BinOp\ Exp_2|\!)^A = \begin{cases} (\!|Exp_1|\!)^A\ BinOp\ (\!|Exp_2|\!)^A \\ \quad \text{if } \text{roleOf}(Exp_1) = \text{roleOf}(Exp_2) = \{A\} \\ \texttt{Unit.id}((\!|Exp_1|\!)^A, (\!|Exp_2|\!)^A) & \text{otherwise} \end{cases}$$

$$\text{rolesOf}(lit@(\overline{B})) = \overline{B}$$

$$\text{rolesOf}(Exp.id) = \overline{B} \quad \text{if } \exists T.\text{typeOf}(Exp.id) = T@(\overline{B})$$

$$\text{typeOf} : Exp \to Type$$

$$\text{rolesOf}(id_{Fun}(\overline{Exp})) = \overline{B} \quad \text{if } \exists T.\text{typeOf}(id_{Fun}(\overline{Exp})) = T@(\overline{B})$$

$$\text{rolesOf}(Exp.id_{Fun}(\overline{Exp})) = \overline{B} \quad \text{if } \exists T.\text{typeOf}(Exp.id_{Fun}(\overline{Exp})) = T@(\overline{B})$$