Syntax

Literals	lit	$::= None \mid True \mid False \mid$ "a" $\mid \ldots \mid 1 \mid \ldots$
Expression	Exp	$::= lit@(\overline{A}) \mid Exp.id \mid f(\overline{Exp}) \mid Exp.f(\overline{Exp}) \mid C[\overline{A}](\overline{Exp})$
Typed Expression	$TExp$	$::= lit@(\overline{A}) : \tau \mid \ldots$
Assign Op.	$AsgOp$	$\in \{$`=, +=, -=, *=, /=, %=, //=`$\}$
Binary Op.	$BinOp$	$\in \{$`||, &&, |, &, ==, !=, <, >, <=, >=, +, -, *, /, %, **`$\}$
Statement	Stm	$::=$ pass $\mid$ return $Exp \mid Exp; Stm \mid id = Exp; Stm$
		$\mid Exp_1\ AsgOp\ Exp_2; Stm \mid$ if $Exp : Stm$ else $: Stm$
		$\mid$ try $: Stm$ except $:\ Exp\ ;\ Stm \mid$ raise Exp

Projection To Python

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

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

$$(\!|f(\overline{Exp}) : \tau|\!)^A = \begin{cases} f(\overline{(\!|Exp|\!)^A}) & \text{if } A \in \text{rolesOf}(f(\overline{Exp})) \\ \texttt{Unit.id}(f(\overline{(\!|Exp|\!)^A})) & \text{if } A \in \text{rolesOf}(\overline{Exp}) \wedge A \notin \text{rolesOf}(f(\overline{Exp})) \\ \texttt{Unit.id}(\overline{(\!|Exp|\!)^A}) & \text{otherwise} \end{cases}$$

$$(\!|Exp.f(\overline{Exp}) : \tau|\!)^A = \begin{cases} (\!|Exp|\!)^A.f(\overline{(\!|Exp|\!)^A}) \\ \qquad \text{if } A \in \text{rolesOf}(Exp) \wedge A \in \text{rolesOf}(\overline{Exp}) \\ \qquad\qquad \wedge A \in \text{rolesOf}(Exp.f(\overline{Exp})) \\ \texttt{Unit.id}((\!|Exp|\!)^A.f(\overline{(\!|Exp|\!)^A})) \\ \qquad \text{if } A \in \text{rolesOf}(Exp) \wedge A \notin \text{rolesOf}(Exp.f(\overline{Exp})) \\ \texttt{Unit.id}((\!|Exp|\!)^A, \overline{(\!|Exp|\!)^A}) \quad \text{otherwise} \end{cases}$$

$$(\!|C[\overline{B}](\overline{Exp}) : \tau|\!)^A = \begin{cases} (\!|C[\overline{B}]|\!)^A(\overline{(\!|Exp|\!)^A}) & A \in \overline{B} \\ \texttt{Unit.id}(\overline{(\!|Exp|\!)^A}) & \text{otherwise} \end{cases}$$

$$\text{rolesOf}(\_ : \tau@(\overline{B})) = \overline{B}$$

$$\text{rolesOf}(\overline{Exp}) = \bigcup_i \text{rolesOf}(Exp_i)$$

$$(\!|\overline{Exp}|\!)^A = Exp'_1, Exp'_2, \cdots, Exp'_n \quad \text{where} \quad Exp'_i = (\!|Exp_i|\!)^A$$

$$
\begin{aligned}
(Stm) \quad & (\!|\text{pass}|\!)^A = \text{pass} \\
& (\!|\text{return } Exp;|\!)^A = \text{return}(\!|Exp|\!)^A \\
& (\!|Exp; Stm|\!)^A = \begin{cases}
\text{match}(\!|Exp|\!)^A : & a \\
\text{case} id : (\!|Stm|\!)^A; & a \\
\text{case\_\_} : (\!|Stm|\!)^A; & a \\
(\!|Exp|\!)^A; (\!|Stm|\!)^A & a \\
(\!|Stm|\!)^A & a
\end{cases}
\end{aligned}
$$