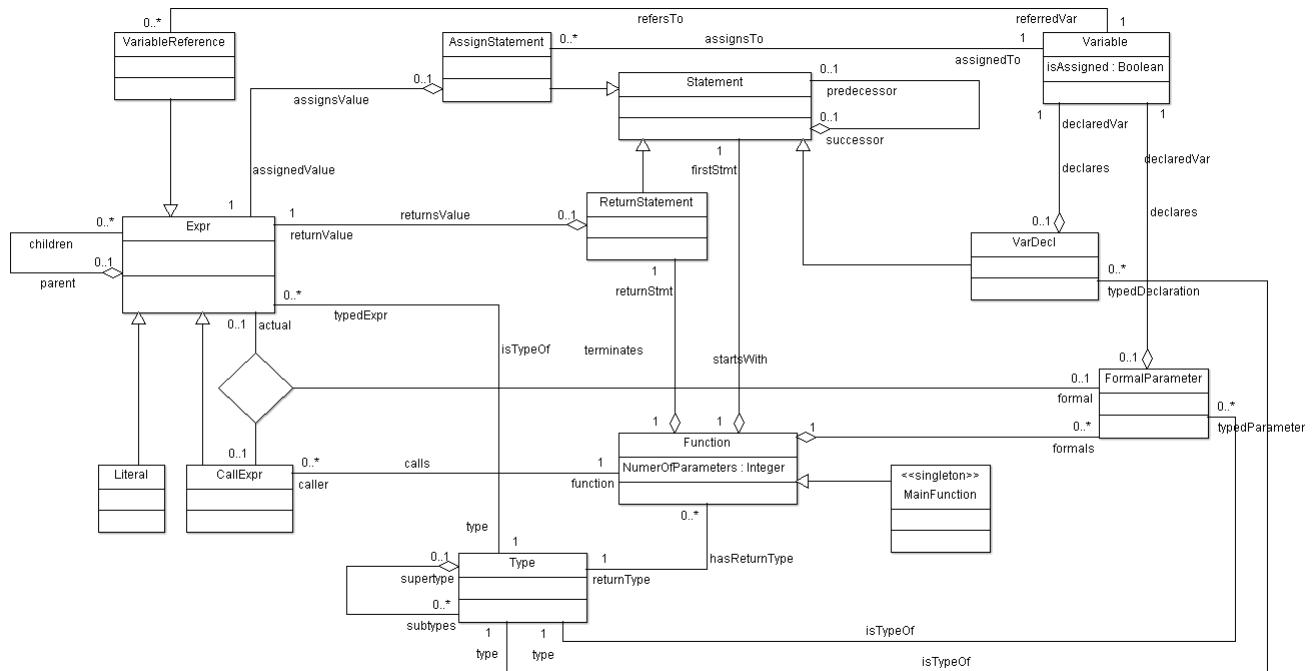


ETH SAE Project 1 - Sherlock

## UML class diagram

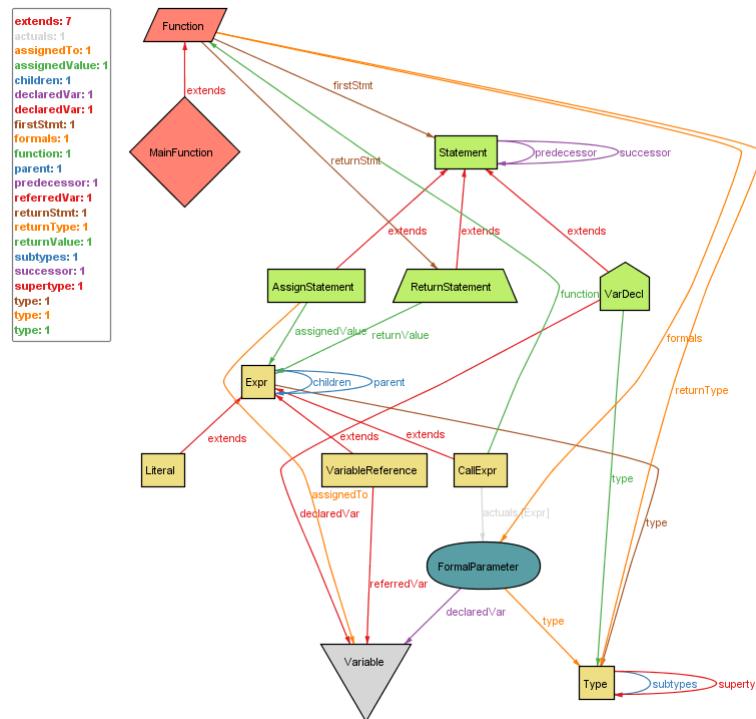


### **Elements that are not encodable in the UML class diagram**

(The non-UML-encodable element is listed first. An optional explanation is in parentheses.)

- The first statement has no predecessor.
  - The return statement has no successor.
  - Actual parameters are mapped to formal parameters. (This would be done by a semantic analyser).
  - Return statement terminates the execution.
  - A function may not contain unreachable statements.
  - Recursion is not allowed.
  - The children of the call expression are in parent-child relation with the actual parameters.
  - There is one main function that takes no parameters.
  - All functions are transitively called from the main function.
  - A variable has to be declared at least once. (We only modelled it has to be declared at most once)
  - Variables must be declared in the same function before the first use such as the first assignment.
  - Variables can only be used in expressions after they have been assigned to.
  - We do not allow dead variables or dead assignments.
  - There are no assignments to parameters.
  - Typing rules for assignments, function calls and return statements.

### **Alloy model from task B**

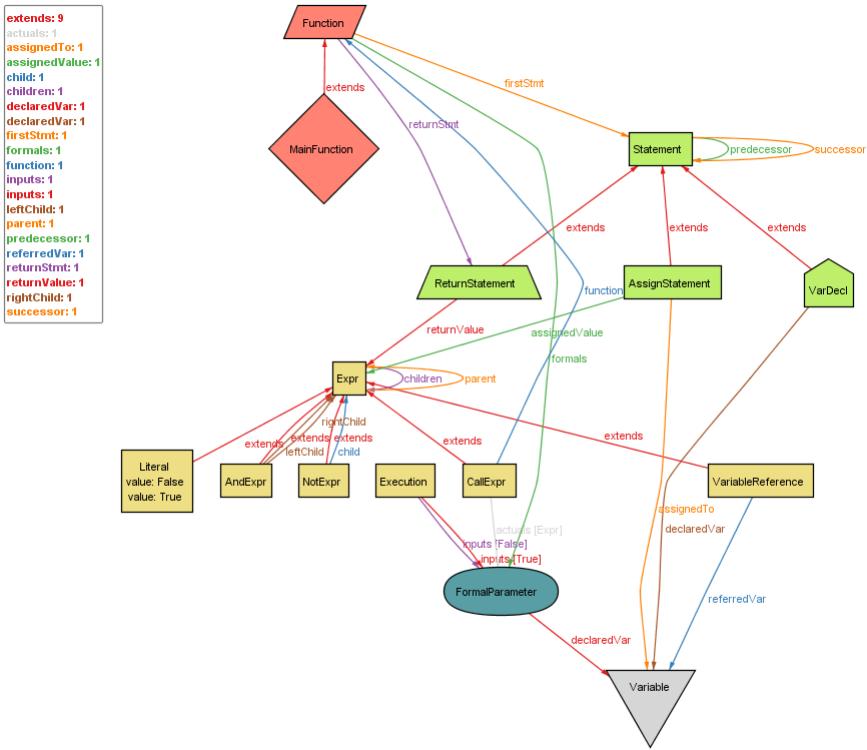


### **Elements that are not encodable in the Alloy model**

(The non-Alloy-encodable element is listed first. An optional explanation is in parentheses.)

- A return statement terminates the execution of the function body. (This is not a static constraint.)
  - A function may not contain unreachable statements.

### **Alloy model from task D**

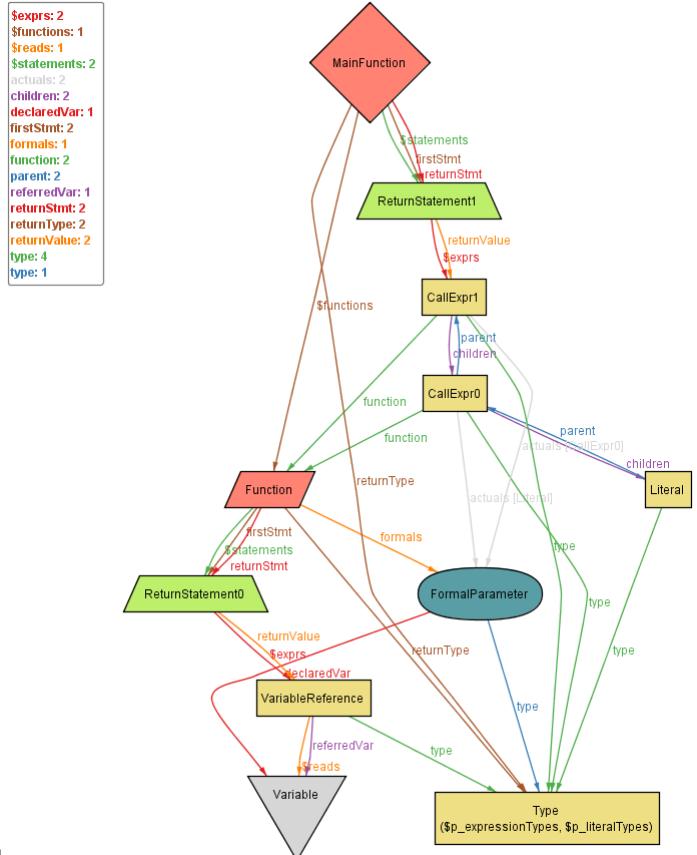


### Instances that are not feasible

- Instance 1 is not feasible since no recursion is allowed.
  - Instance 5 is not feasible since we only have one literal yet two different types - and these two conditions cannot be fulfilled simultaneously.

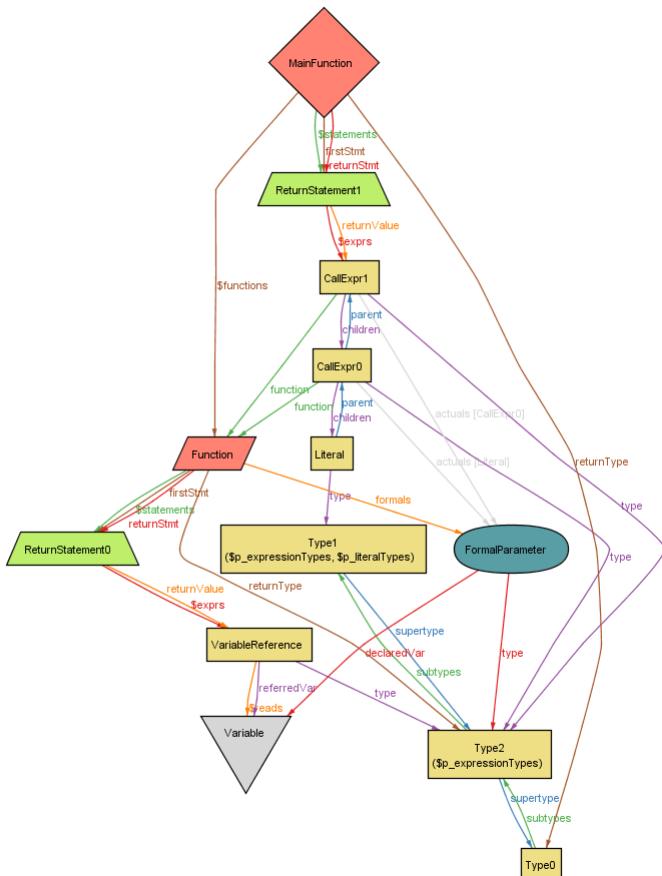
## Image exports from task C

## Instance 2



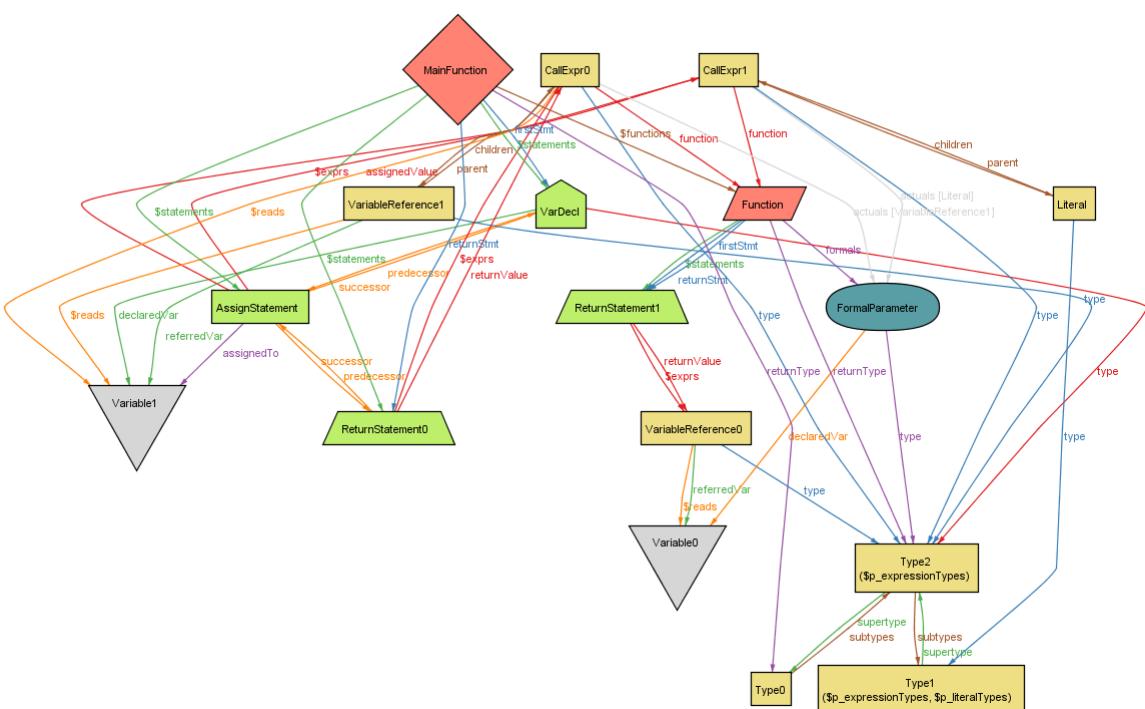
### Instance 1

```
$exprs: 2  
$functions: 1  
$reads: 1  
$statements: 2  
actuals: 2  
children: 2  
declaredVar: 1  
firstStmt: 2  
formals: 1  
function: 2  
parent: 2  
referredVar: 1  
returnStmt: 2  
returnType: 2  
returnValue: 2  
subtypes: 2  
superType: 2  
type: 4  
type: 1
```



## Instance 2

```
$exprs: 3  
$functions: 1  
$reads: 3  
$statements: 4  
actuals: 2  
assignedTo: 1  
assignedValue: 1  
children: 2  
declaredVar: 1  
declaredVar: 1  
firstStmt: 2  
forms: 1  
function: 2  
parent: 2  
predecessor: 2  
referredVar: 2  
returnStmt: 2  
returnType: 2  
returnValue: 2  
subtypes: 2  
successor: 2  
superType: 2  
type: 5  
type: 1  
type: 1
```

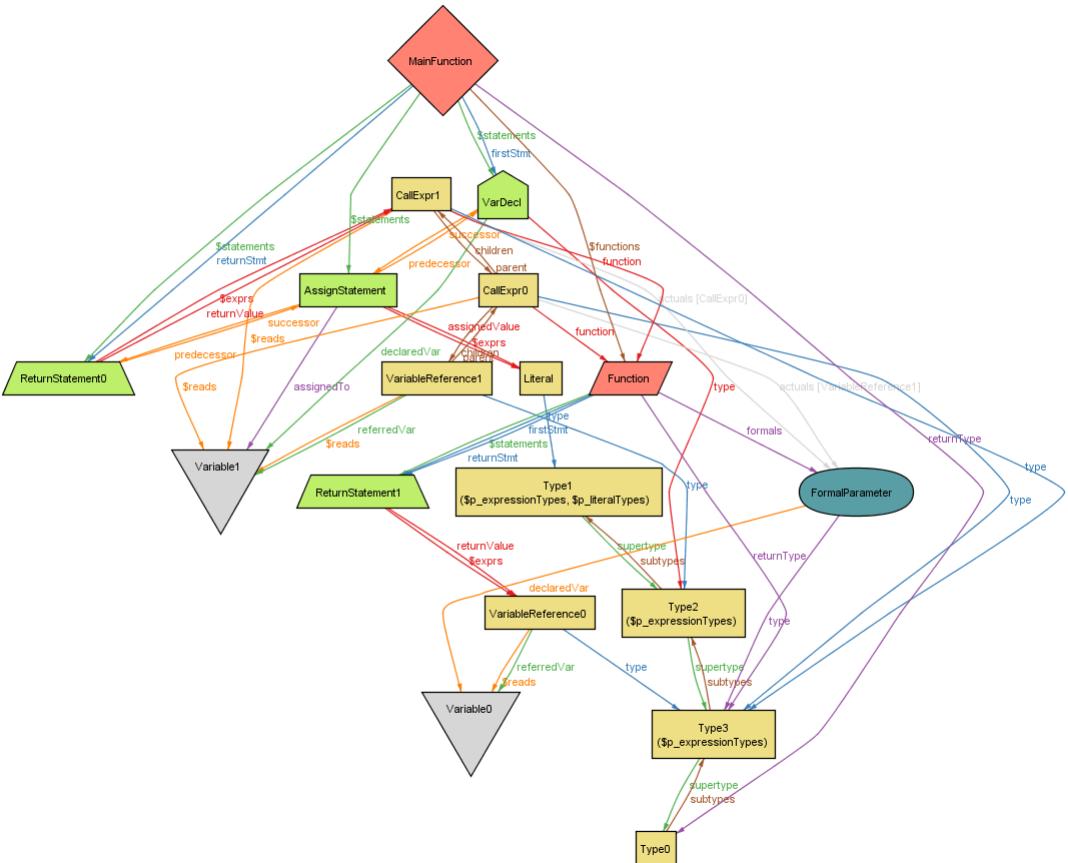


### Instance 3

```

$exprs: 3
$functions: 1
$reads: 4
$statements: 4
actuals: 2
assigned1to: 1
assignedValue: 1
children: 2
declaredVar: 1
declaredVar: 1
firstStmt: 2
formals: 1
function: 2
parent: 2
predecessor: 2
referredVar: 2
returnStmt: 2
returnValue: 2
subtypes: 3
successor: 2
superType: 3
type: 5
type: 1
type: 1

```

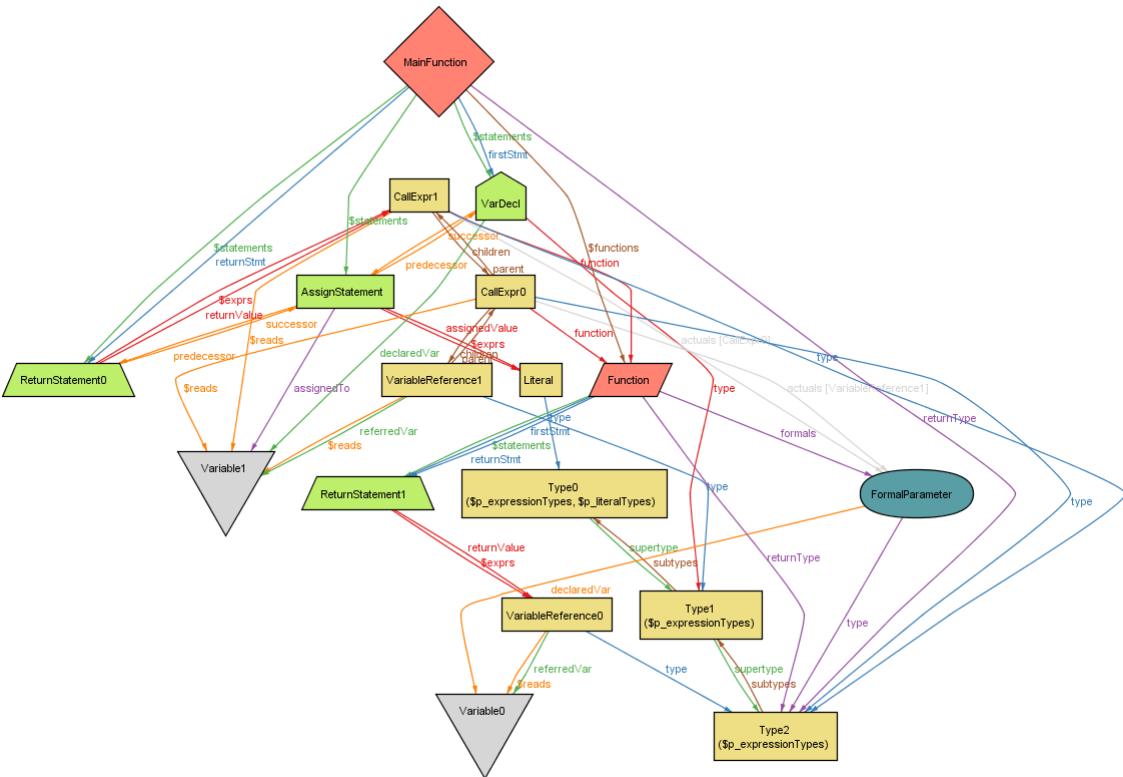


Instance 4

```

$exprs: 3
$functions: 1
$reads: 4
$statements: 4
actuals: 2
assigned1to: 1
assignedValue: 1
children: 2
declaredVar: 1
declaredVar: 1
firstStmt: 2
formals: 1
function: 2
parent: 2
predecessor: 2
referredVar: 2
returnStmt: 2
returnValue: 2
subtypes: 2
successor: 2
superType: 2
type: 5
type: 1
type: 1

```

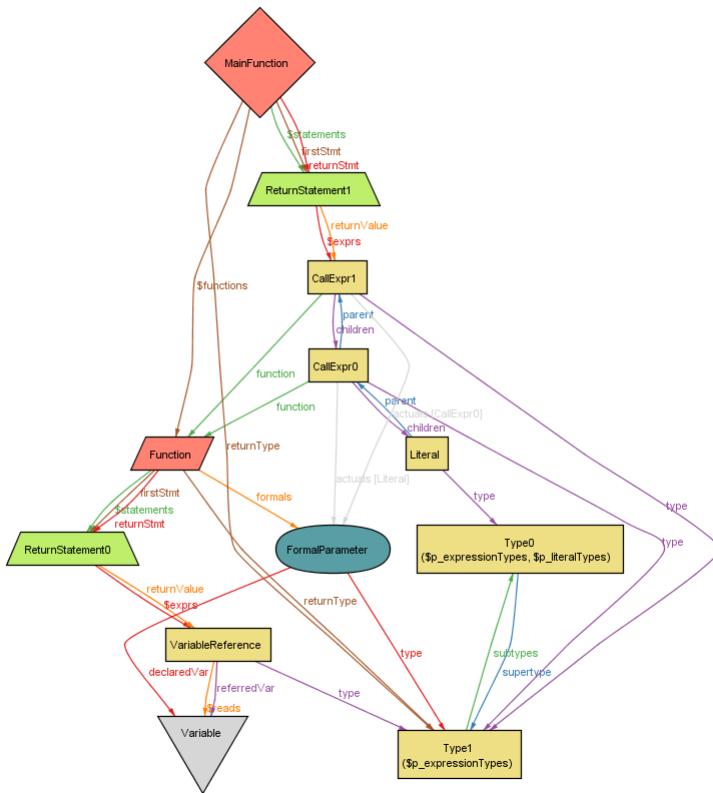


Instance 5

```

$exprs: 2
$functions: 1
$reads: 1
$statements: 2
actuals: 2
children: 2
declaredVar: 1
firstStmt: 2
formals: 1
function: 2
parent: 2
referredVar: 1
returnStmt: 2
returnType: 2
returnValue: 2
subtypes: 1
superType: 1
type: 4
type: 1

```

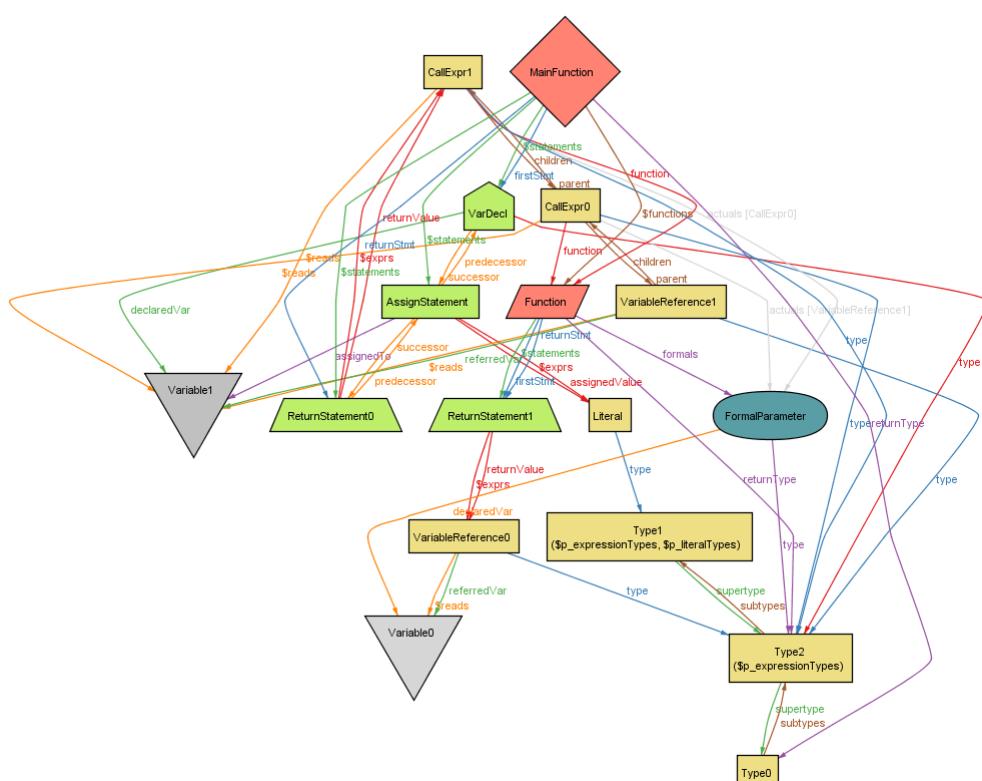


Instance 6

```

$exprs: 3
$functions: 1
$reads: 4
$statements: 4
actuals: 2
assignedTo: 1
assignedValue: 1
children: 2
declaredVar: 1
declaredVar: 1
firstStmt: 1
formals: 1
function: 2
parent: 2
predecessor: 2
referredVar: 2
returnStmt: 2
returnType: 2
returnValue: 2
subtypes: 2
successor: 2
superType: 2
type: 5
type: 1
type: 1

```

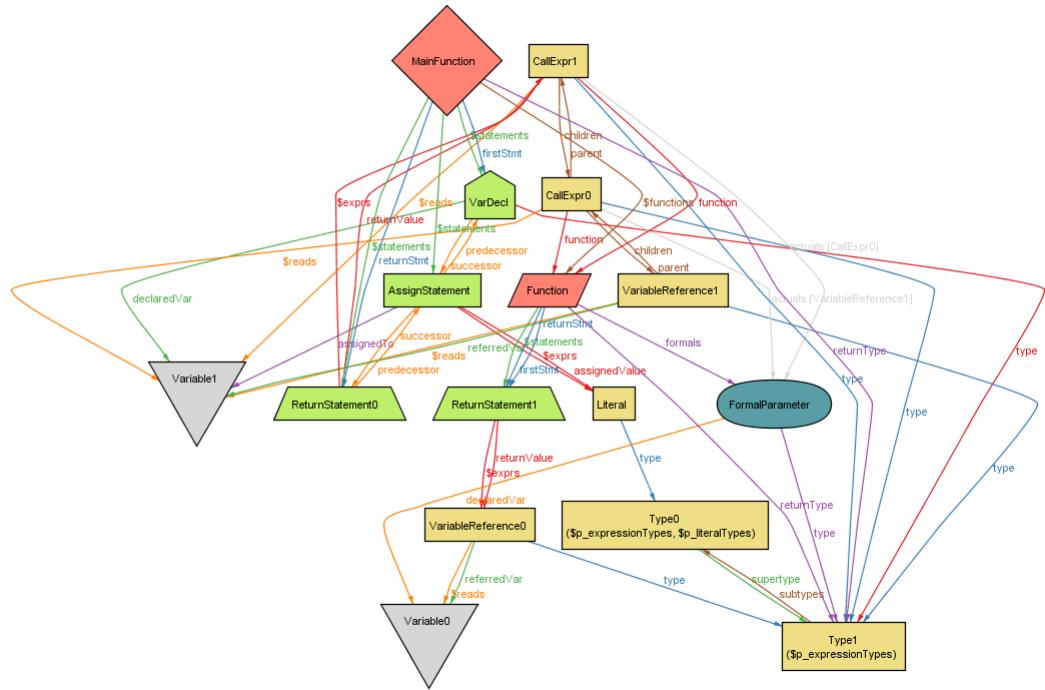


Instance 7

```

$exprs: 3
$functions: 1
$reads: 4
$statements: 4
actuals: 2
assignedValue: 1
children: 2
declaredVar: 1
declaredVar: 1
firstStmt: 2
formals: 1
function: 2
parent: 2
predecessor: 2
referredVar: 2
returnStmt: 2
returnValue: 2
subtypes: 1
successor: 2
supertype: 1
type: 5
type: 1
type: 1

```

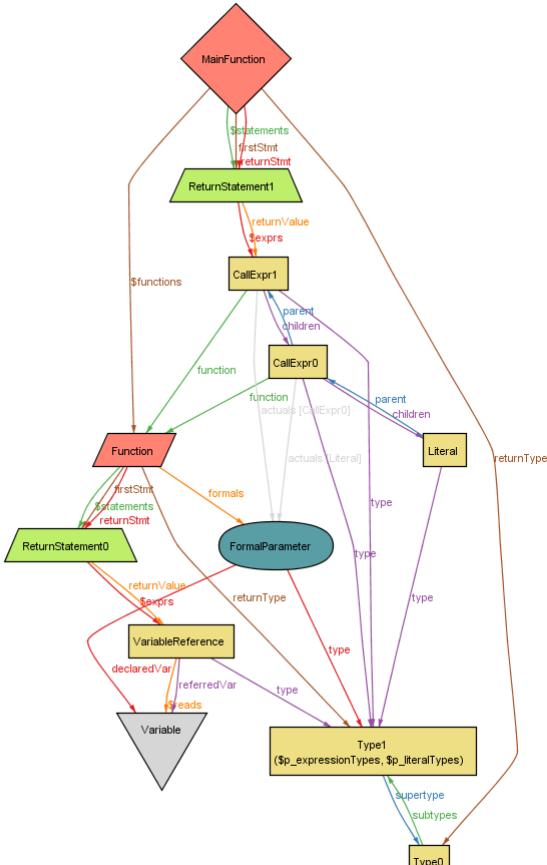


Instance 8

```

$exprs: 2
$functions: 1
$reads: 1
$statements: 2
actuals: 2
children: 2
declaredVar: 1
firstStmt: 2
formals: 1
function: 1
parent: 2
predecessor: 1
referredVar: 1
returnStmt: 1
returnValue: 2
subtypes: 2
successor: 1
supertype: 1
type: 4
type: 1
type: 1

```

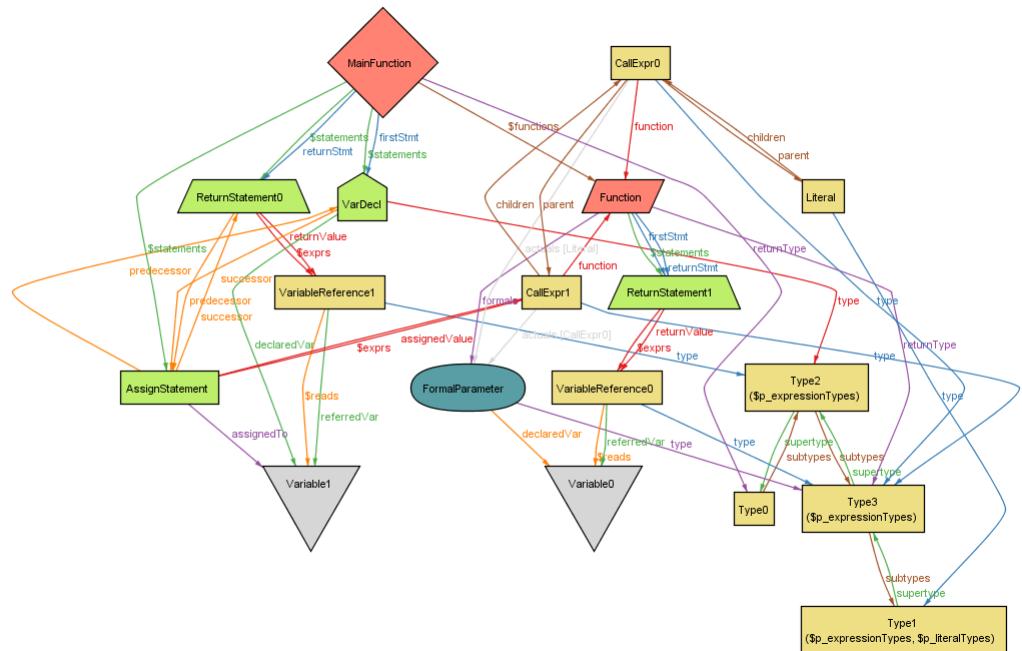


Instance 9

```

$exprs: 3
$functions: 1
$reads: 2
$statements: 4
actuals: 2
assignedTo: 1
assignedValue: 1
children: 2
declaredVar: 1
declaredVar: 1
firstStmt: 2
formals: 1
function: 2
parent: 2
predecessor: 2
referredVar: 2
returnStmt: 2
returnValue: 2
subtypes: 3
successor: 2
supertype: 3
type: 5
type: 1
type: 1

```

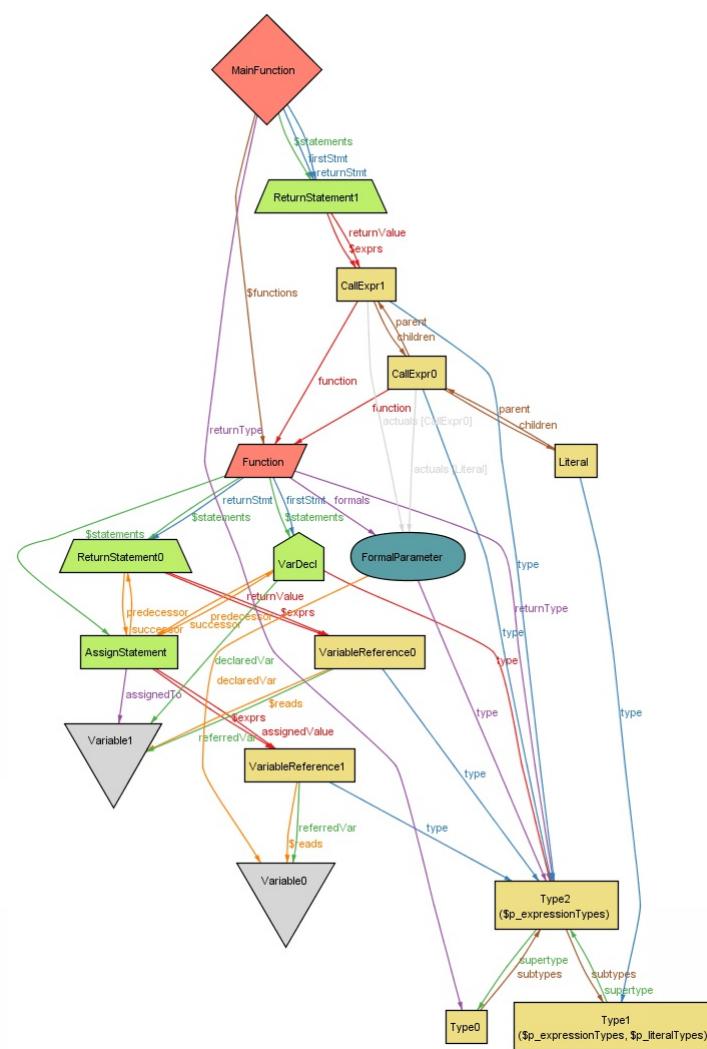


Instance 10

```

$exprs: 3
$functions: 1
$reads: 2
$statements: 4
actuals: 2
assignedTo: 1
assignedValue: 1
children: 2
declaredVar: 1
declaredVar: 1
firstStmt: 2
formals: 1
function: 2
parent: 2
predecessor: 2
referredVar: 2
returnStmt: 2
returnValue: 2
subtypes: 2
successor: 2
supertype: 2
type: 5
type: 1
type: 1

```

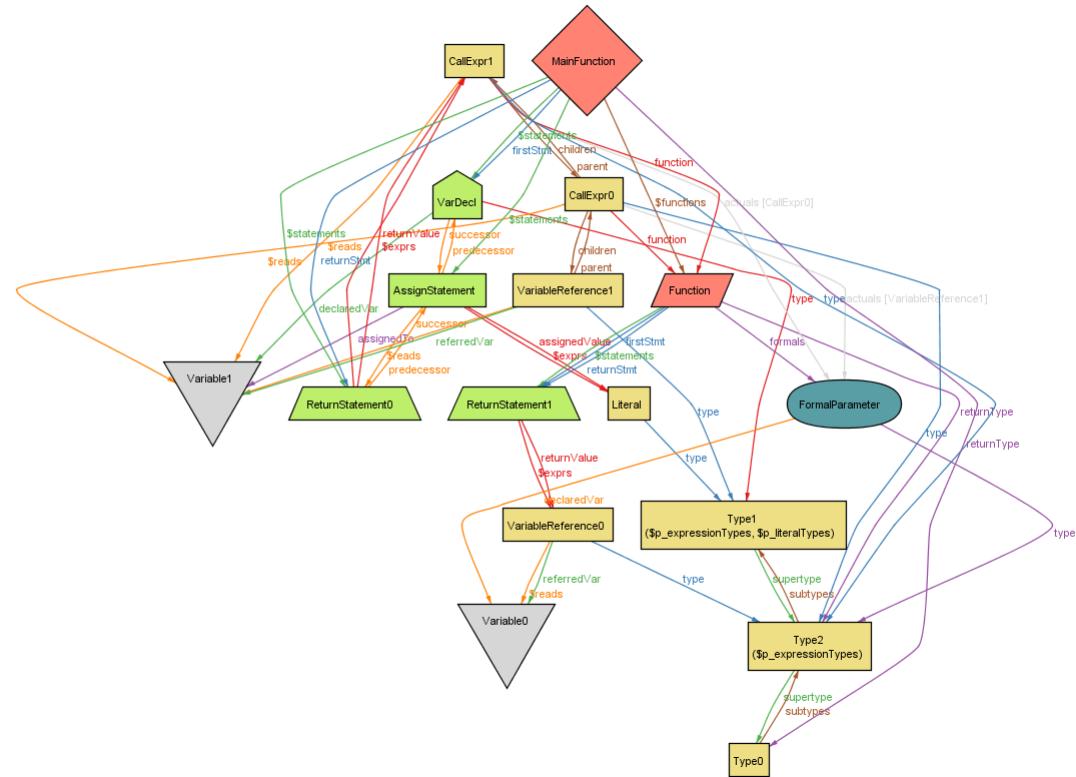


Instance 11

```

$exprs: 3
$functions: 1
$reads: 4
$statements: 4
actuals: 2
assignedTo: 1
assignedValue: 1
children: 2
declaredVar: 1
declaredVar: 1
firstStmt: 2
formals: 1
function: 2
parent: 2
predecessor: 2
referredVar: 2
returnStmt: 2
returnValue: 2
subtypes: 2
successor: 2
superType: 2
type: 5
type: 1
type: 1

```

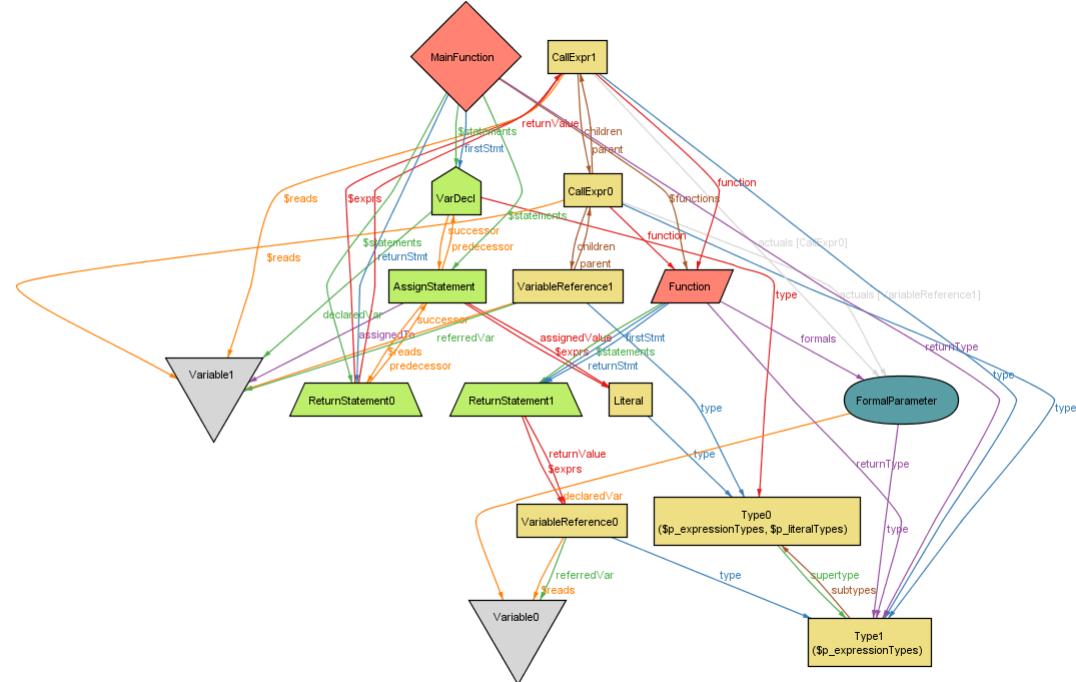


Instance 12

```

$exprs: 3
$functions: 1
$reads: 4
$statements: 4
actuals: 2
assignedTo: 1
assignedValue: 1
children: 2
declaredVar: 1
declaredVar: 1
firstStmt: 2
formals: 1
function: 2
parent: 2
predecessor: 2
referredVar: 2
returnStmt: 2
returnValue: 2
subtypes: 1
successor: 2
superType: 1
type: 5
type: 1
type: 1

```

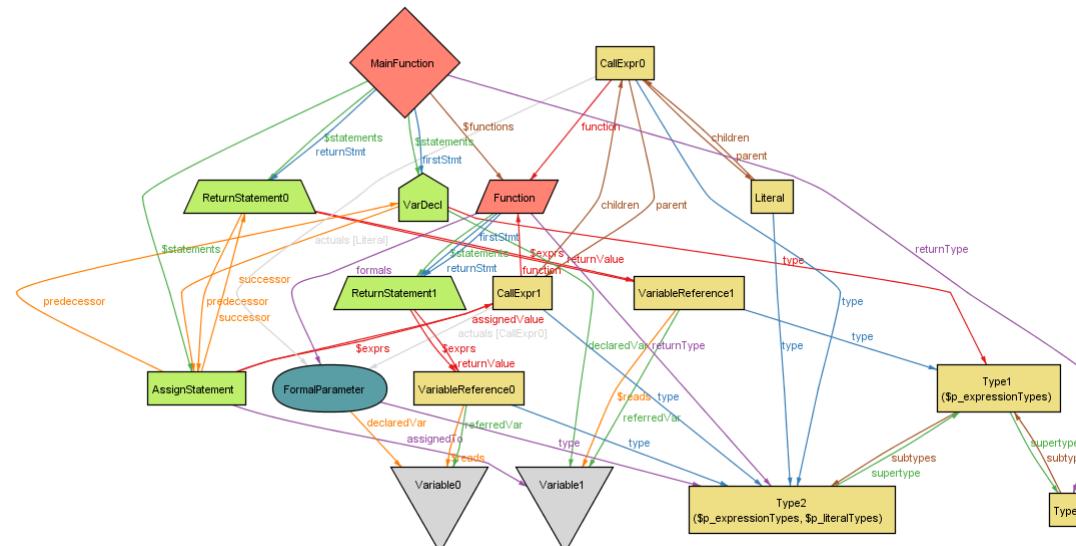


Instance 13

```

$exprs: 3
$functions: 1
$reads: 2
$statements: 4
actuals: 2
assignedTo: 1
assignedValue: 1
children: 2
declaredVar: 1
declaredVar: 1
firstStmt: 2
formals: 1
function: 2
parent: 2
predecessor: 2
referredVar: 2
returnStmt: 2
returnValue: 2
subtypes: 2
successor: 2
superType: 2
type: 5
type: 1
type: 1

```

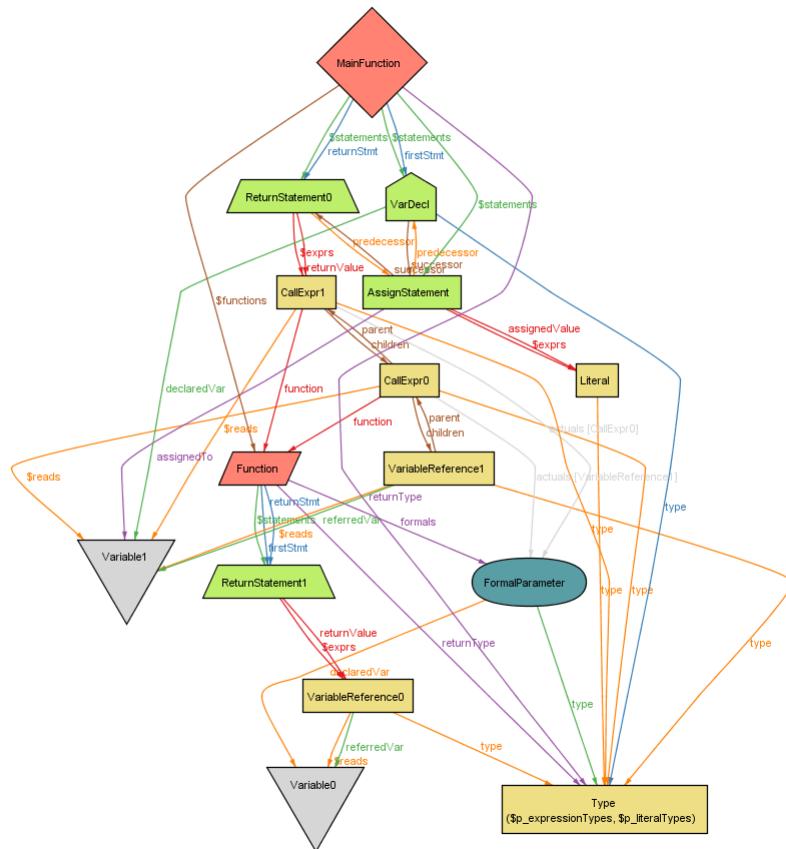


Instance 14

```

$exprs: 3
$functions: 1
$reads: 4
$statements: 4
actuals: 2
assignedTo: 1
assignedValue: 1
children: 2
declaredVar: 1
declaredVar: 1
firstStmt: 2
formals: 1
function: 2
parent: 2
predecessor: 2
referredVar: 2
returnStmt: 2
returnValue: 2
successor: 2
type: 5
type: 1
type: 1

```

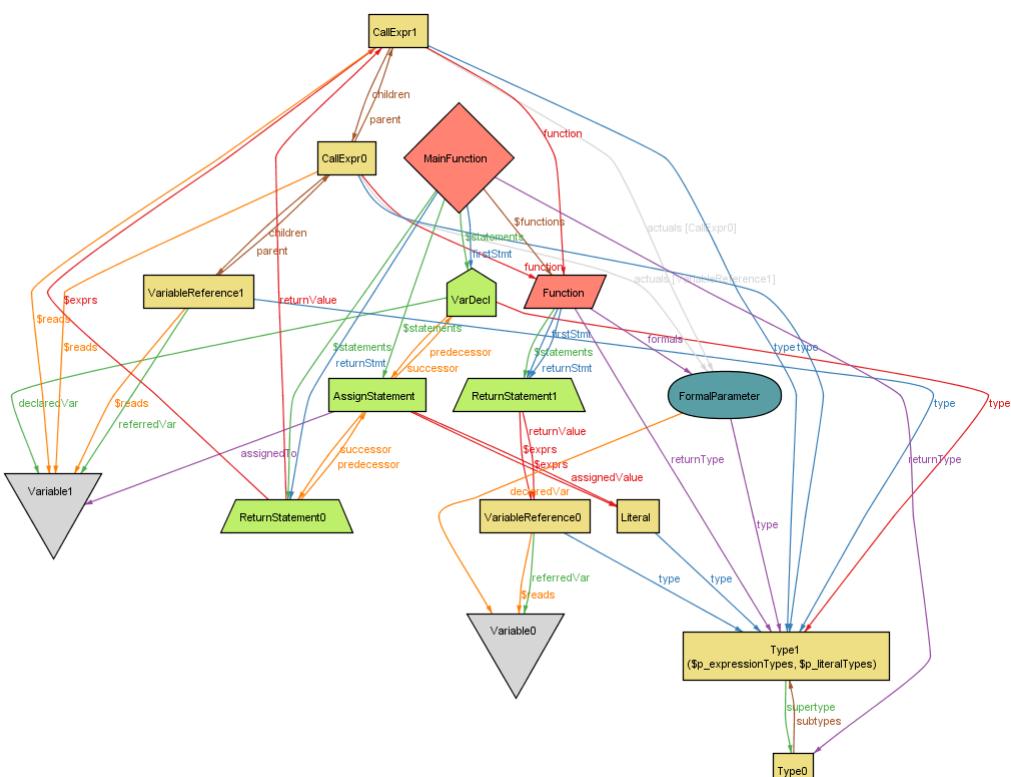


Instance 15

```

$exprs: 3
$functions: 1
$reads: 4
$statements: 4
actuals: 2
assignedTo: 1
assignedValue: 1
children: 2
declaredVar: 1
declaredVar: 1
firstStmt: 2
formals: 1
function: 2
parent: 2
predecessor: 2
referredVar: 2
returnStmt: 2
returnValue: 2
successor: 2
subtype: 1
successor: 2
supertype: 1
type: 5
type: 1
type: 1

```

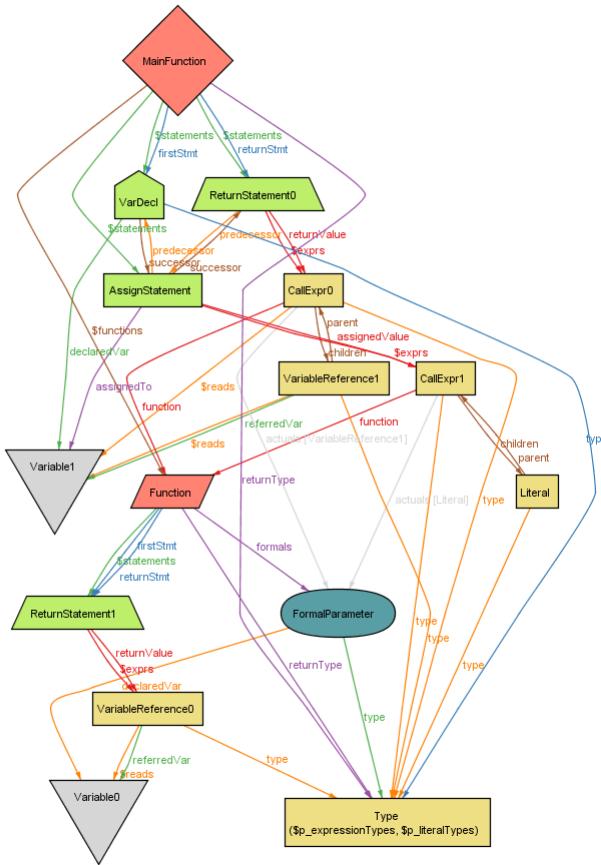


Instance 16

```

$exprs: 3
$functions: 1
$reads: 3
$statements: 4
actuals: 2
assignedTo: 1
assignedValue: 1
children: 2
declaredVar: 1
declaredVar: 1
firstStmt: 2
formals: 1
function: 2
parent: 2
predecessor: 2
referedVar: 2
returnStmt: 2
returnType: 2
returnValue: 2
successor: 2
type: 5
type: 1
type: 1

```

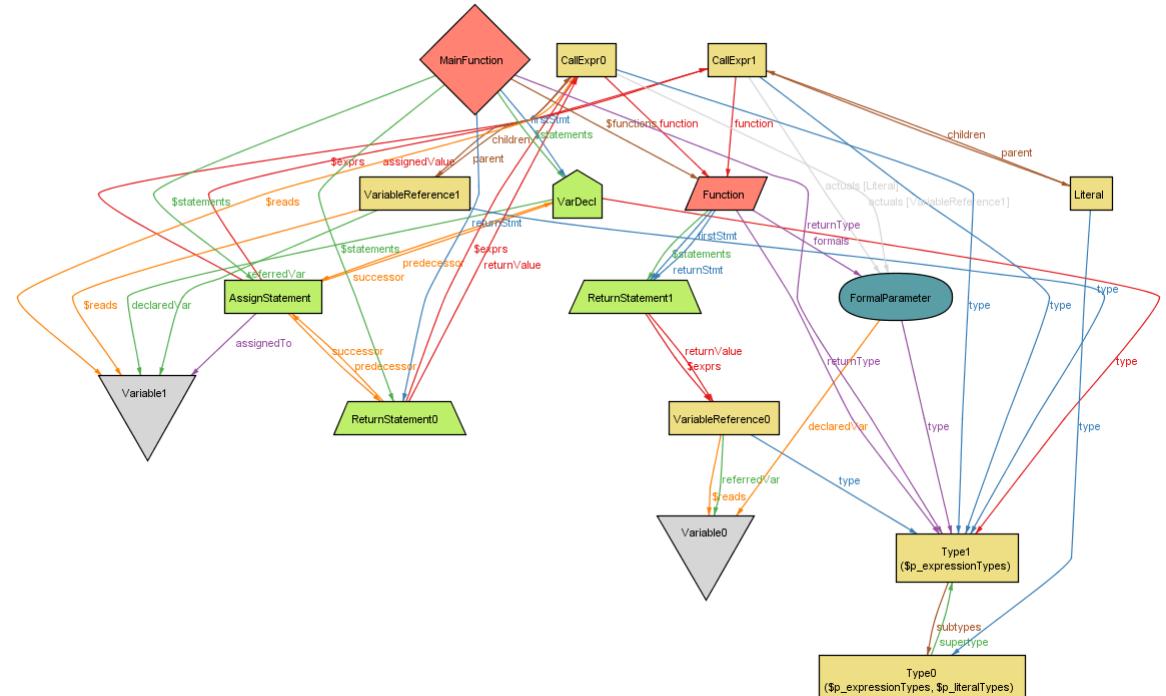


Instance 17

```

$exprs: 3
$functions: 1
$reads: 3
$statements: 4
actuals: 2
assignedTo: 1
assignedValue: 1
children: 2
declaredVar: 1
declaredVar: 1
firstStmt: 2
formals: 1
function: 2
parent: 2
predecessor: 2
referedVar: 2
returnStmt: 2
returnType: 2
returnValue: 2
subtypes: 2
successor: 2
superType: 1
type: 5
type: 1
type: 1

```

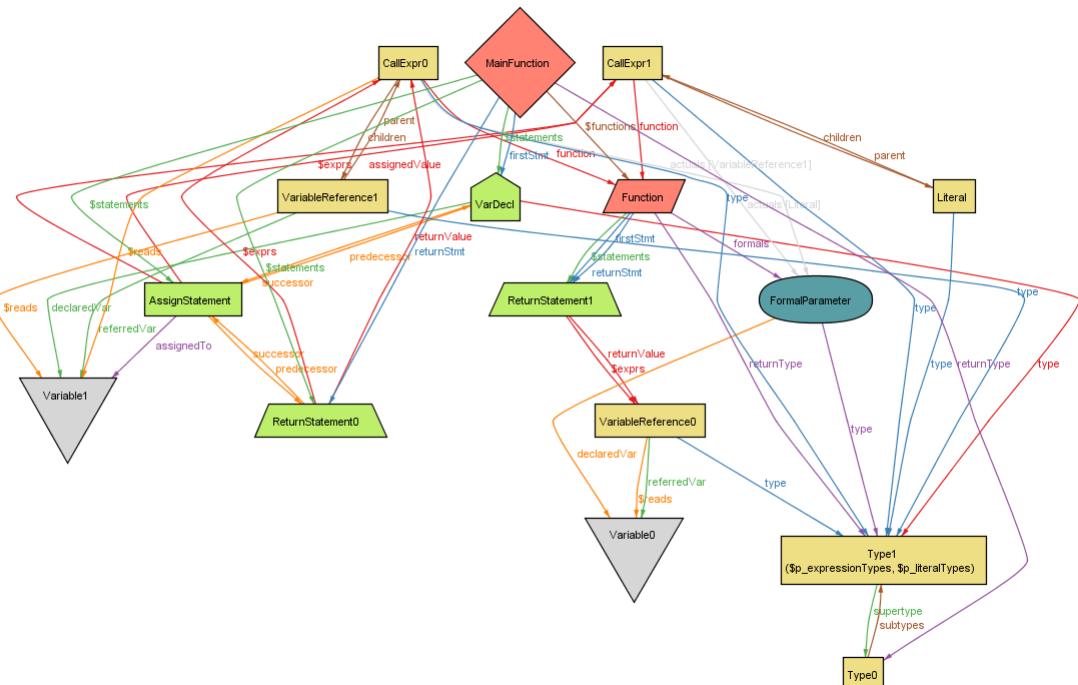


Instance 18

```

$exprs: 3
$functions: 1
$reads: 3
$statements: 4
actuals: 2
assignedTo: 1
assignedValue: 1
children: 2
declaredVar: 1
declaredVar: 1
firstStmt: 2
formals: 1
function: 2
parent: 2
predecessor: 2
referredVar: 2
returnStmt: 2
returnValue: 2
subtypes: 1
successor: 2
supertype: 1
type: 5
type: 1
type: 1

```

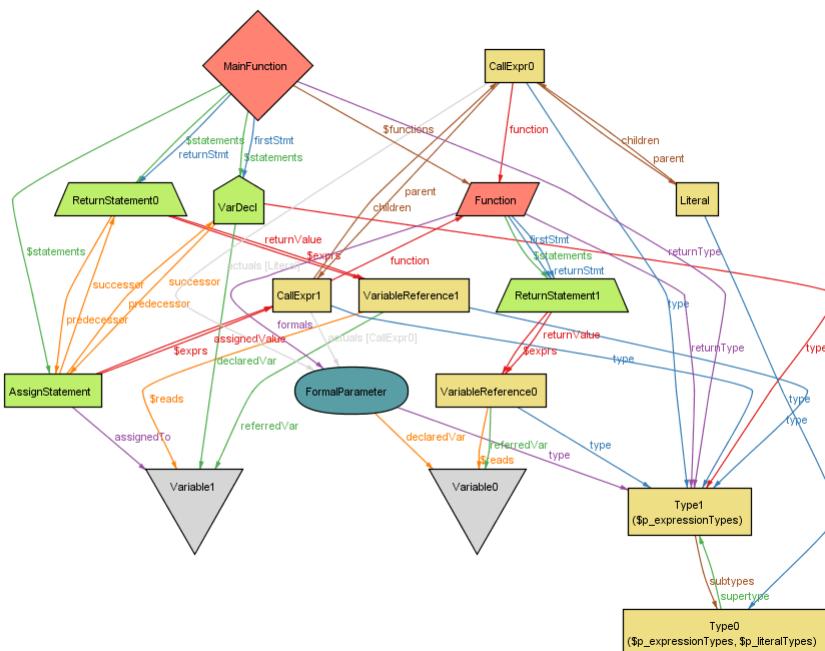


Instance 19

```

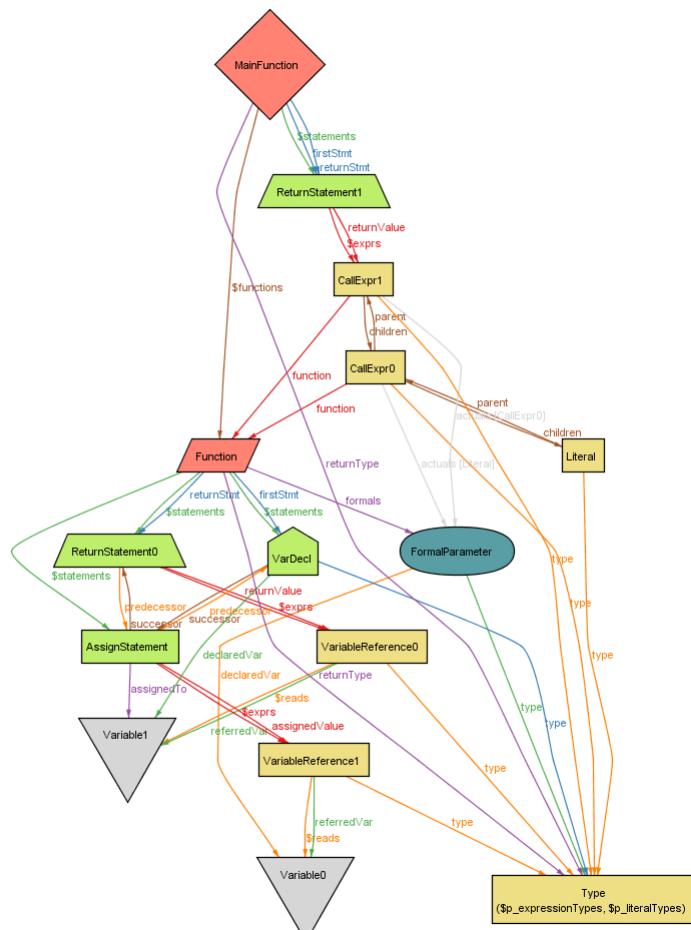
$exprs: 3
$functions: 1
$reads: 2
$statements: 4
actuals: 2
assignedTo: 1
assignedValue: 1
children: 2
declaredVar: 1
declaredVar: 1
firstStmt: 2
formals: 1
function: 2
parent: 2
predecessor: 2
referredVar: 2
returnStmt: 2
returnValue: 2
subtypes: 1
successor: 2
supertype: 1
type: 5
type: 1
type: 1

```



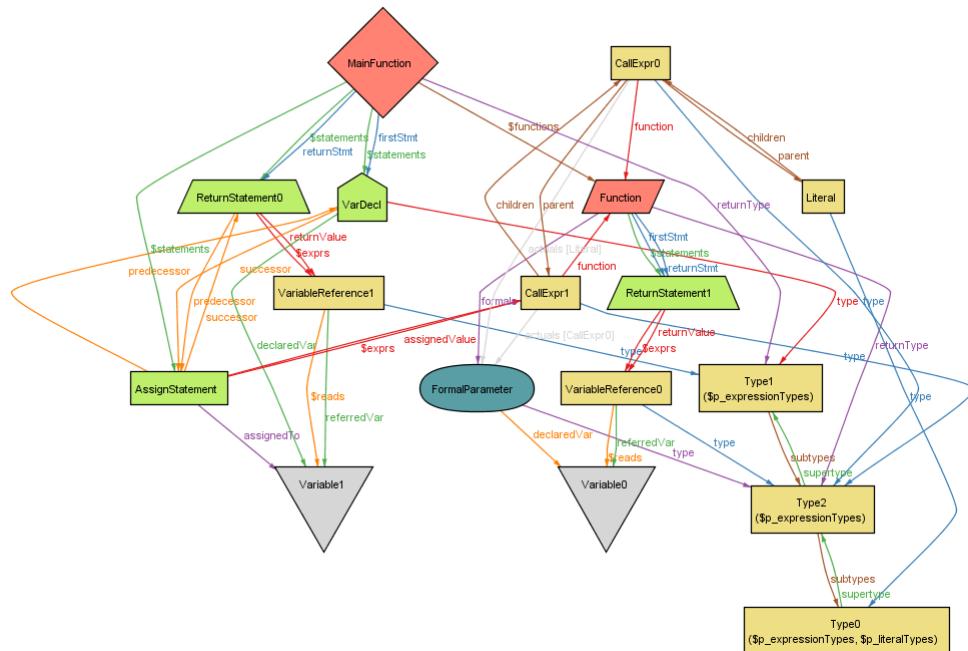
Instance 20

```
$exprs: 3  
$functions: 1  
$reads: 2  
$statements: 4  
actuals: 2  
assignedTo: 1  
assignedValue: 1  
children: 2  
declaredVar: 1  
declaredVar: 1  
firstStmt: 2  
formals: 1  
function: 2  
parent: 2  
predecessor: 2  
REFERREDVAR: 2  
returnStmt: 2  
returnType: 2  
returnValue: 2  
successor: 2  
type: 5  
type: 1  
type: 1
```

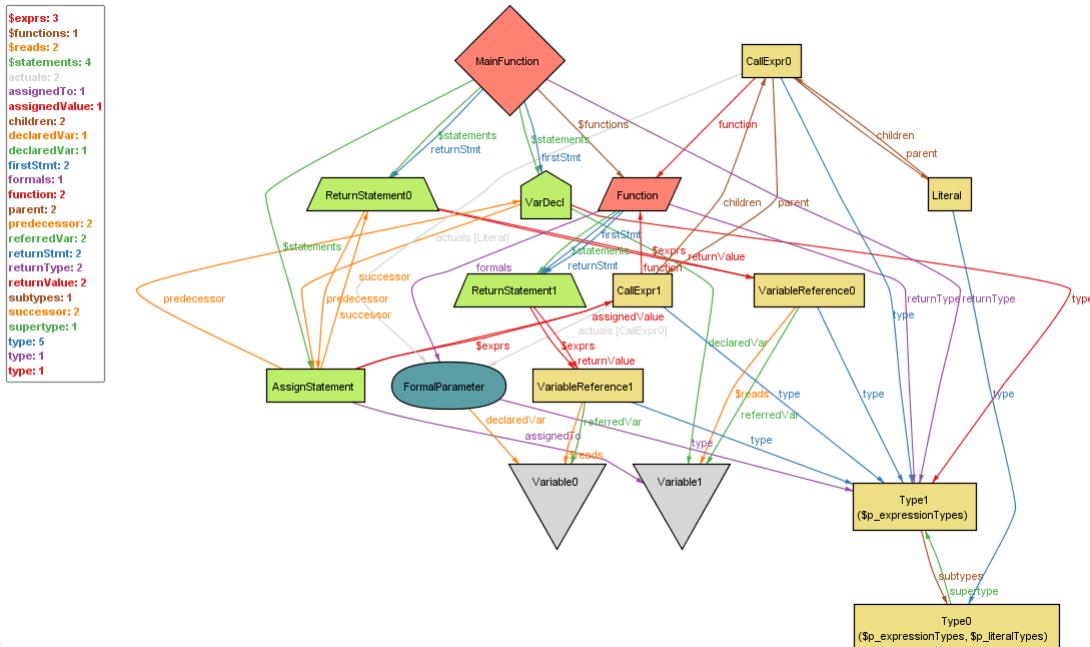


### Instance 21

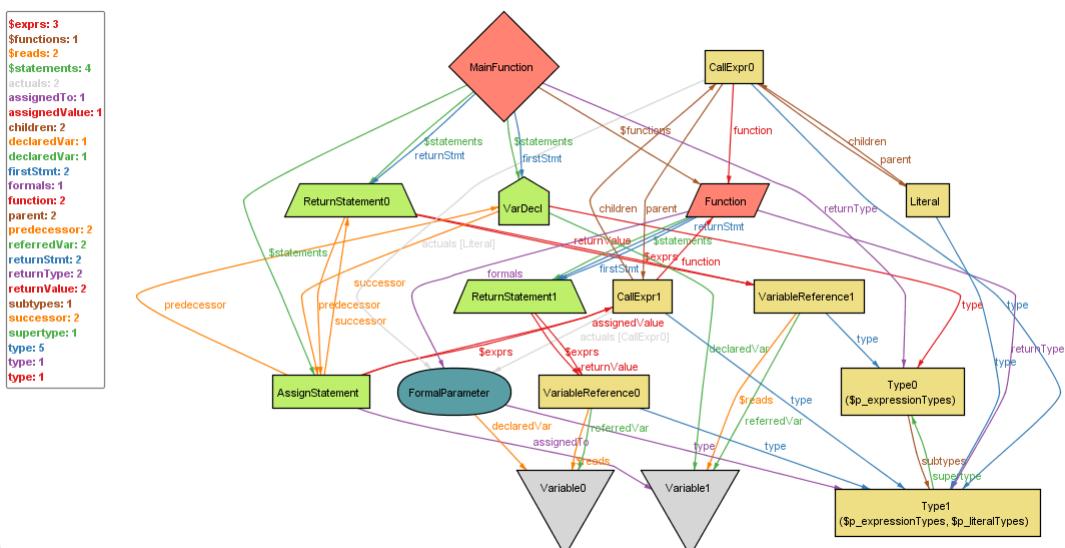
```
$exprs: 3  
$functions: 1  
$reads: 2  
$statements: 4  
actuals: 2  
assignedTo: 1  
assignedValue: 1  
children: 2  
declaredVar: 1  
declaredVar: 1  
firstStmt: 2  
formals: 1  
function: 2  
parent: 2  
predecessor: 2  
REFERREDvar: 2  
returnSmt: 2  
returnType: 2  
returnValue: 2  
subtypes: 2  
successor: 2  
superstype: 2  
type: 5  
type: 1  
type: 1
```



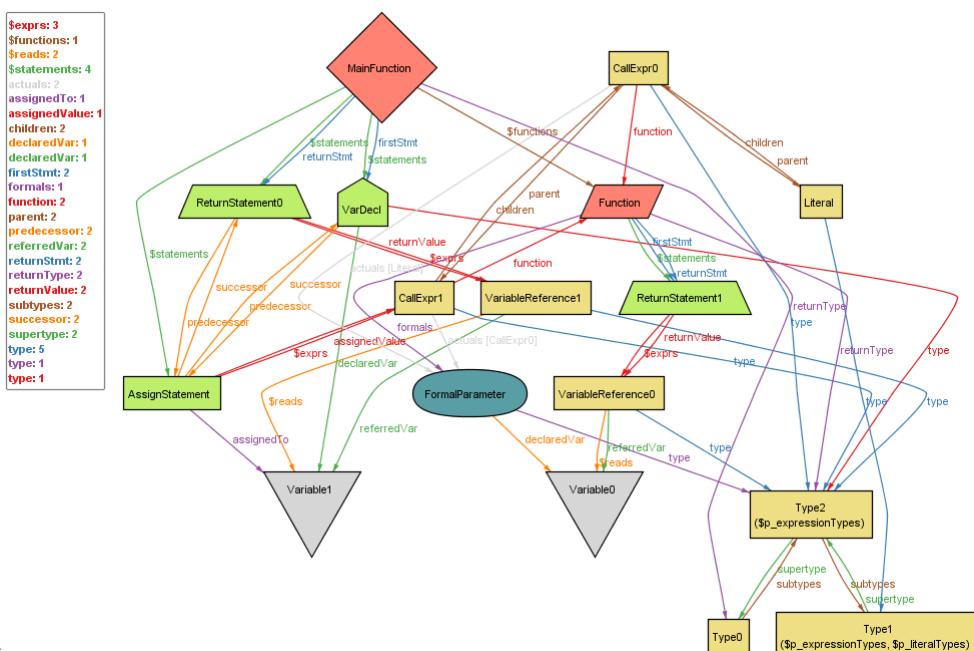
### Instance 22



Instance 23



Instance 24

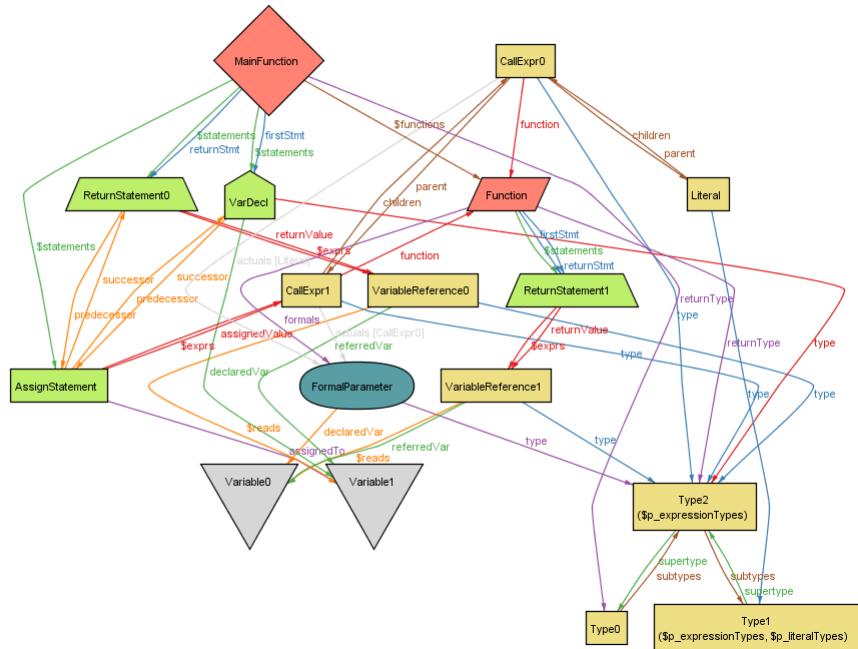


Instance 25

```

$exprs: 3
$functions: 1
$reads: 2
$statements: 4
actuals: 2
assignedTo: 1
assignedValue: 1
children: 2
declaredVar: 1
declaredVar: 1
firstStmt: 2
formals: 1
function: 2
parent: 2
predecessor: 2
referredVar: 2
returnStmt: 2
returnValue: 2
subtypes: 2
successor: 2
supertype: 2
type: 5
type: 1
type: 1

```

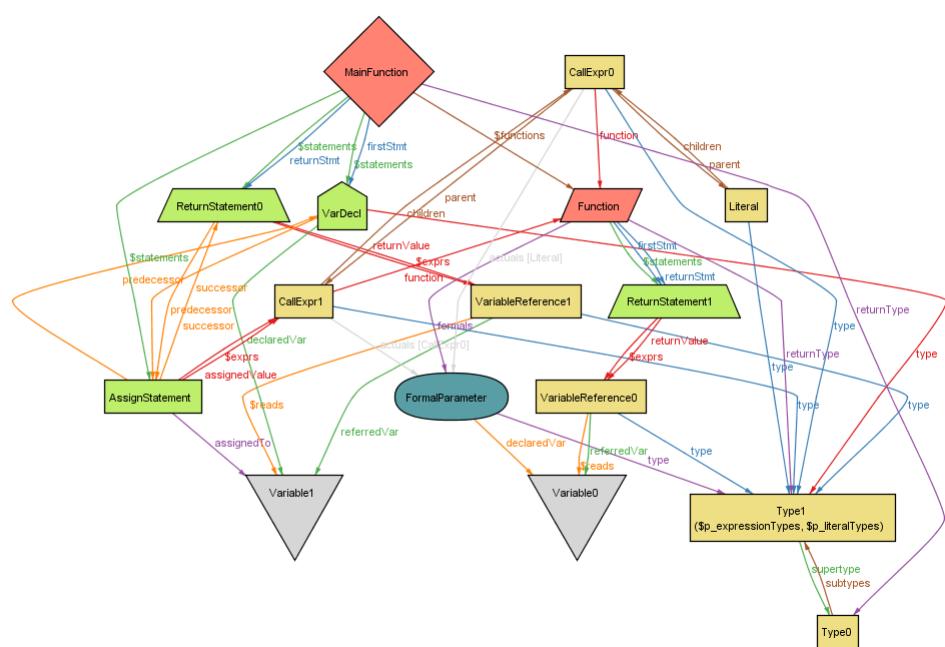


Instance 26

```

$exprs: 3
$functions: 1
$reads: 2
$statements: 4
actuals: 2
assignedTo: 1
assignedValue: 1
children: 2
declaredVar: 1
declaredVar: 1
firstStmt: 2
formals: 1
function: 2
parent: 2
predecessor: 2
referredVar: 2
returnStmt: 2
returnValue: 2
subtypes: 2
successor: 2
supertype: 1
type: 5
type: 1
type: 1

```

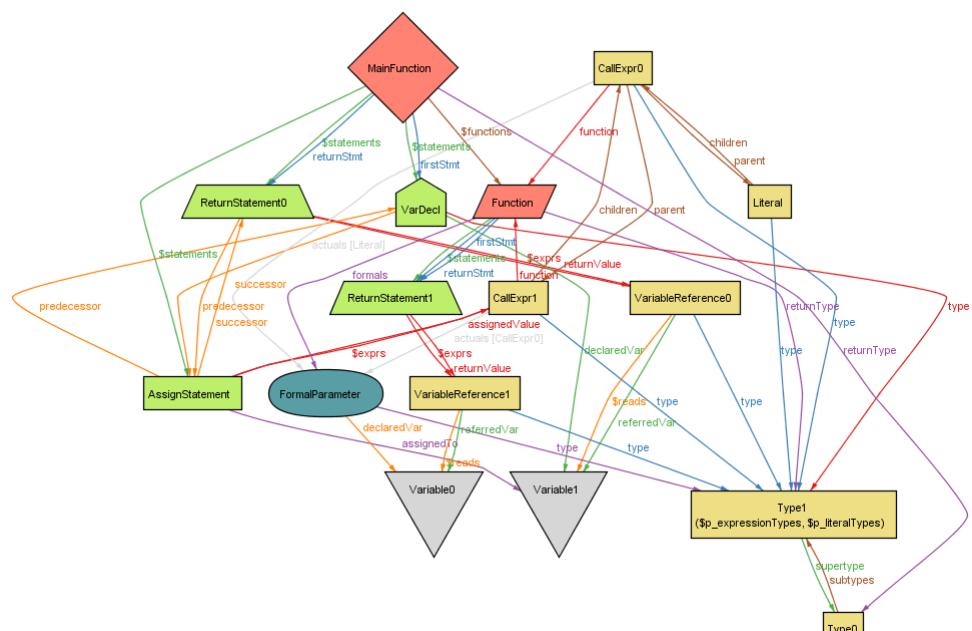


Instance 27

```

$exprs: 3
$functions: 1
$reads: 2
$statements: 4
actuals: 2
assignedTo: 1
assignedValue: 1
children: 2
declaredVar: 1
declaredVar: 1
firstStmt: 2
formals: 1
function: 2
parent: 2
predecessor: 2
referredVar: 2
returnStmt: 2
returnValue: 2
subtypes: 1
successor: 2
supertype: 1
type: 5
type: 1
type: 1

```

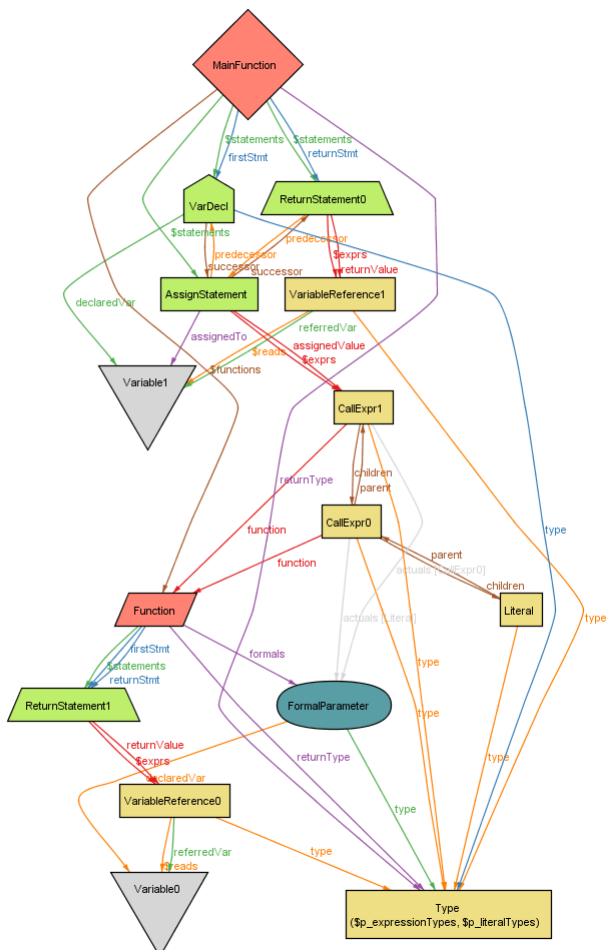


Instance 28

```

$exprs: 3
$functions: 1
$reads: 2
$statements: 4
actuals: 2
assignedTo: 1
assignedValue: 1
children: 2
declaredVar: 1
declaredVar: 1
firstStmt: 2
formals: 1
function: 2
parent: 2
predecessor: 2
referredVar: 2
returnStmt: 2
returnType: 2
returnValue: 2
successor: 2
type: 5
type: 1
type: 1

```

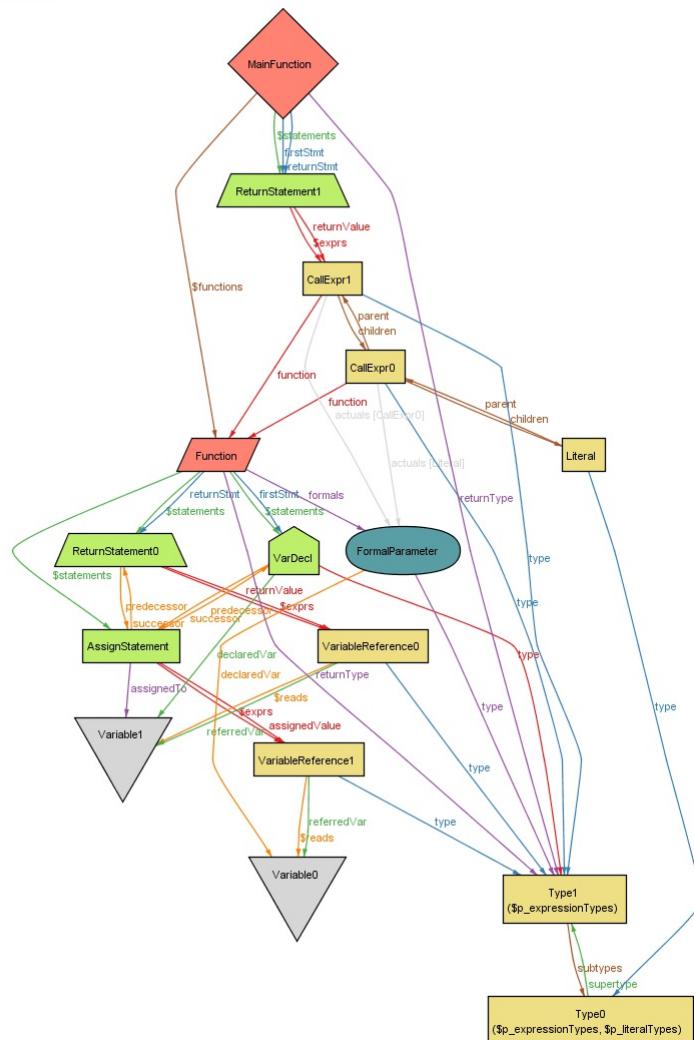


Instance 29

```

$exprs: 3
$functions: 1
$reads: 2
$statements: 4
actuals: 2
assignedTo: 1
assignedValue: 1
children: 2
declaredVar: 1
declaredVar: 1
firstStmt: 2
formals: 1
function: 2
parent: 2
predecessor: 2
referredVar: 2
returnStmt: 2
returnType: 2
returnValue: 2
subtypes: 1
superType: 1
type: 5
type: 1
type: 1

```

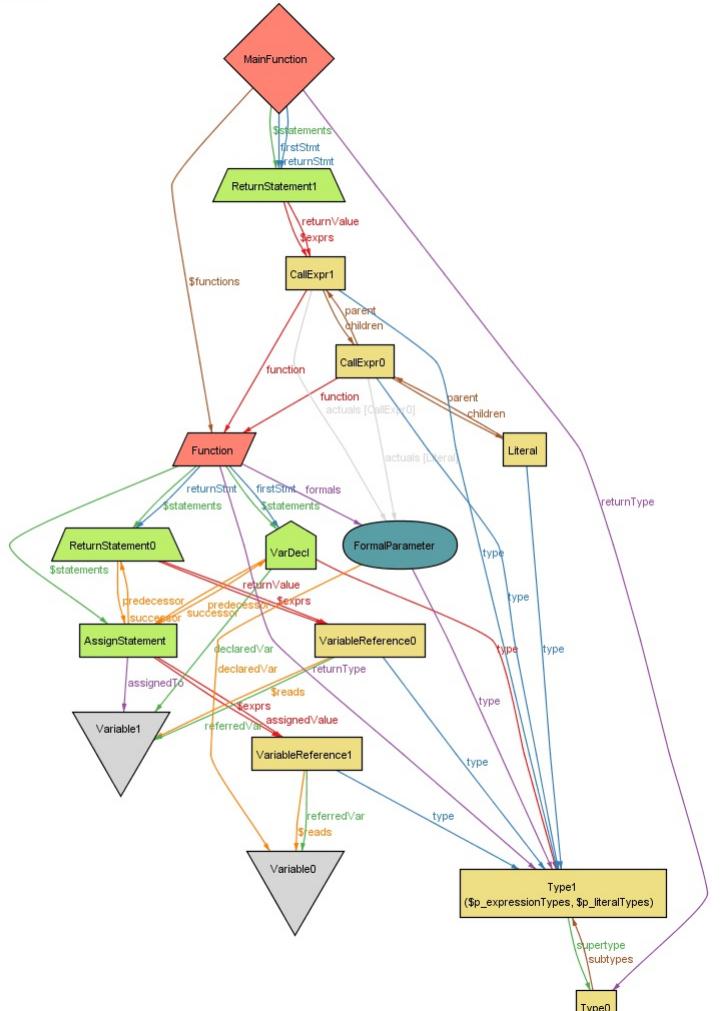


Instance 30

```

$exprs: 3
$functions: 1
$reads: 2
$statements: 4
actuals: 2
assignedTo: 1
assignedValue: 1
children: 2
declaredVar: 1
firstStmt: 2
formals: 1
functions: 2
parent: 2
predecessor: 2
referredVar: 2
returnStmt: 2
returnType: 2
returnValue: 2
subtypes: 1
successor: 2
supertype: 1
type: 5
type: 1
type: 1

```



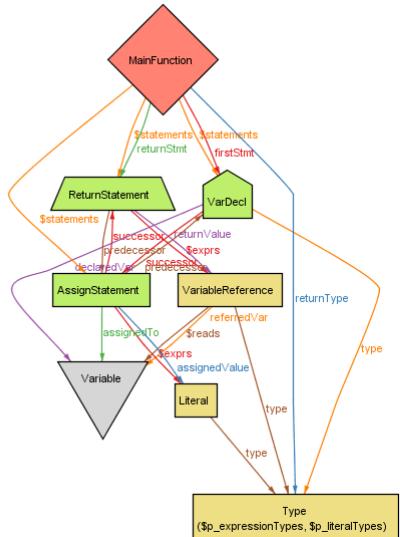
Instance 31

Instance 3

```

$exprs: 2
$reads: 1
$statements: 3
assignedTo: 1
assignedValue: 1
declaredVar: 1
firstStmt: 1
predecessor: 2
referredVar: 1
returnStmt: 1
returnType: 1
returnValue: 1
successor: 2
type: 2
type: 1

```



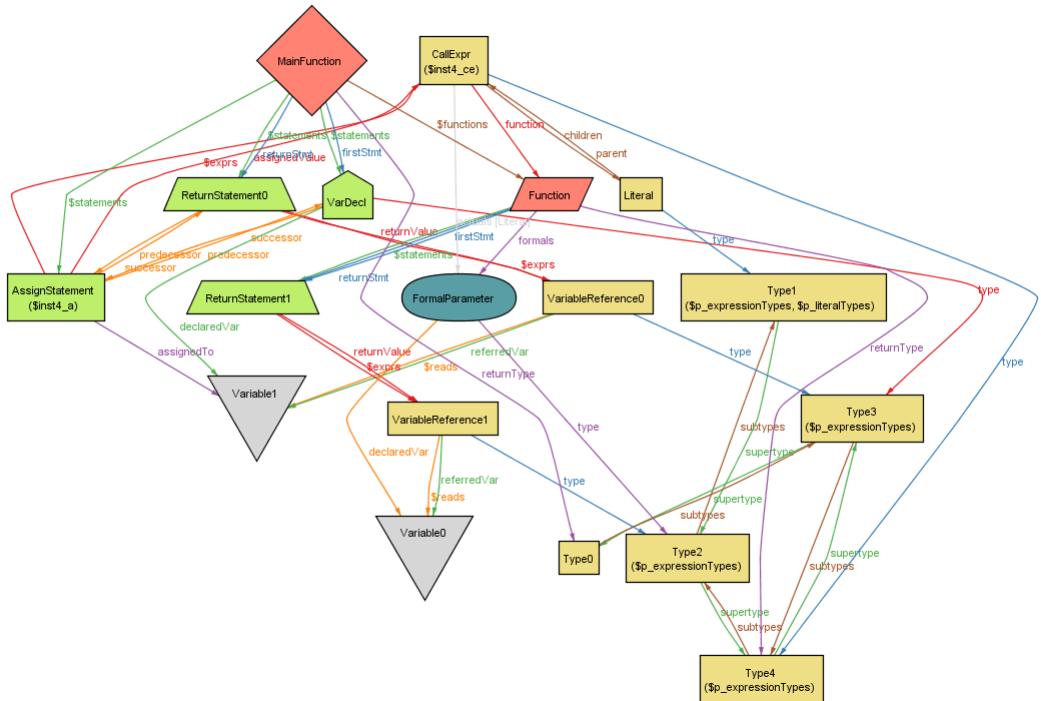
Instance 1

Instance 4

```

$exprs: 3
$functions: 1
$reads: 2
$statements: 4
actuals: 1
assigned1to: 1
assignedValue: 1
children: 1
declaredVar: 1
declaredVar: 1
firstStmt: 2
formals: 1
function: 1
parent: 1
predecessor: 2
referredVar: 2
returnStmt: 2
returnValue: 2
subtypes: 4
successor: 2
superType: 4
type: 4
type: 1
type: 1

```

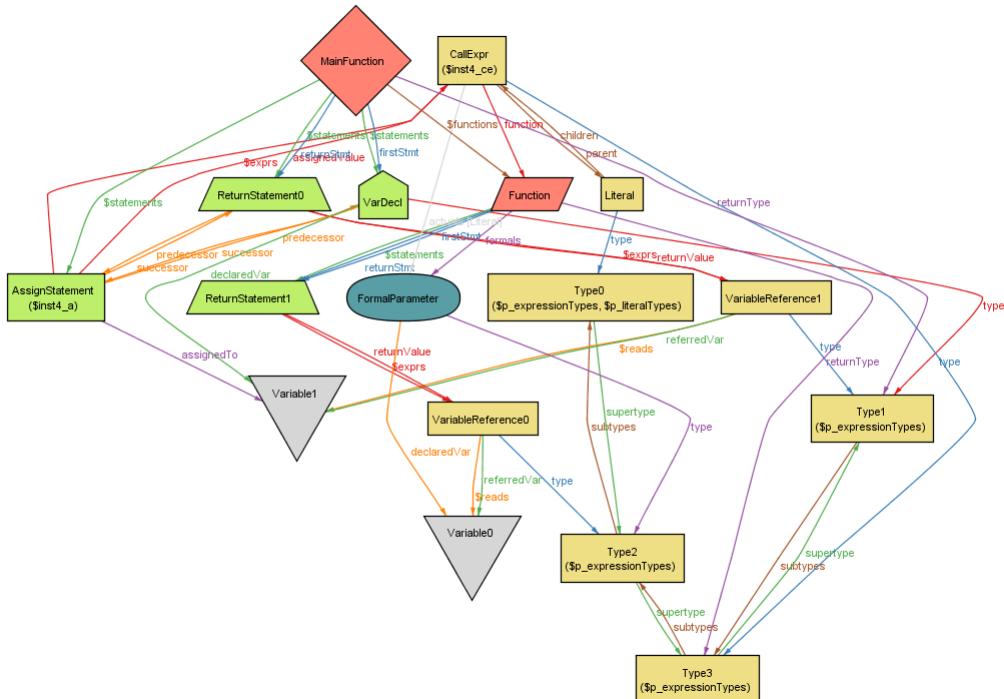


Instance 1

```

$exprs: 3
$functions: 1
$reads: 2
$statements: 4
actuals: 1
assigned1to: 1
assignedValue: 1
children: 1
declaredVar: 1
declaredVar: 1
firstStmt: 2
formals: 1
function: 1
parent: 1
predecessor: 2
referredVar: 2
returnStmt: 2
returnValue: 2
subtypes: 3
successor: 2
superType: 3
type: 4
type: 1
type: 1

```

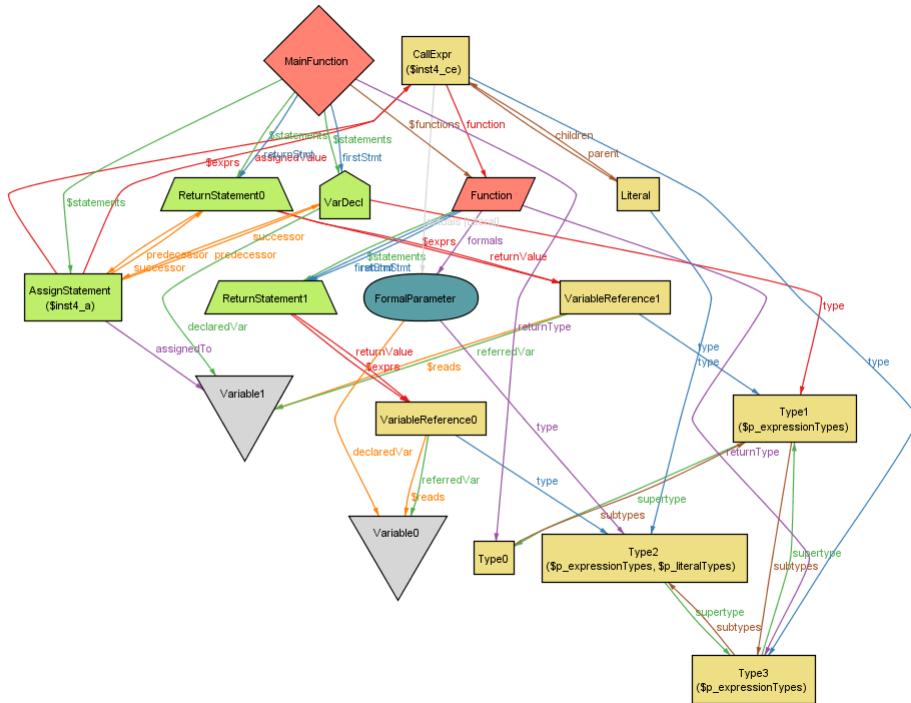


Instance 2

```

$exprs: 3
$functions: 1
$reads: 2
$statements: 4
actuals: 1
assigned1to: 1
assignedValue: 1
children: 1
declaredVar: 1
declaredVar: 1
firstStmt: 2
formals: 1
function: 1
parent: 1
predecessor: 2
referredVar: 2
returnStmt: 2
returnType: 2
returnValue: 2
subtypes: 3
successor: 2
superType: 3
type: 4
type: 1
type: 1

```

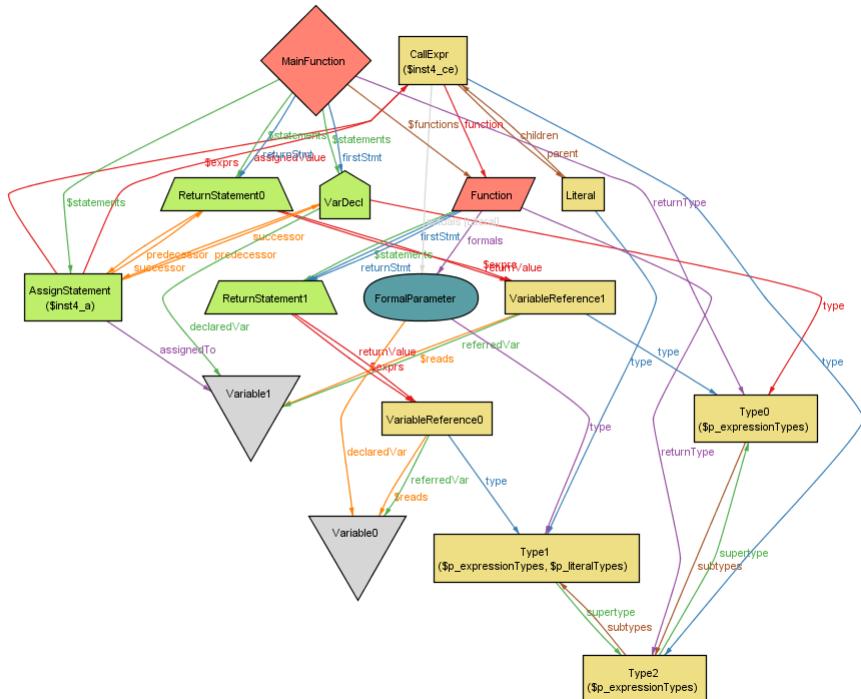


Instance 3

```

$exprs: 3
$functions: 1
$reads: 2
$statements: 4
actuals: 1
assigned1to: 1
assignedValue: 1
children: 1
declaredVar: 1
declaredVar: 1
firstStmt: 2
formals: 1
function: 1
parent: 1
predecessor: 2
referredVar: 2
returnStmt: 2
returnType: 2
returnValue: 2
subtypes: 2
successor: 2
superType: 2
type: 4
type: 1
type: 1

```

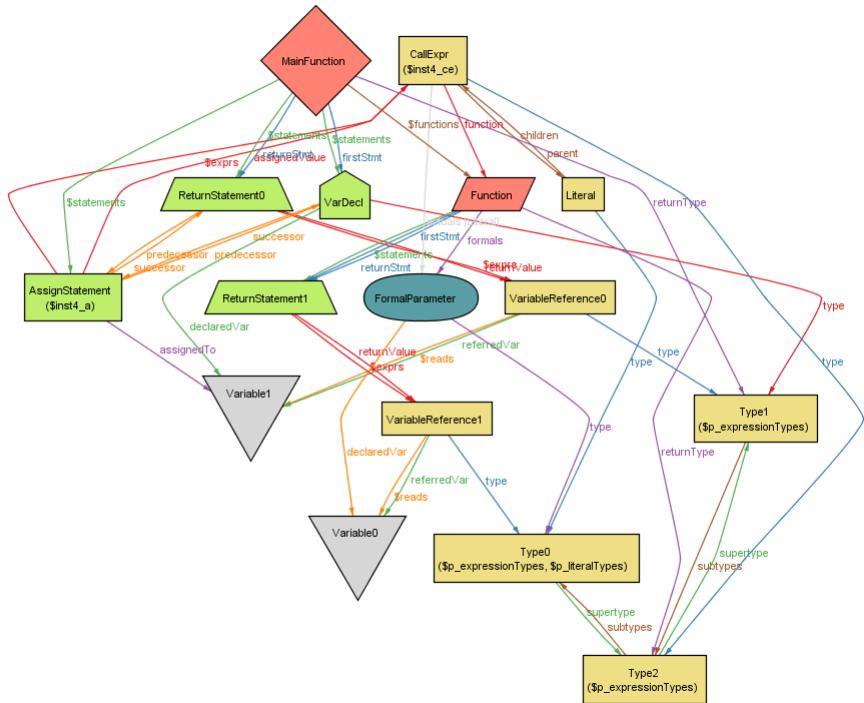


Instance 4

```

$exprs: 3
$functions: 1
$reads: 2
$statements: 4
actuals: 1
assigned1to: 1
assignedValue: 1
children: 1
declaredVar: 1
declaredVar: 1
firstStmt: 2
formals: 1
function: 1
parent: 1
predecessor: 2
referredVar: 2
returnStmt: 2
returnValue: 2
subtypes: 2
successor: 2
supertype: 2
type: 4
type: 1
type: 1

```

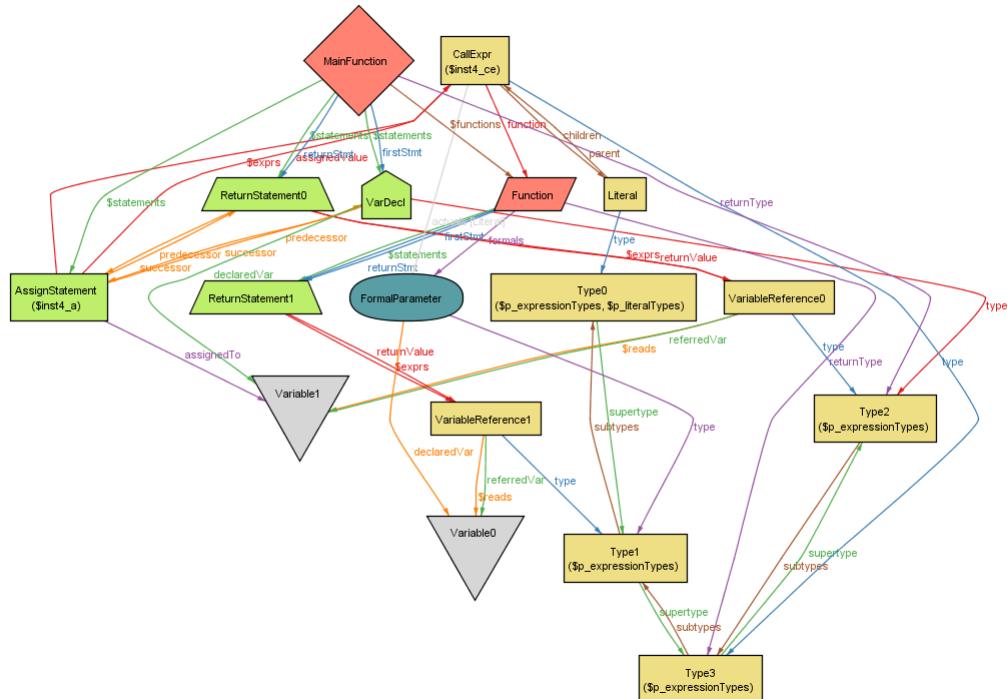


Instance 5

```

$exprs: 3
$functions: 1
$reads: 2
$statements: 4
actuals: 1
assigned1to: 1
assignedValue: 1
children: 1
declaredVar: 1
declaredVar: 1
firstStmt: 2
formals: 1
function: 1
parent: 1
predecessor: 2
referredVar: 2
returnStmt: 2
returnValue: 2
subtypes: 3
successor: 2
supertype: 3
type: 4
type: 1
type: 1

```

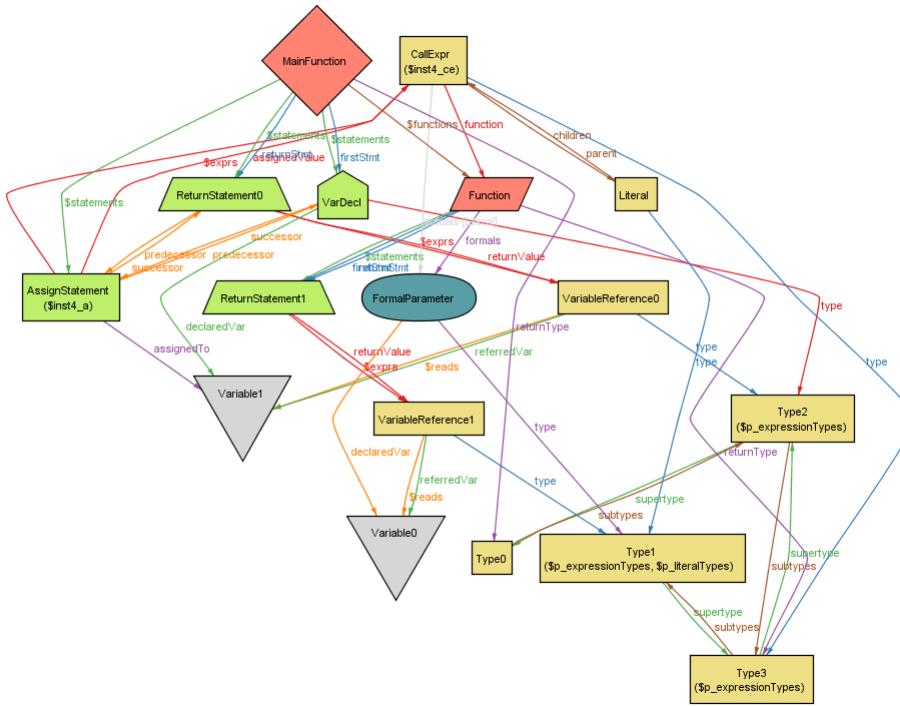


Instance 6

```

$exprs: 3
$functions: 1
$reads: 2
$statements: 4
actuals: 1
assignedTo: 1
assignedValue: 1
children: 1
declaredVar: 1
declaredVar: 1
firstStmt: 2
formals: 1
function: 1
parent: 1
predecessor: 2
referredVar: 2
returnStmt: 2
returnType: 2
returnValue: 2
subtypes: 3
successor: 2
supertype: 3
type: 4
type: 1
type: 1

```



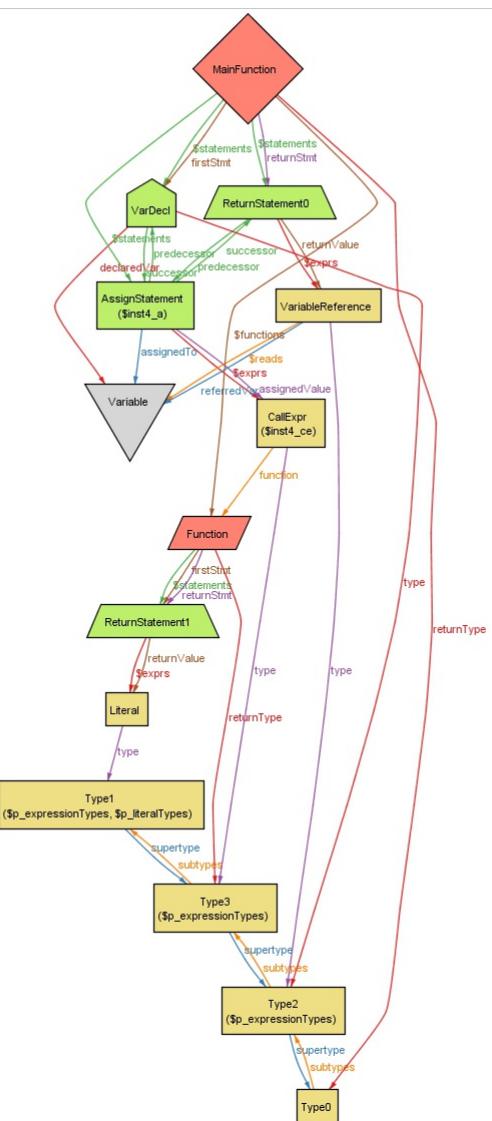
Instance 7

Instance 8

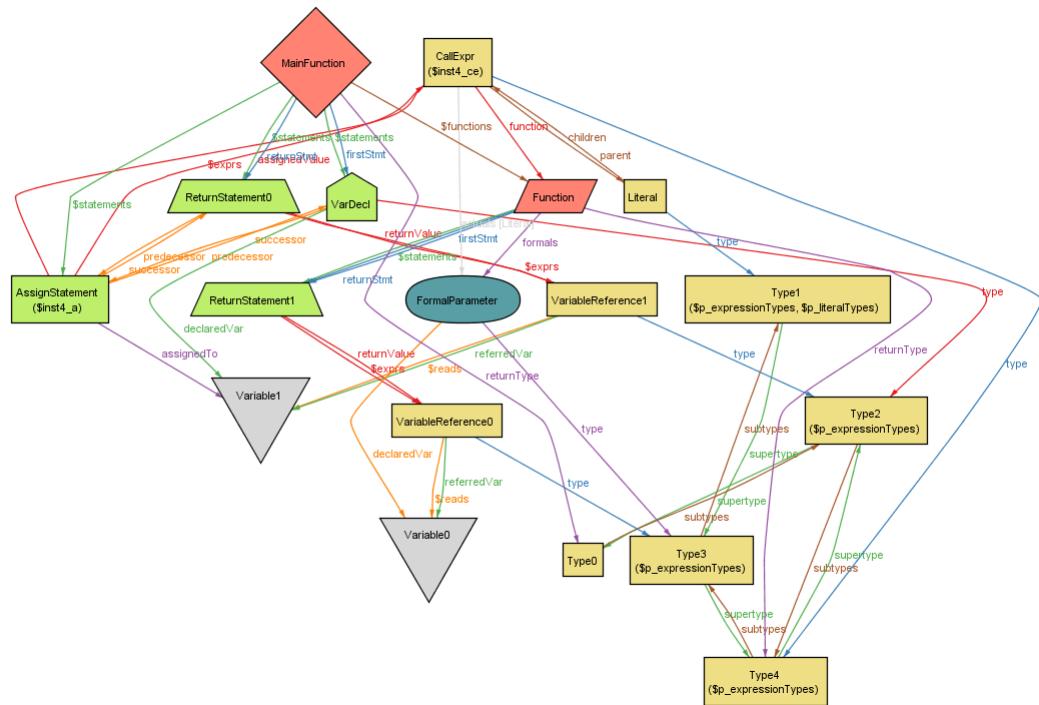
```

$exprs: 3
$functions: 1
$reads: 1
$statements: 4
actuals: 1
assignedTo: 1
assignedValue: 1
children: 1
declaredVar: 1
function: 1
parent: 1
predecessor: 2
referredVar: 1
returnStmt: 2
returnType: 2
returnValue: 2
subtypes: 3
successor: 2
supertype: 3
type: 3
type: 1

```



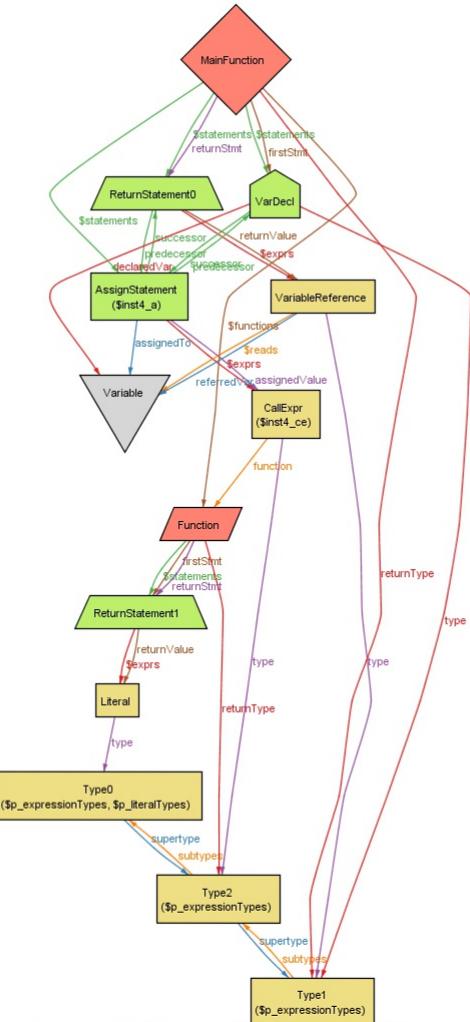
```
$exprs: 3
$functions: 1
$reads: 2
$statements: 4
actuals: 1
assignedTo: 1
assignedValue: 1
children: 1
declaredVar: 1
declaredVar: 1
firstStmt: 2
formals: 1
function: 1
parent: 1
predecessor: 2
REFERREDvar: 2
returnSmt: 2
returnType: 2
returnValue: 2
subtypes: 4
successor: 2
superstype: 4
type: 4
type: 1
type: 1
```



### Instance 9

### Instance 10

```
$exprs: 3  
$functions: 1  
$reads: 1  
$statements: 4  
assignedTo: 1  
assignedValue:  
declaredVar: 1  
firstStmt: 2  
function: 1  
predecessor: 2  
REFERREDVAR: 1  
returnStmt: 2  
RETURNTYPE: 2  
returnValue: 2  
subtypes: 2  
successor: 2  
supertype: 2  
type: 3  
type: 1
```



## Instances that are not feasible