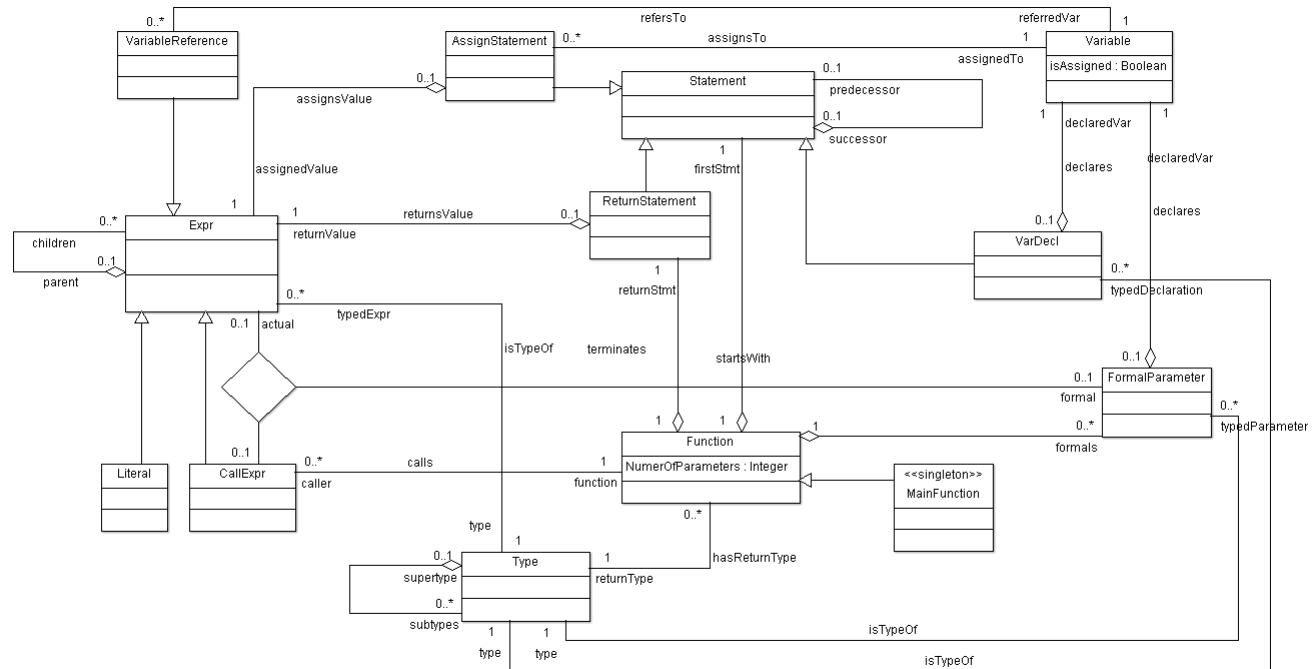


ETH SAE Project 1 - Sherlock

Source code and XML files are in `hand-in.zip`.

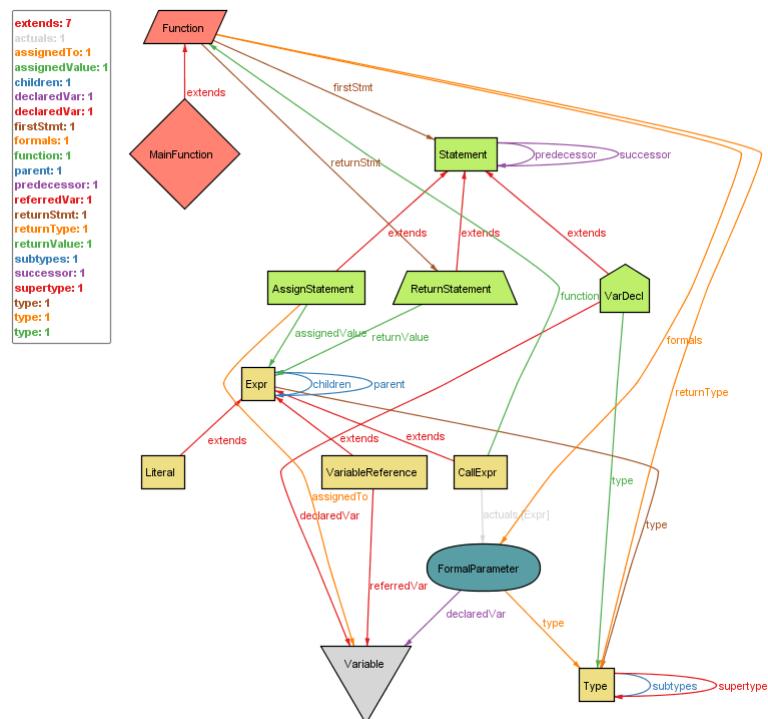
UML class diagram



Elements that are not encodable in the UML class diagram

- The first statement has no predecessor.
- The return statement has no successor.
- Actual parameters are mapped to the formal parameters of the function our expression calls.
- A return statement terminates the execution of the function body.
- A function may not contain unreachable statements.
- Recursion is not allowed.
- The call expressions 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, but we want to say that variables are declared exactly 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 for task B

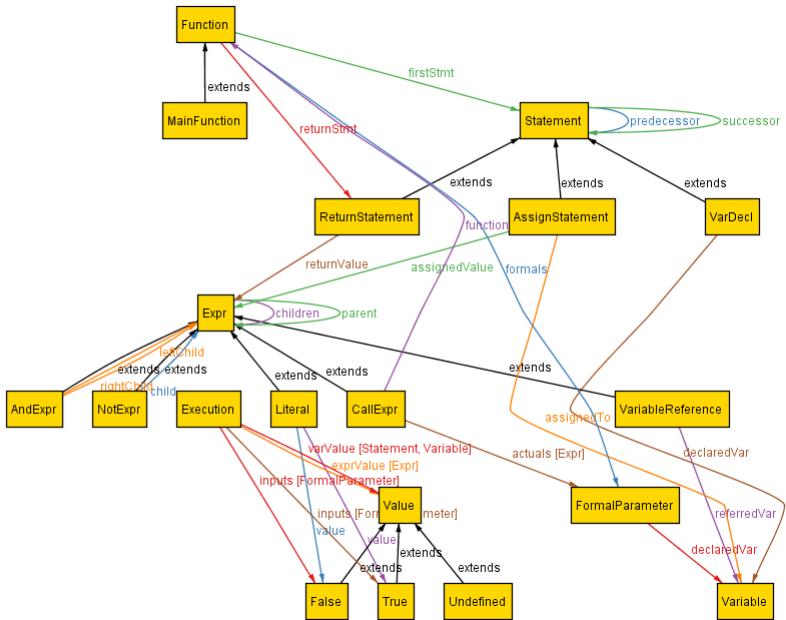
- A return statement terminates the execution of the function body. (This is not a static constraint.)
- A function may not contain unreachable statements.

Alloy model from task D

```

extends: 12
actuals: 1
assignedTo: 1
assignedValue: 1
child: 1
children: 1
declaredVar: 1
declaredVar: 1
exprValue: 1
firstStmt: 1
formats: 1
function: 1
inputs: 1
inputs: 1
leftChild: 1
parent: 1
predecessor: 1
REFERREDVAR: 1
returnStmt: 1
returnValue: 1
rightChild: 1
successor: 1
value: 1
value: 1
varValue: 1

```



Instances that are not feasible in task C

- Instance 1 is not feasible. We would need two function calls from the main function to itself. However, the LINEAR language does not allow recursion.
- 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

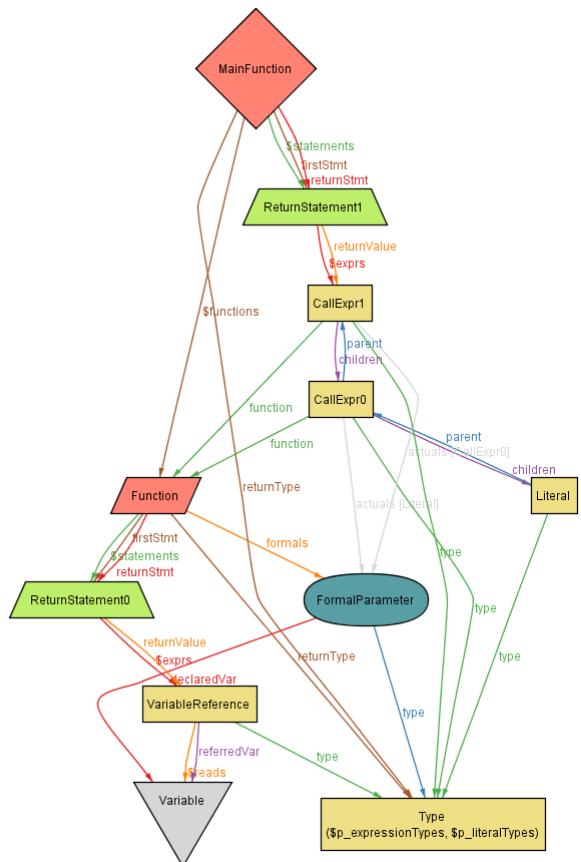
(output truncated to 10 images)

Screen 1

```

$expressions: 2
$functions: 1
$reads: 1
$statements: 2
actuals: 2
children: 2
declaredVar: 1
firstStmt: 2
formats: 1
function: 2
parent: 2
REFERREDVAR: 1
returnStmt: 2
returnType: 2
returnValue: 2
type: 4
type: 1

```

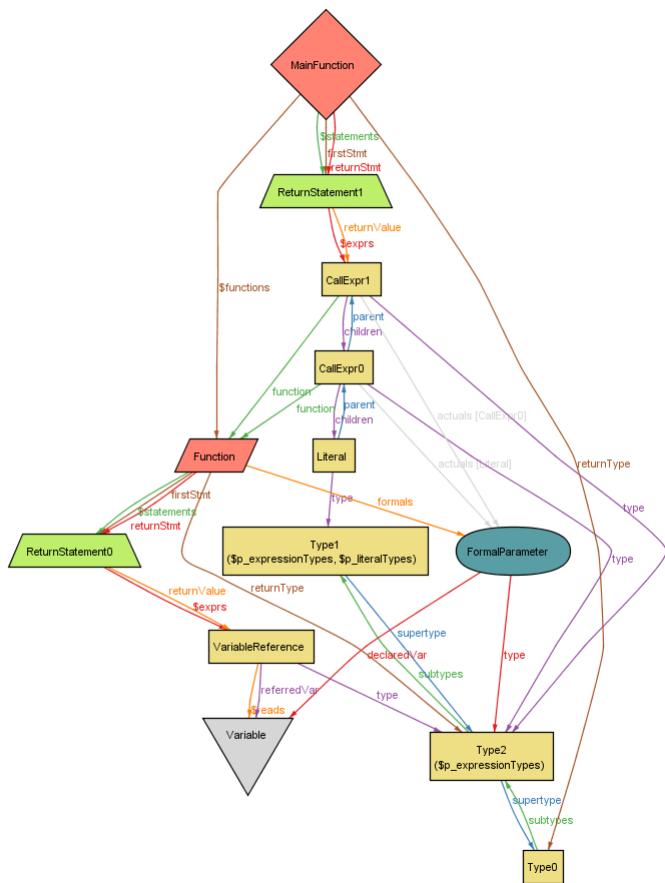


Screen 2

```

$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

```

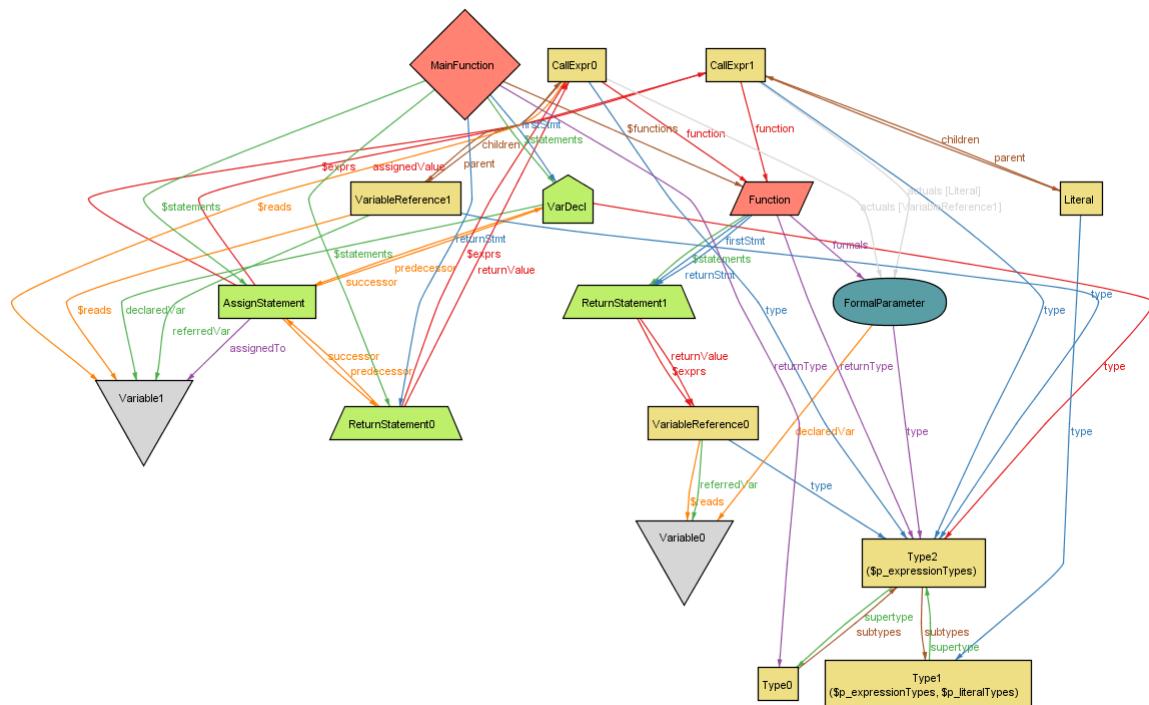


Screen 3

```

$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
returnType: 2
returnValue: 2
subtypes: 2
successor: 2
superType: 2
type: 5
type: 1
type: 1

```

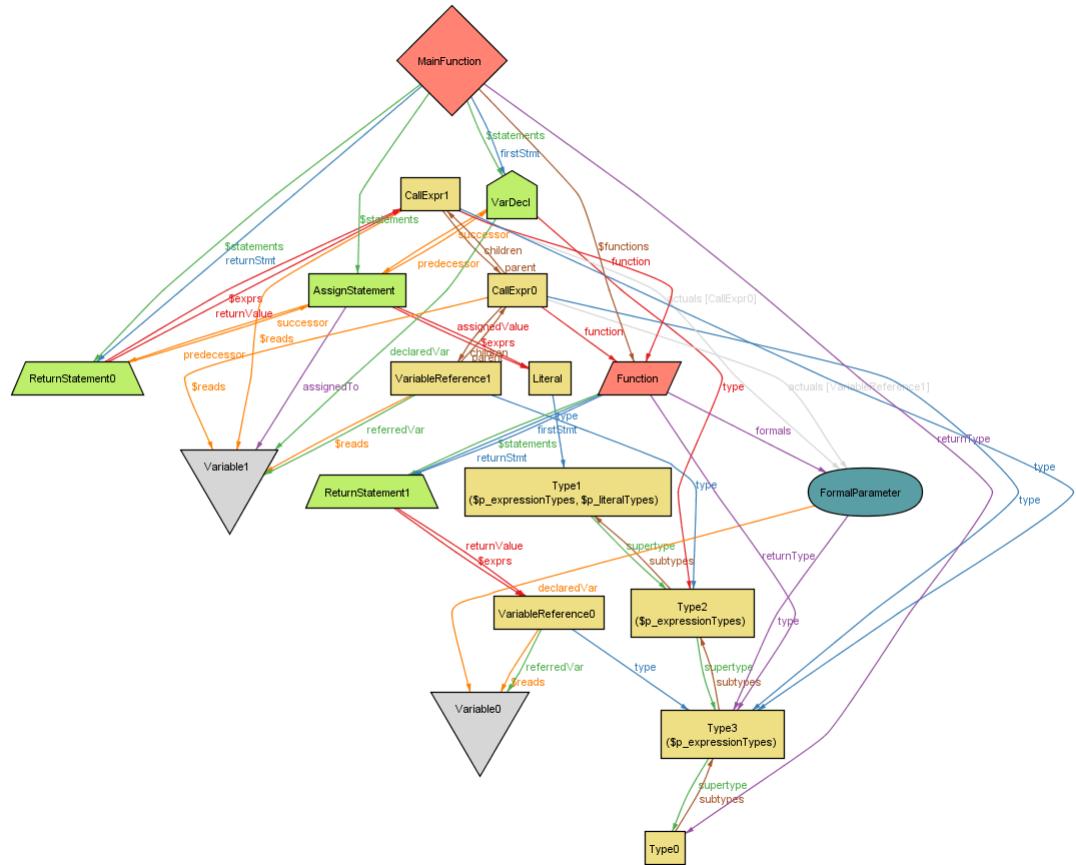


Screen 4

```

$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
returnType: 2
returnValue: 2
subtypes: 3
successor: 2
superType: 3
type: 5
type: 1
type: 1

```

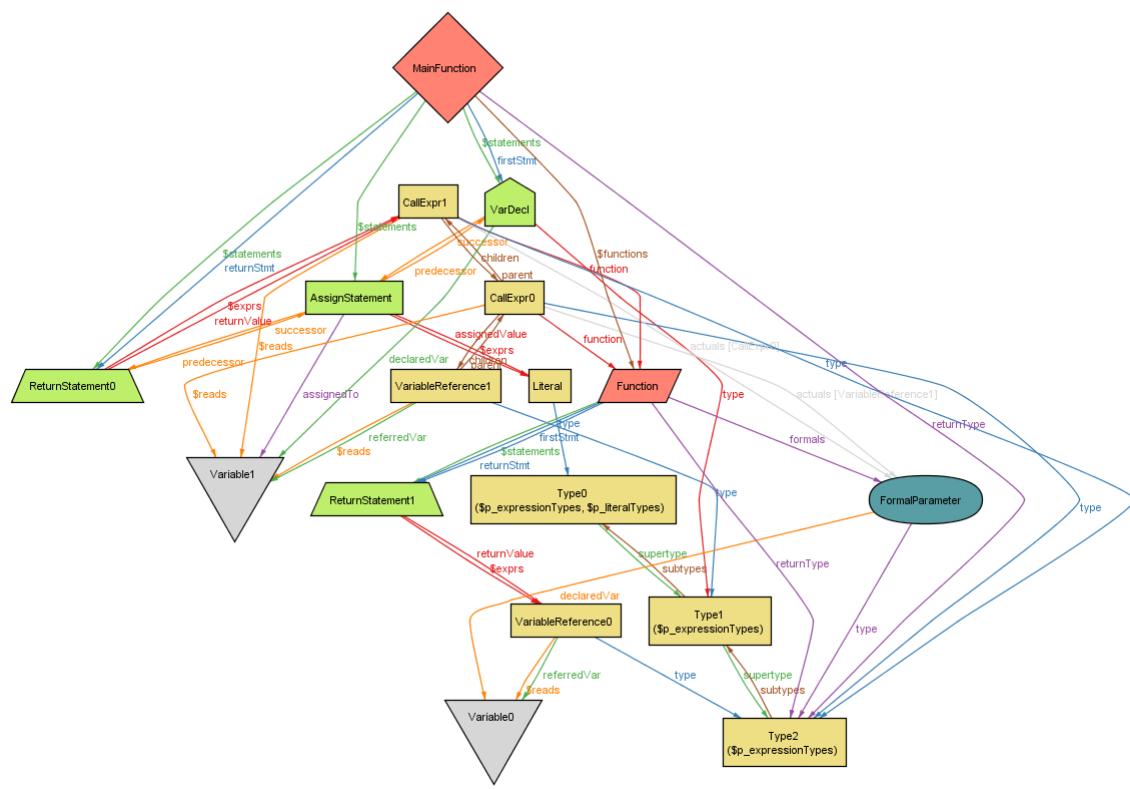


Screen 5

```

$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
returnType: 2
returnValue: 2
subtypes: 2
superType: 2
type: 5
type: 1
type: 1

```

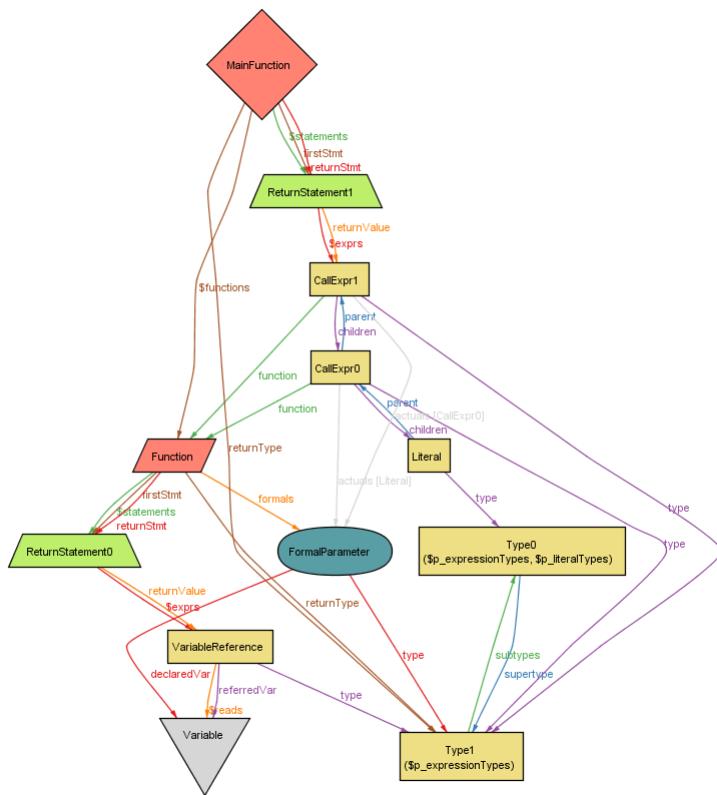


Screen 6

```

$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

```

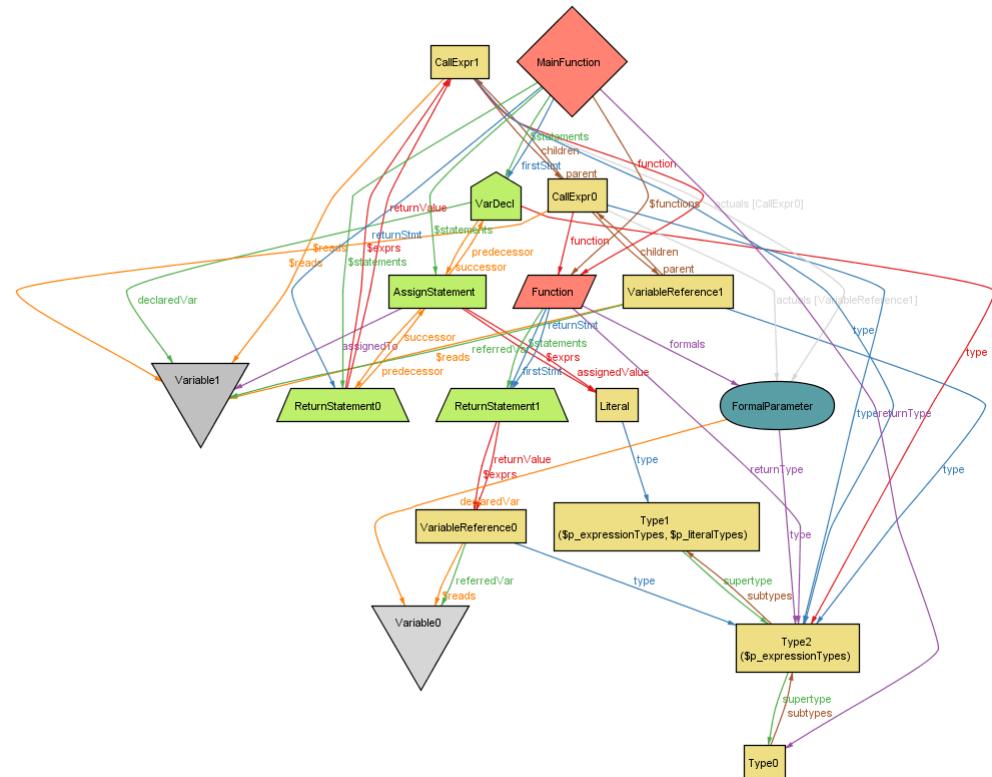


Screen 7

```

$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
returnType: 2
returnValue: 2
subtypes: 2
successor: 2
supertype: 2
type: 5
type: 1
type: 1

```

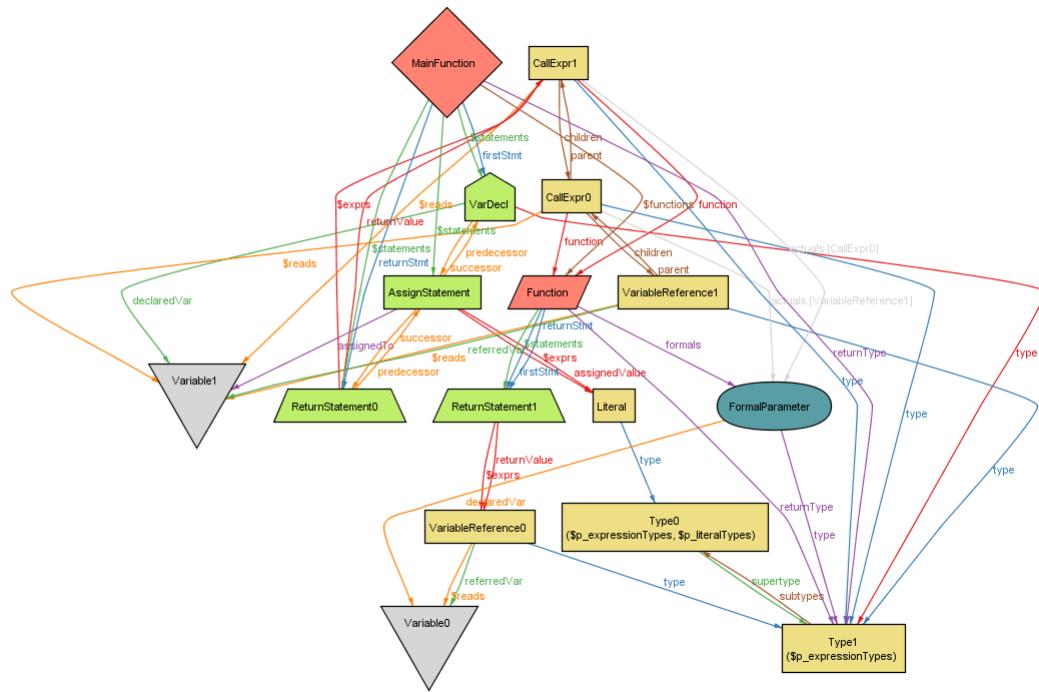


Screen 8

```

$exprs: 3
$reads: 1
$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
successor: 2
superType: 1
type: 5
type: 1
type: 1

```

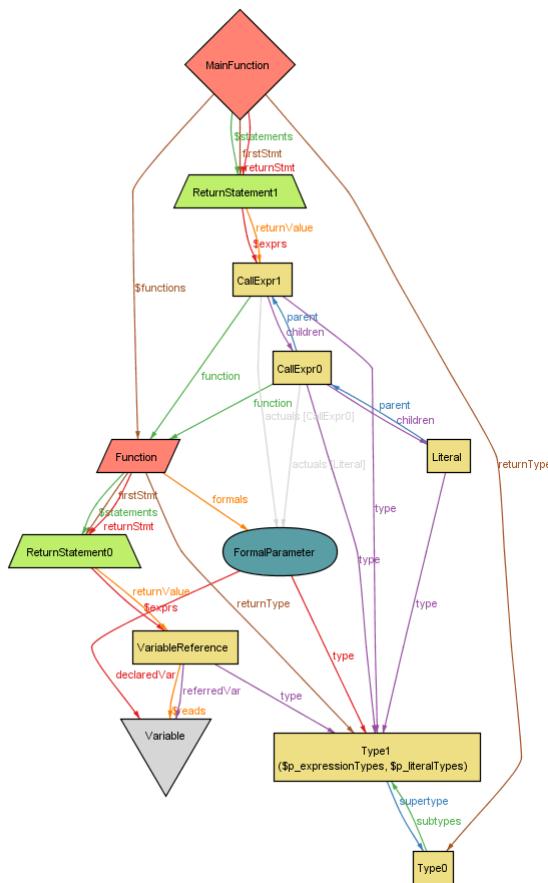


Screen 9

```

$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

```

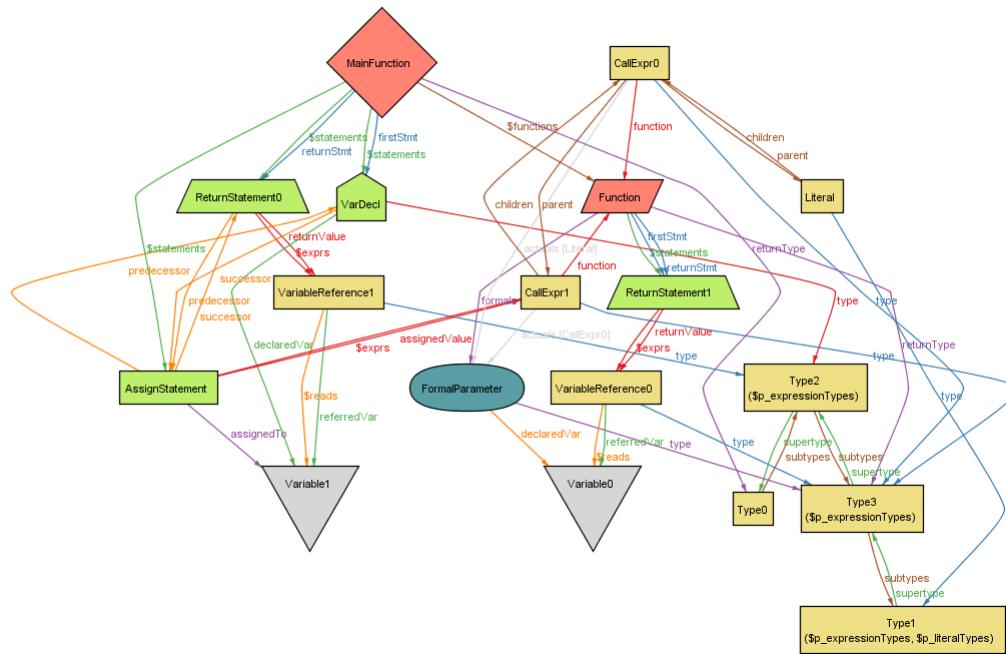


Screen 10

```

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

```



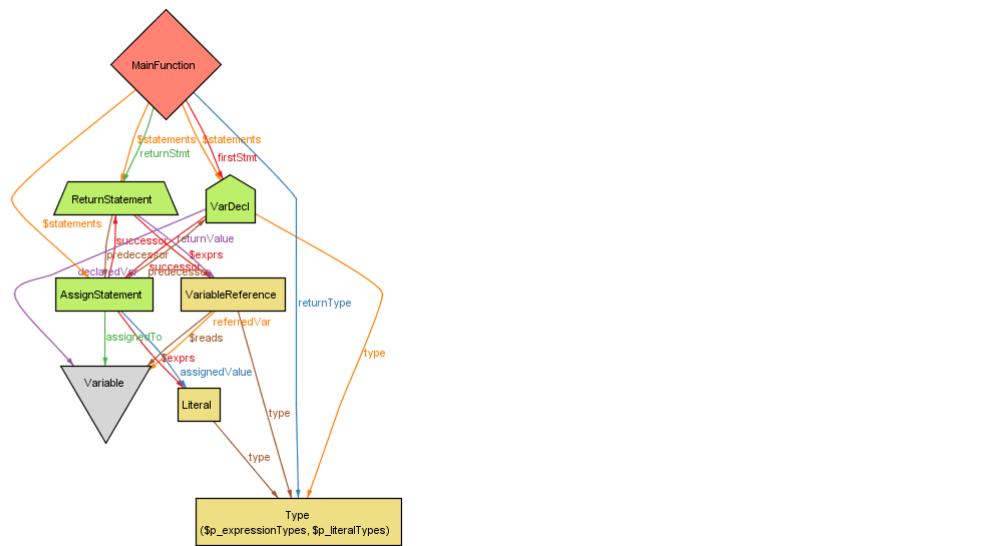
Instance 3

Screen 1

```

$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

```

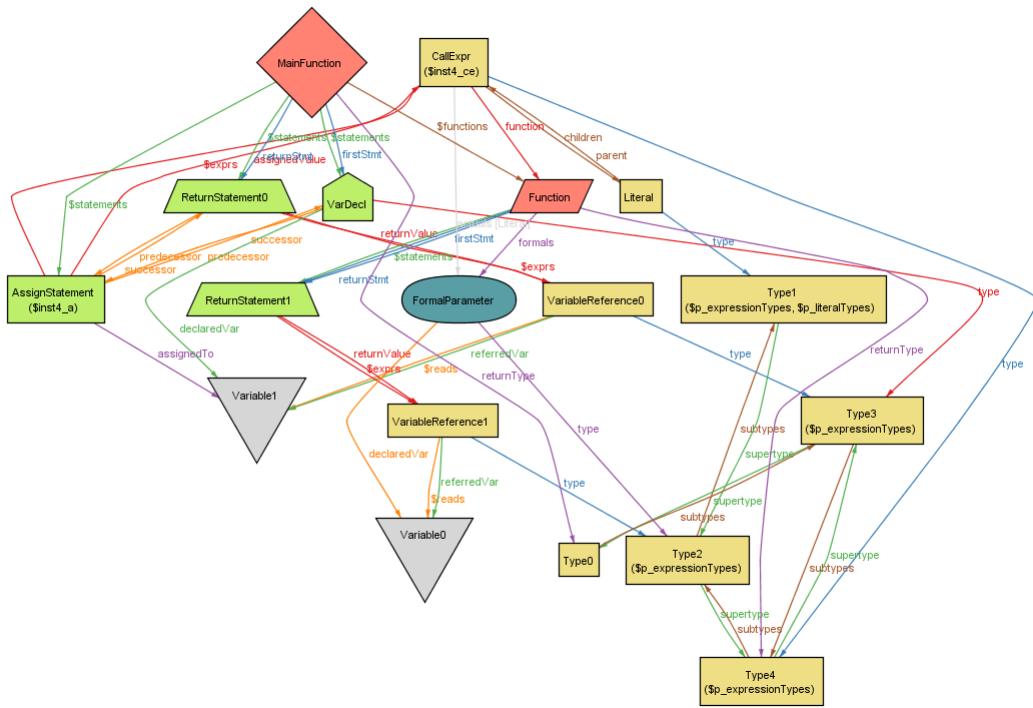


Instance 4

(output truncated to 10 images)

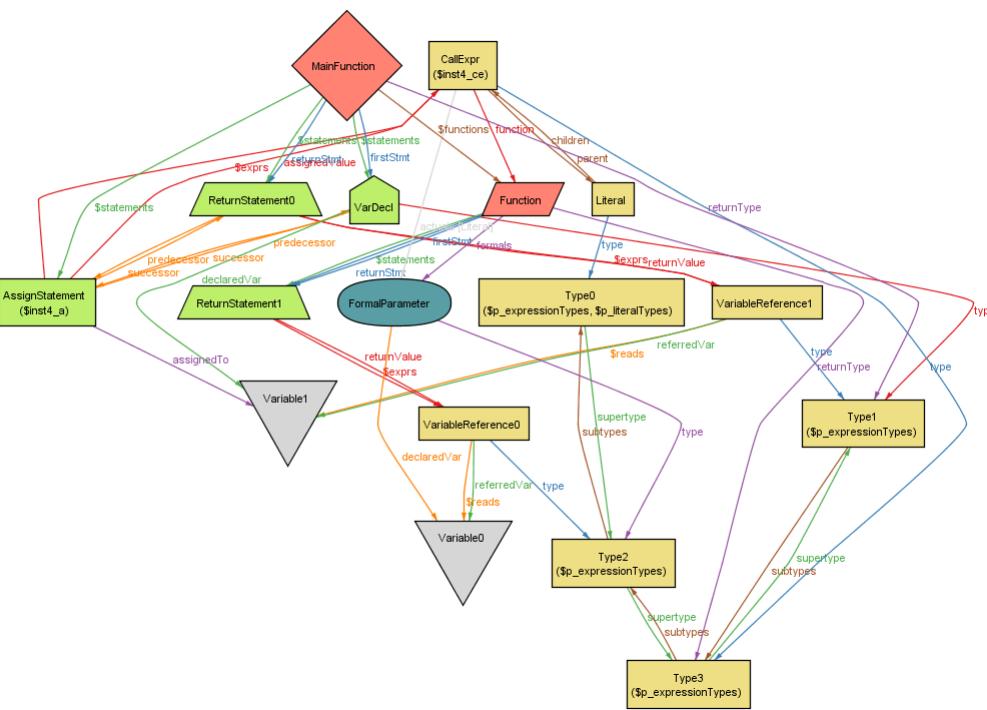
Screen 1

```
$exprs: 3  
$functions: 1  
$reads: 2  
$statements: 4  
actuals: 1  
assignedTo: 1  
assignedValue: 1  
children: 1  
declaredVar: 1  
declaredVar: 1  
firstSmt: 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
```



Screen 2

```
$exprs: 3  
$functions: 1  
$reads: 2  
$statements: 4  
$assumes: 1  
$assignedTo: 1  
$assignedValue: 1  
children: 1  
$declaredVar: 1  
$declaredVar: 1  
firstSmt: 2  
function: 1  
functions: 1  
parent: 1  
$predecessor: 2  
$referredVar: 2  
returnSmt: 2  
returnType: 2  
returnValue: 2  
subtypes: 3  
successor: 2  
superstype: 3  
type: 4  
type: 1  
type: 1
```

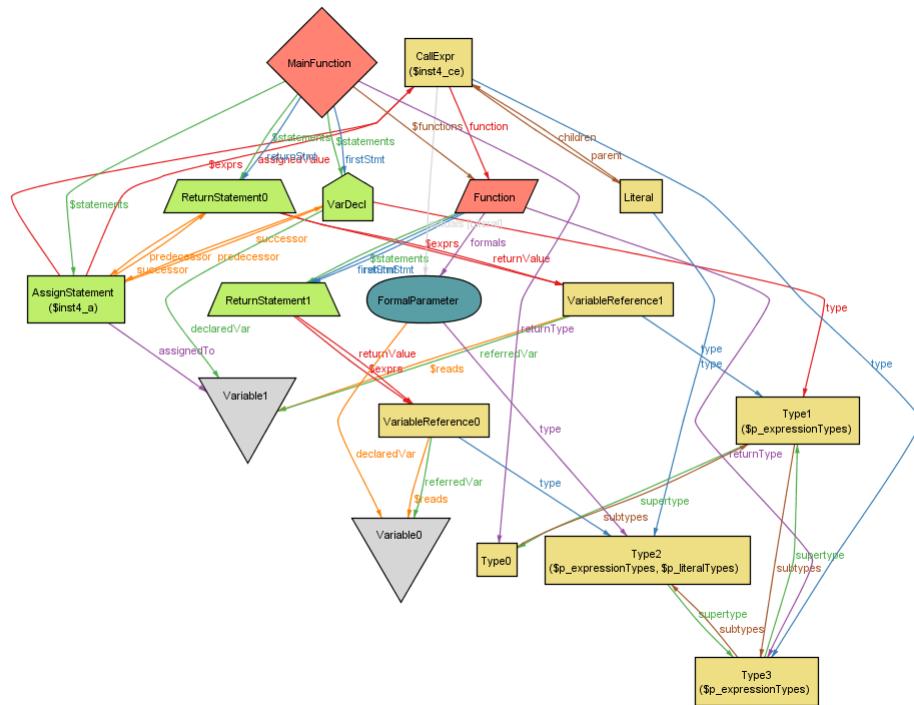


Screen 3

```

$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

```

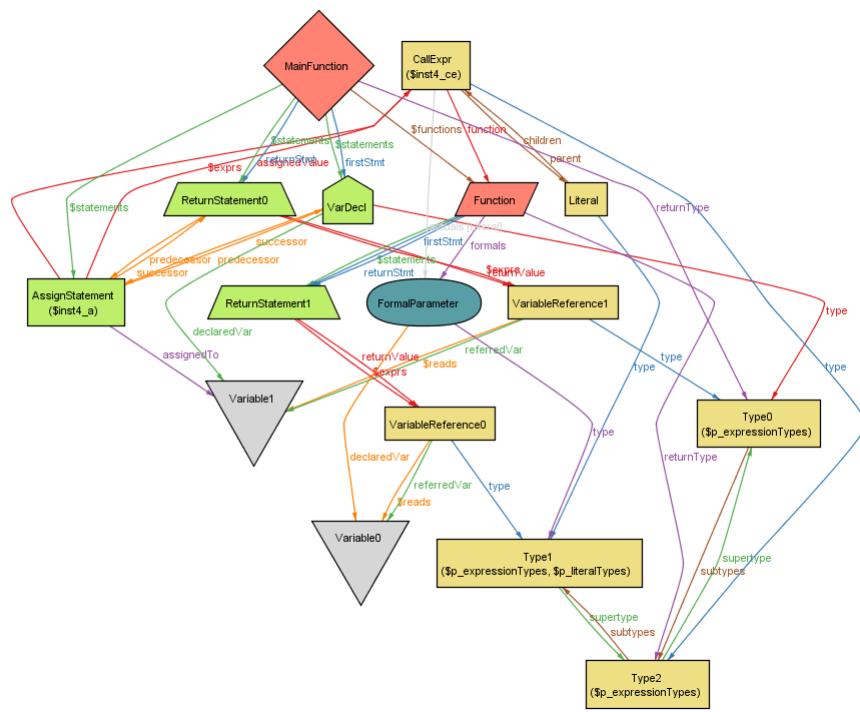


Screen 4

```

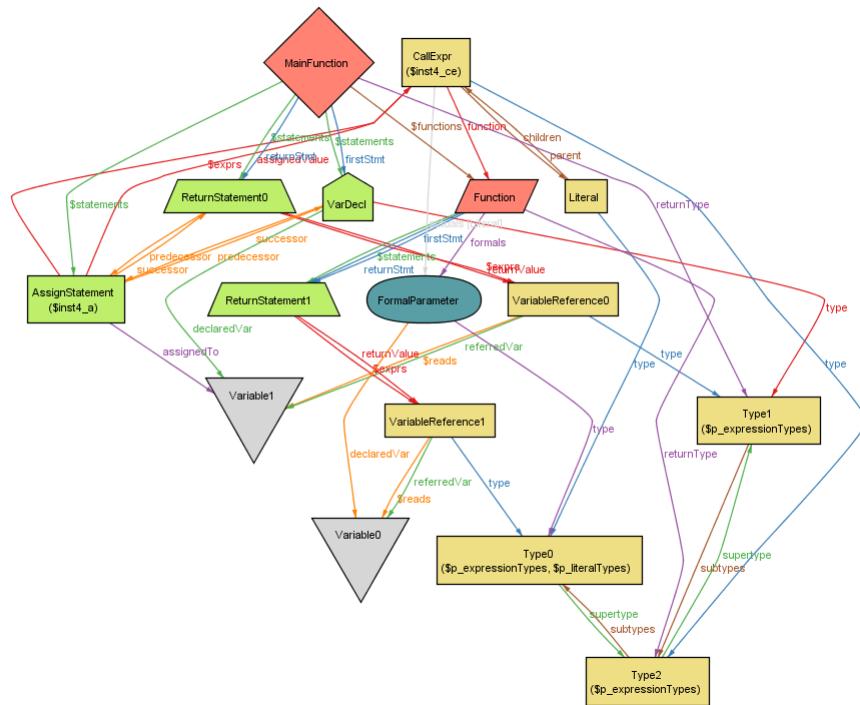
$exprs: 3
$functions: 1
$reads: 2
$statements: 4
actuals: 1
assignedTo: 1
assignedValue: 1
children: 1
declaredVar: 1
declaredVar: 1
firstStmt: 2
formals: 1
function: 1
parent: 1
predecessor: 2
referredVar: 2
returnStmt: 2
returnType: 2
returnValue: 2
subtypes: 2
successor: 2
superType: 2
type: 4
type: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

```



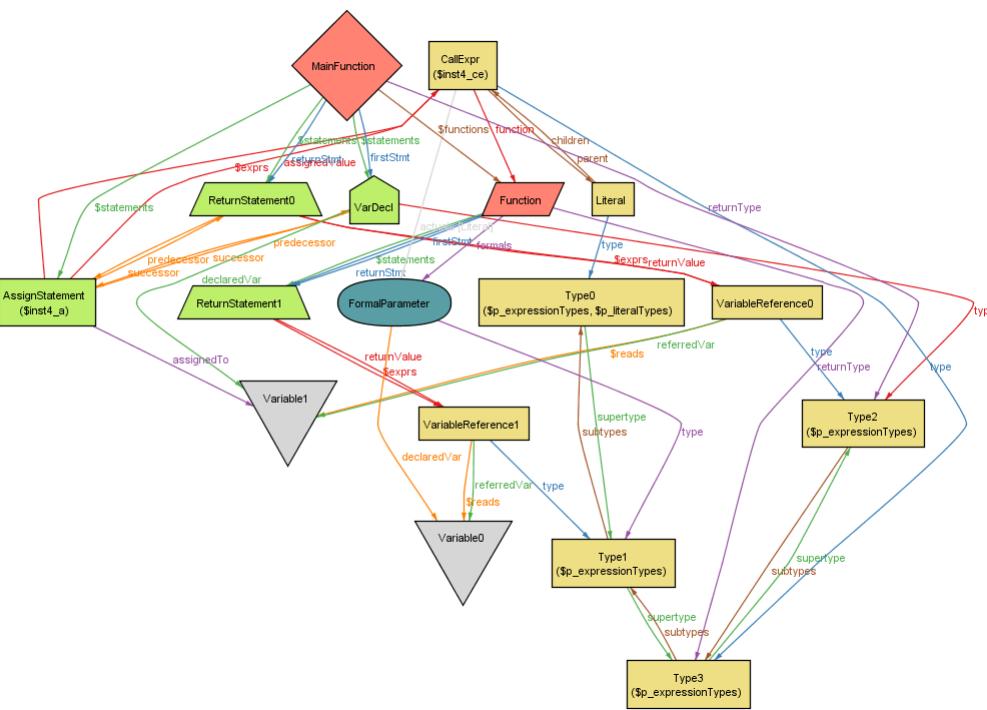
Screen 5

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

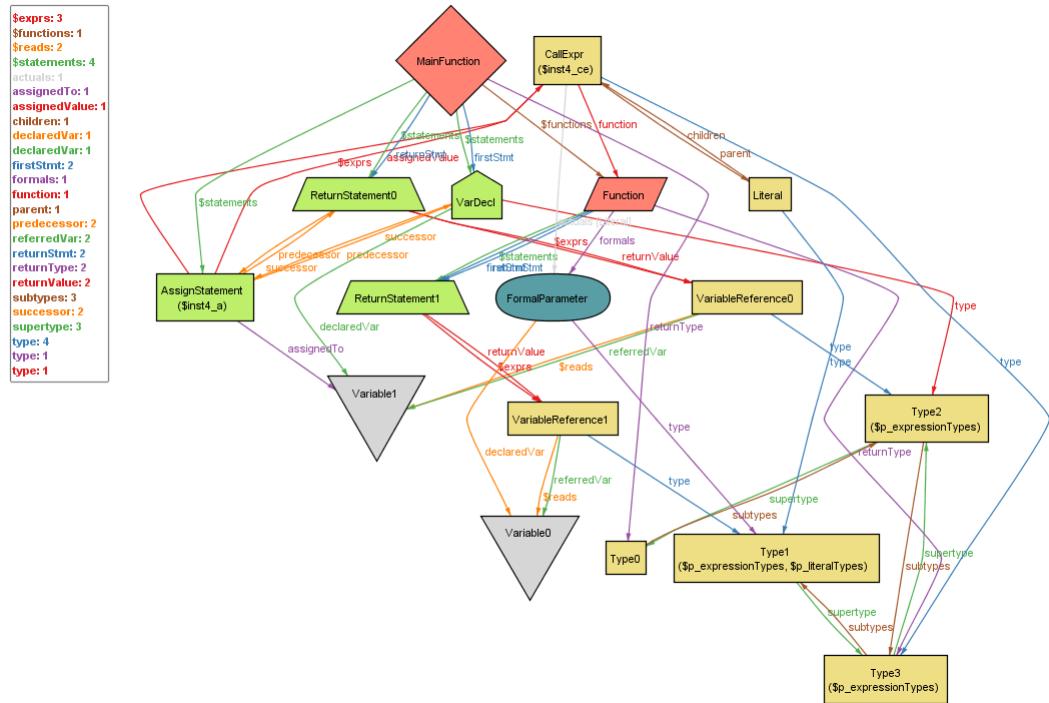


Screen 6

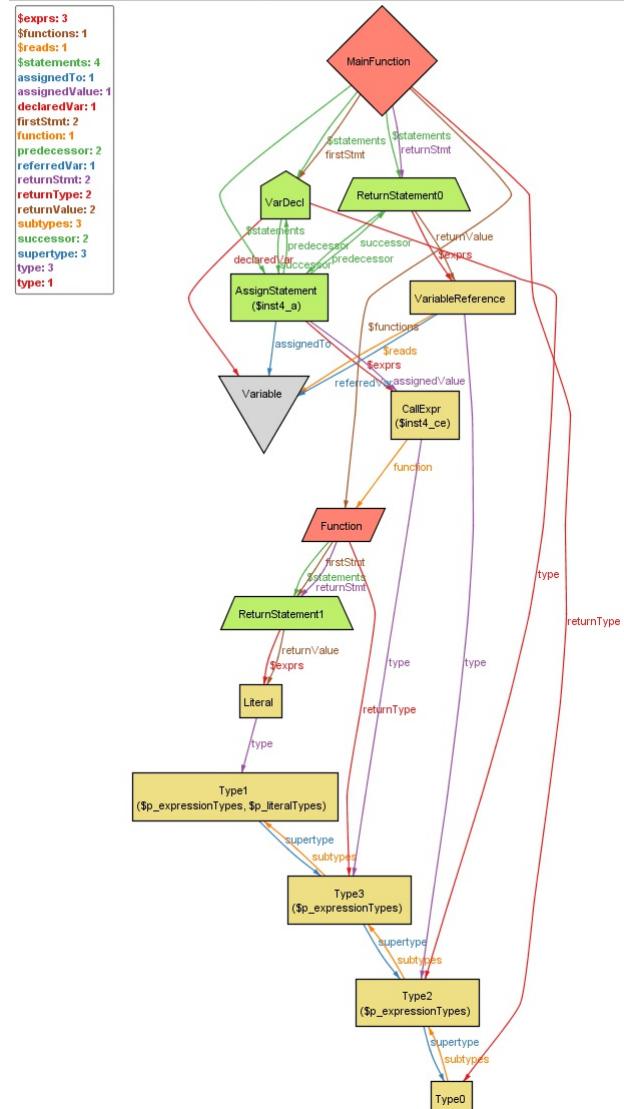
```
$exprs: 3  
$functions: 1  
$reads: 2  
$statements: 4  
$assumes: 1  
$assignedTo: 1  
$assignedValue: 1  
children: 1  
$declaredVar: 1  
$declaredVar: 1  
firstSmt: 2  
function: 1  
functions: 1  
parent: 1  
$predecessor: 2  
$referredVar: 2  
returnSmt: 2  
returnType: 2  
returnValue: 2  
subtypes: 3  
successor: 2  
superstype: 3  
type: 4  
type: 1  
type: 1
```



Screen 7



Screen 8

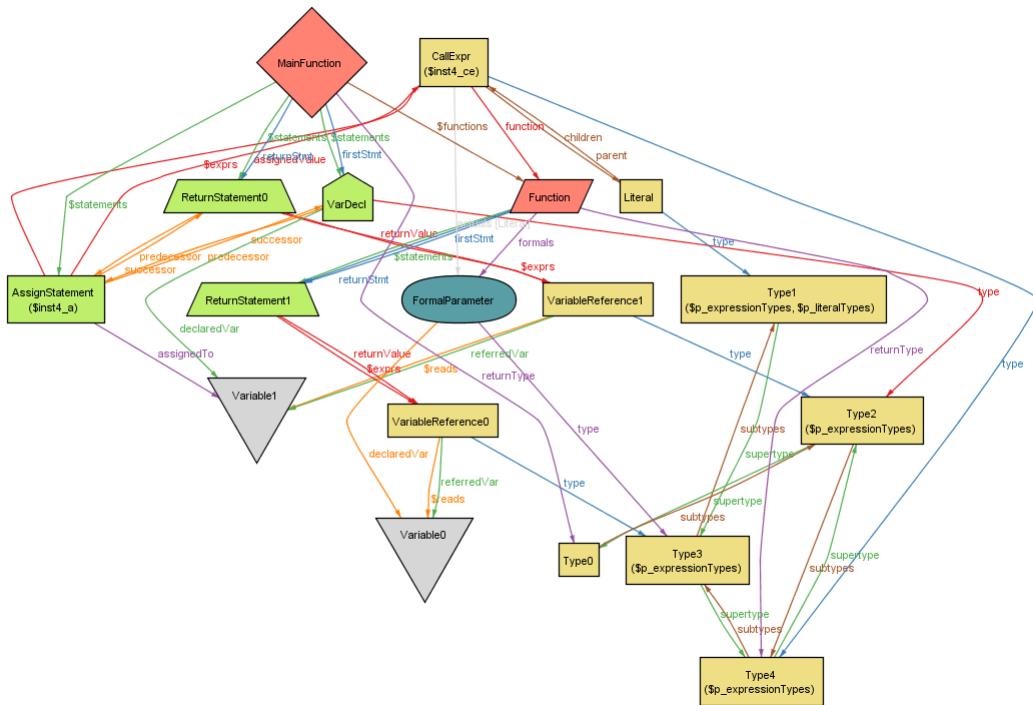


Screen 9

```

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

```

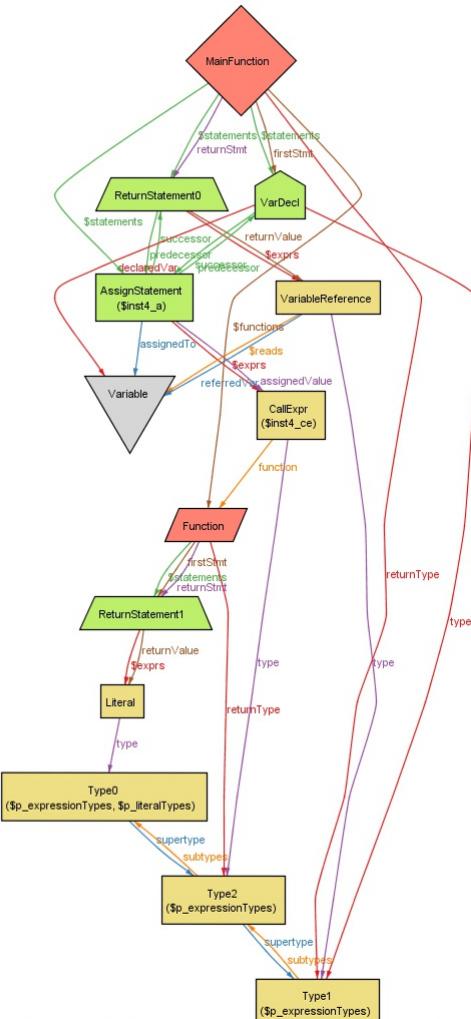


Screen 10

```

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

```



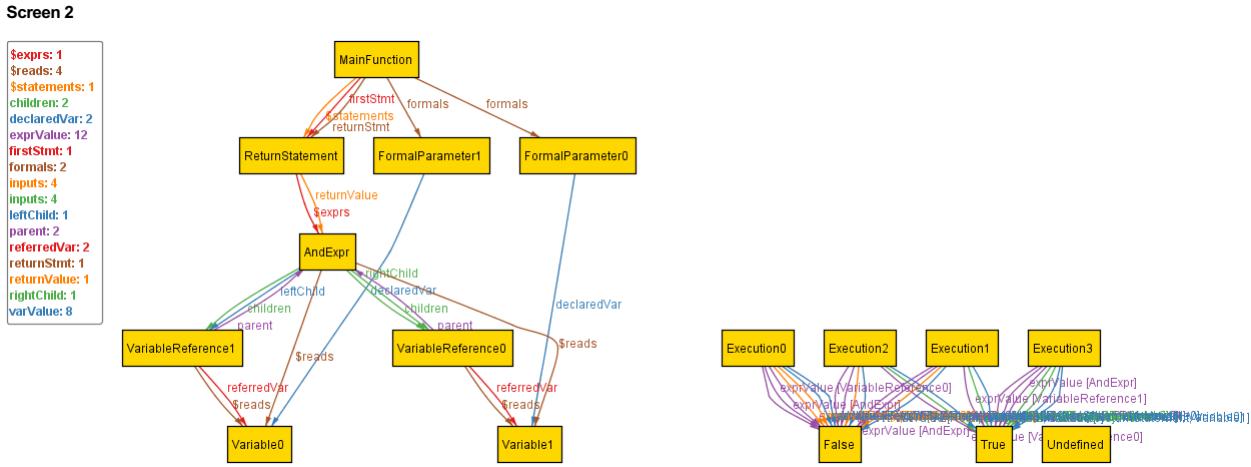
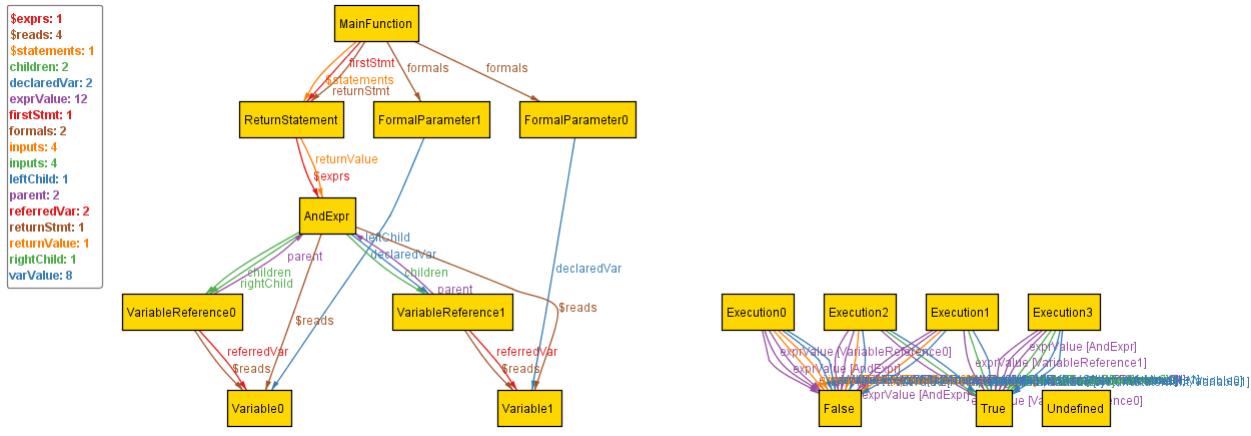
Instances that are not feasible in task E

(There are no infeasible instances.)

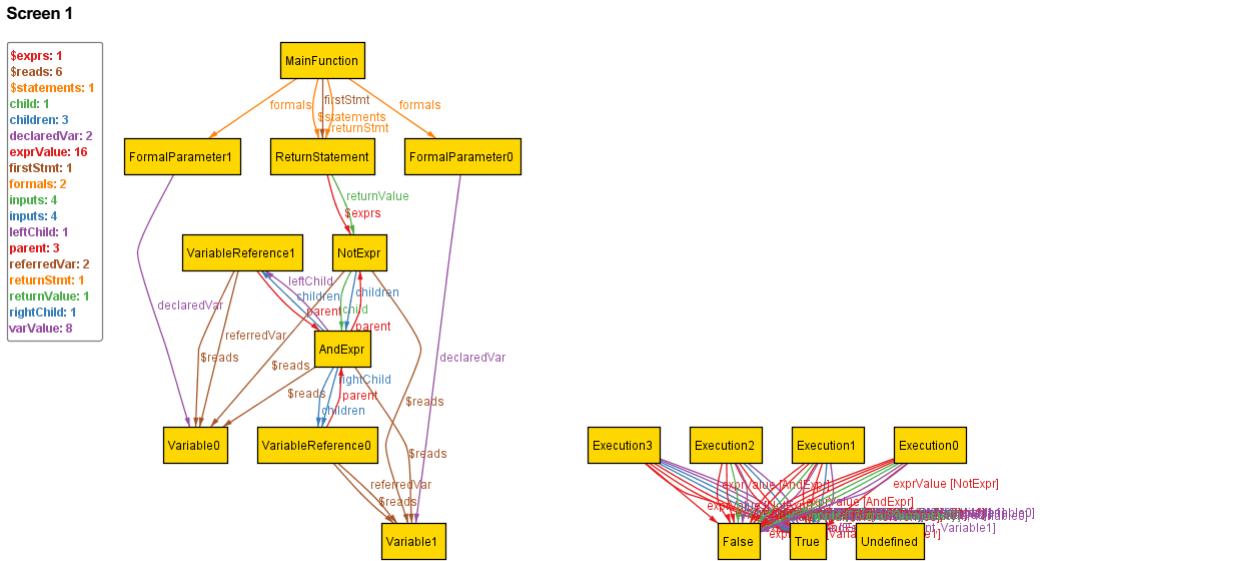
Image exports from task E

Instance 1

Screen 1



Instance 2

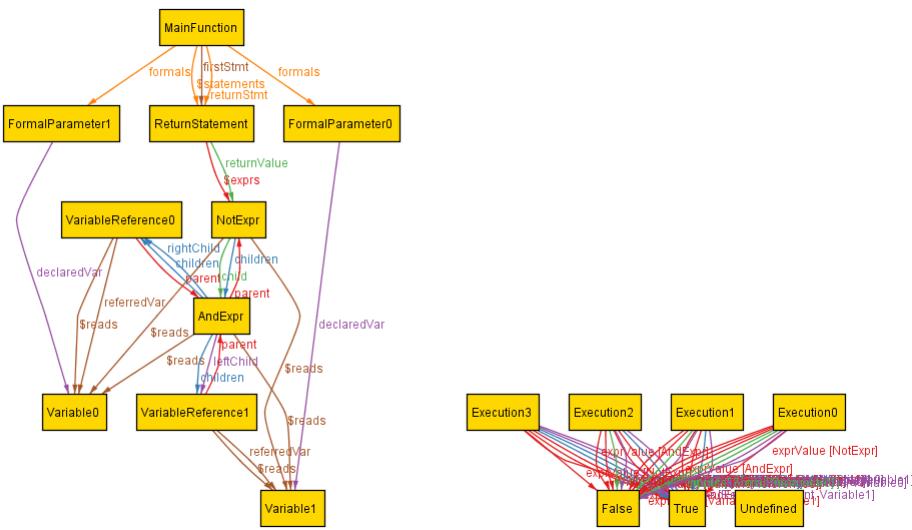


Screen 2

```

$exprs: 1
$reads: 6
$statements: 1
child: 1
children: 3
declaredVar: 2
exprValue: 16
firstStmt: 1
formals: 2
inputs: 4
inputs: 4
leftChild: 1
parent: 3
referredVar: 2
returnStmt: 1
returnValue: 1
rightChild: 1
varValue: 8

```



Instance 3

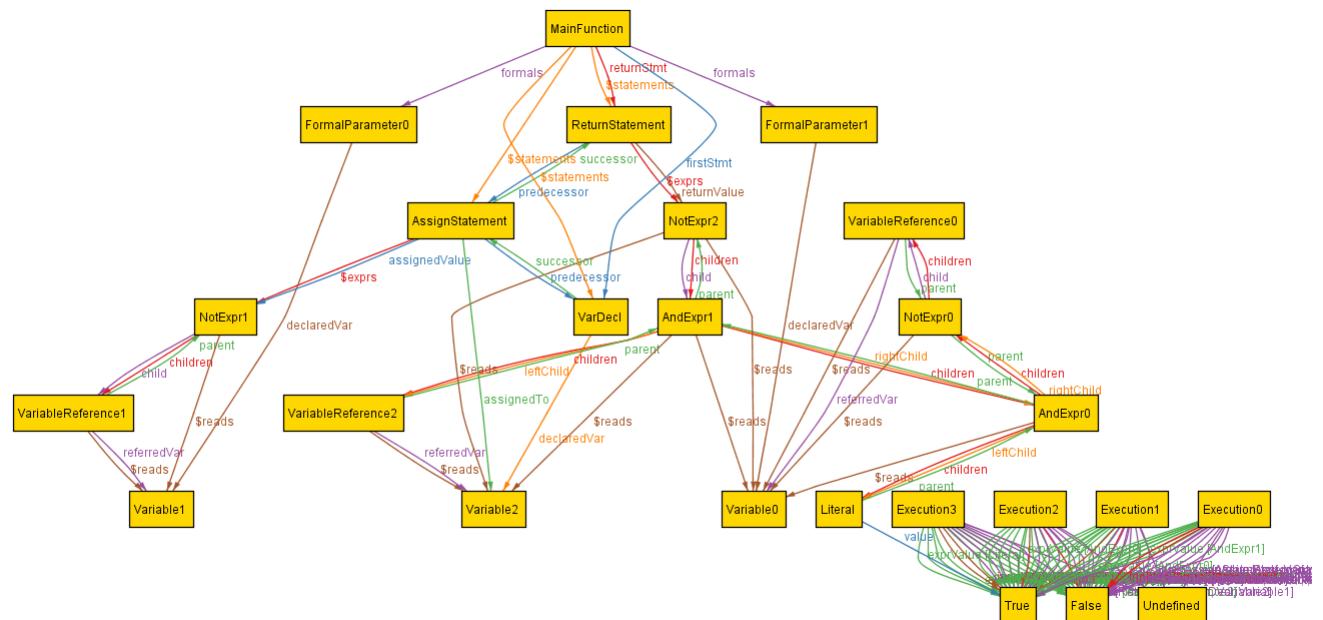
(output truncated to 10 images)

Screen 1

```

$exprs: 2
$reads: 10
$statements: 3
assignedTo: 1
assignedValue: 1
child: 3
children: 7
declaredVar: 2
declaredVar: 1
exprValue: 36
firstStmt: 1
formals: 2
inputs: 4
inputs: 4
leftChild: 2
parent: 7
predecessor: 2
referredVar: 3
returnStmt: 1
returnValue: 1
rightChild: 2
successor: 2
value: 1
varValue: 32

```

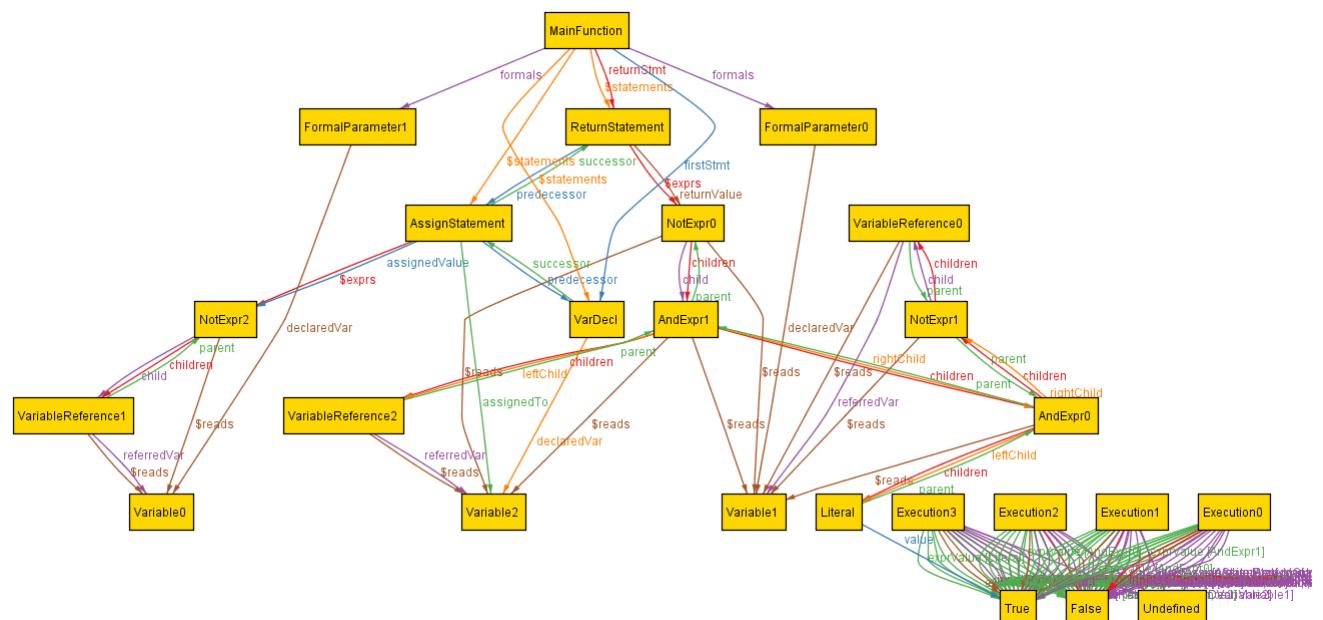


Screen 2

```

$exprs: 2
$reads: 10
$statements: 3
assignedTo: 1
assignedValue: 1
child: 3
children: 7
declaredVar: 2
declaredVar: 1
exprValue: 36
firstStmt: 1
formals: 2
inputs: 4
inputs: 4
leftChild: 2
parent: 7
predecessor: 2
referredVar: 3
returnStmt: 1
returnValue: 1
rightChild: 2
successor: 2
value: 1
varValue: 32

```

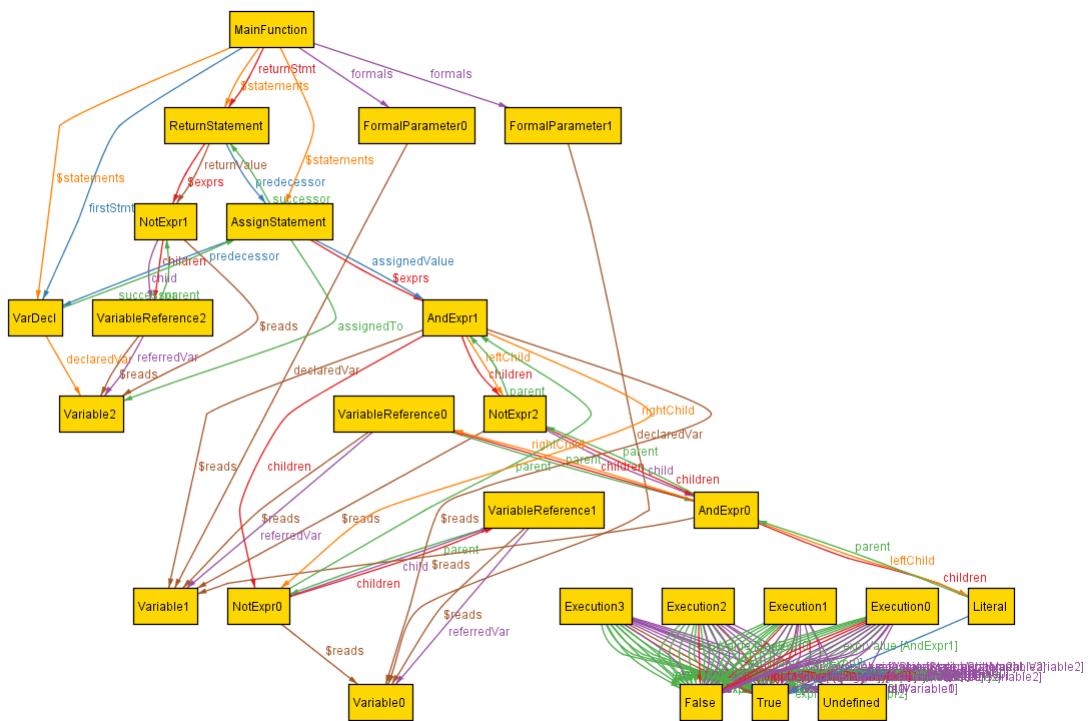


Screen 3

```

$exprs: 2
$reads: 9
$statements: 3
assignedTo: 1
assignedValue: 1
child: 3
children: 7
declaredVar: 2
declaredVar: 1
exprValue: 36
firstStmt: 1
formals: 2
inputs: 4
inputs: 4
leftChild: 2
parent: 7
predecessor: 2
referredVar: 3
returnStmt: 1
returnValue: 1
rightChild: 2
successor: 2
value: 1
varValue: 32

```

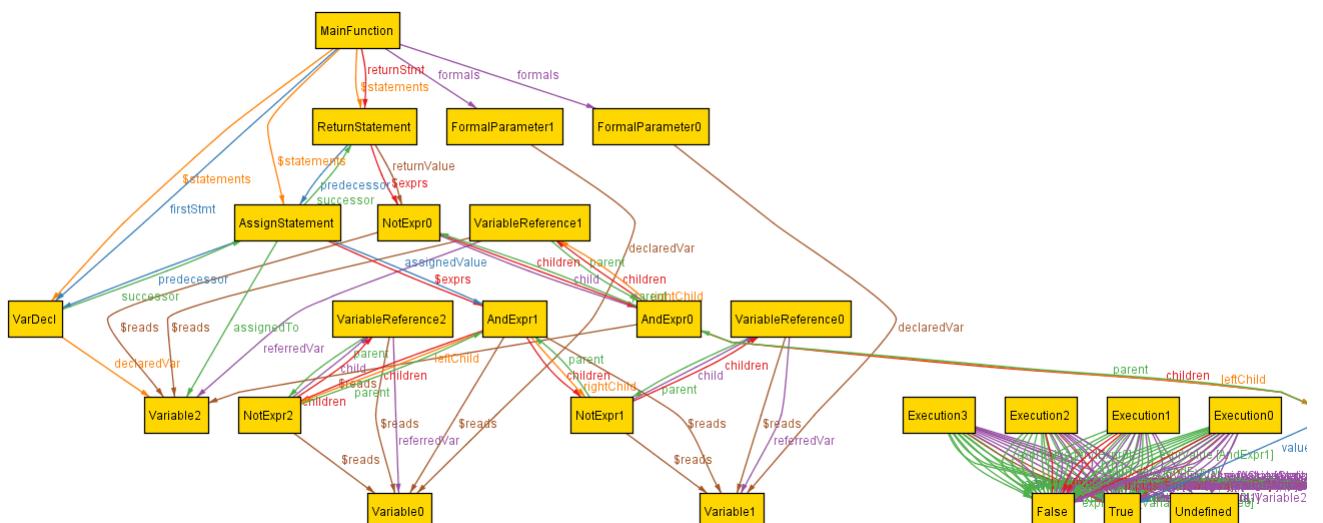


Screen 4

```

$exprs: 2
$reads: 9
$statements: 3
assignedTo: 1
assignedValue: 1
child: 3
children: 7
declaredVar: 2
declaredVar: 1
exprValue: 36
firstStmt: 1
formals: 2
inputs: 4
inputs: 4
leftChild: 2
parent: 7
predecessor: 2
referredVar: 3
returnStmt: 1
returnValue: 1
rightChild: 2
successor: 2
value: 1
varValue: 32

```

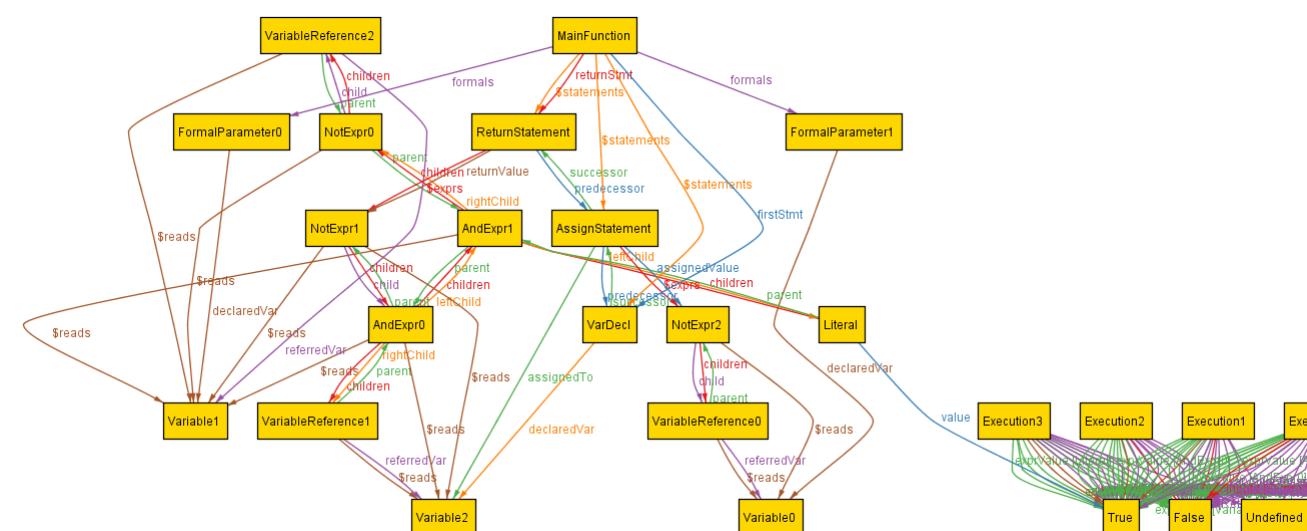


Screen 5

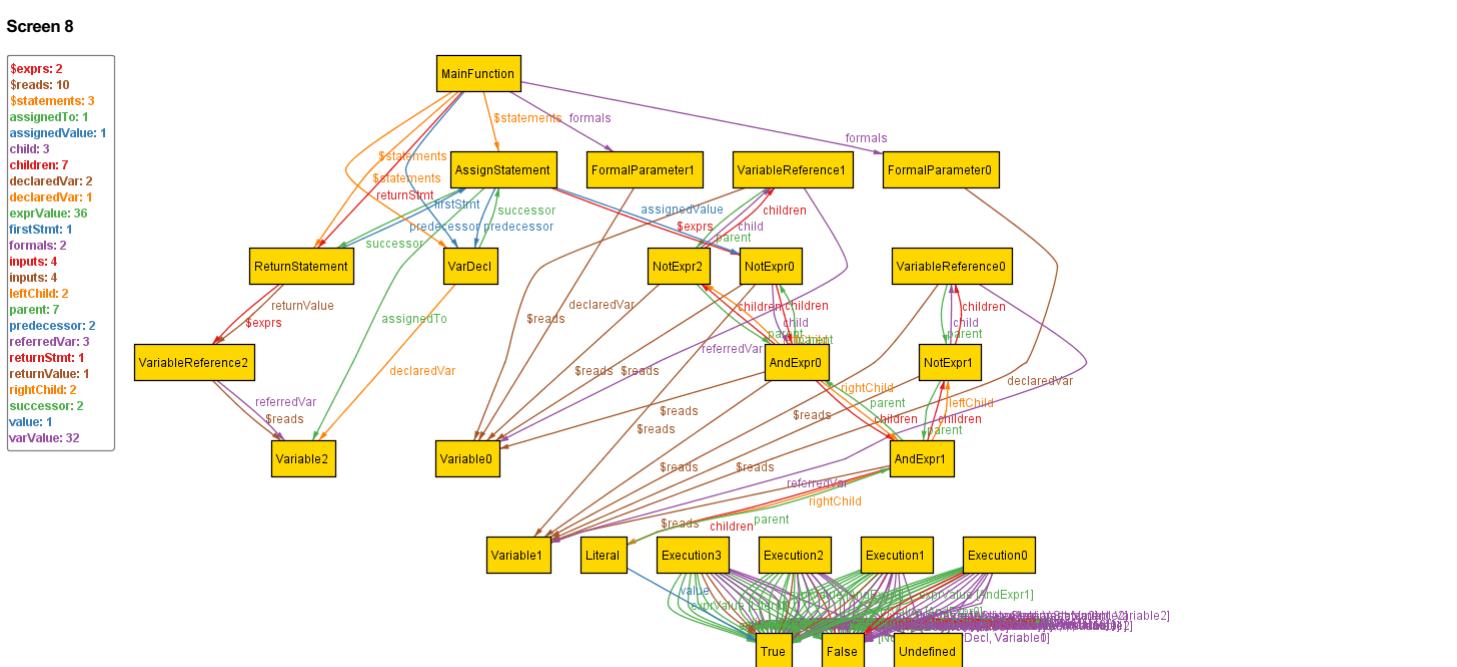
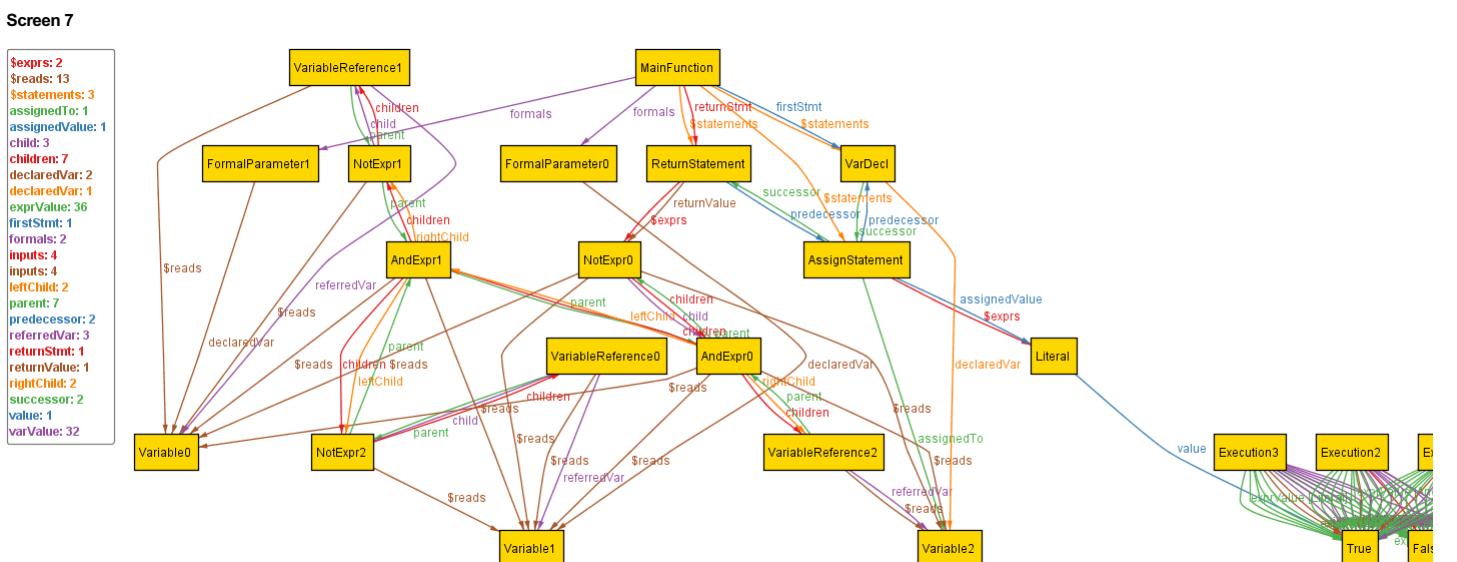
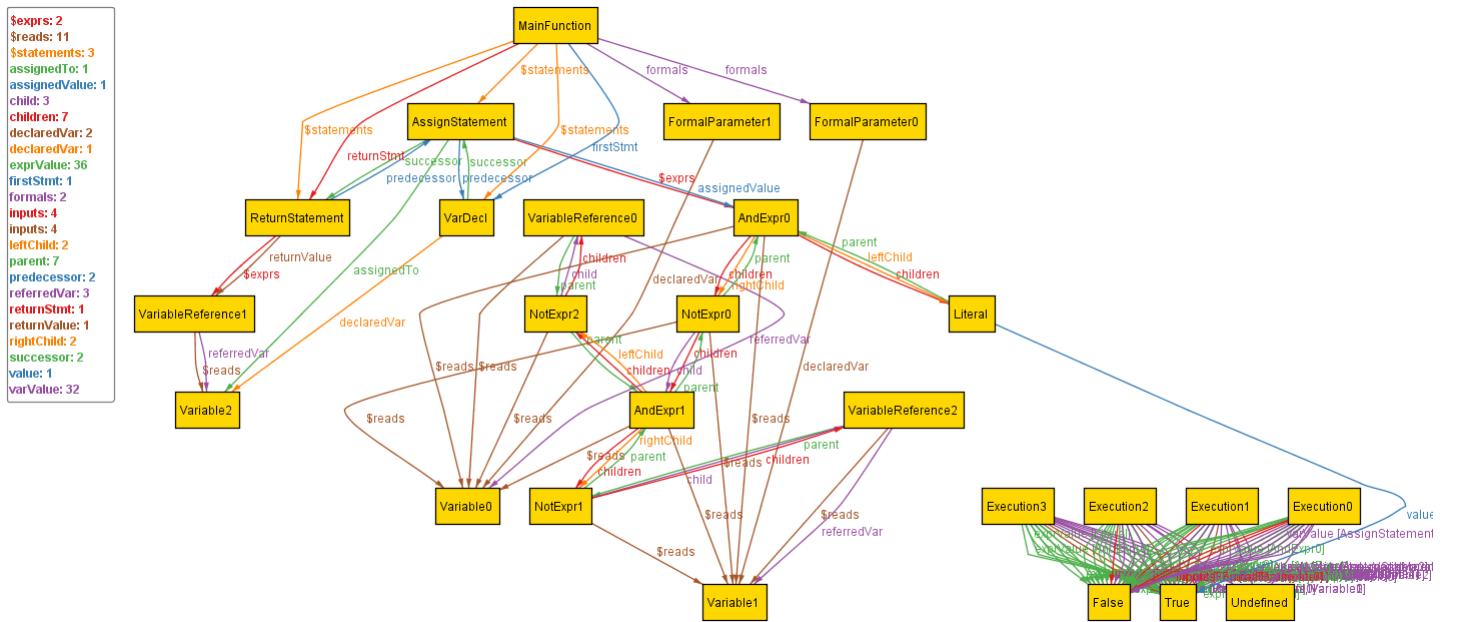
```

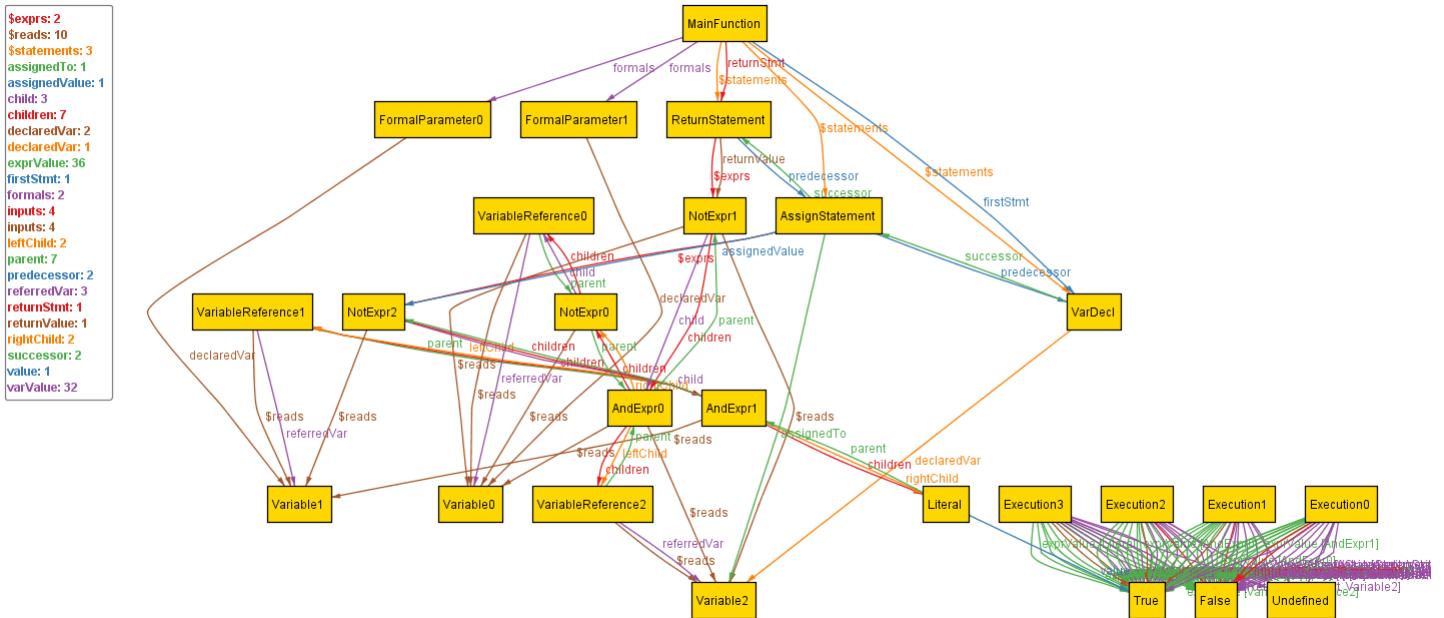
$exprs: 2
$reads: 10
$statements: 3
assignedTo: 1
assignedValue: 1
child: 3
children: 7
declaredVar: 2
declaredVar: 1
exprValue: 36
firstStmt: 1
formals: 2
inputs: 4
inputs: 4
leftChild: 2
parent: 7
predecessor: 2
referredVar: 3
returnStmt: 1
returnValue: 1
rightChild: 2
successor: 2
value: 1
varValue: 32

```

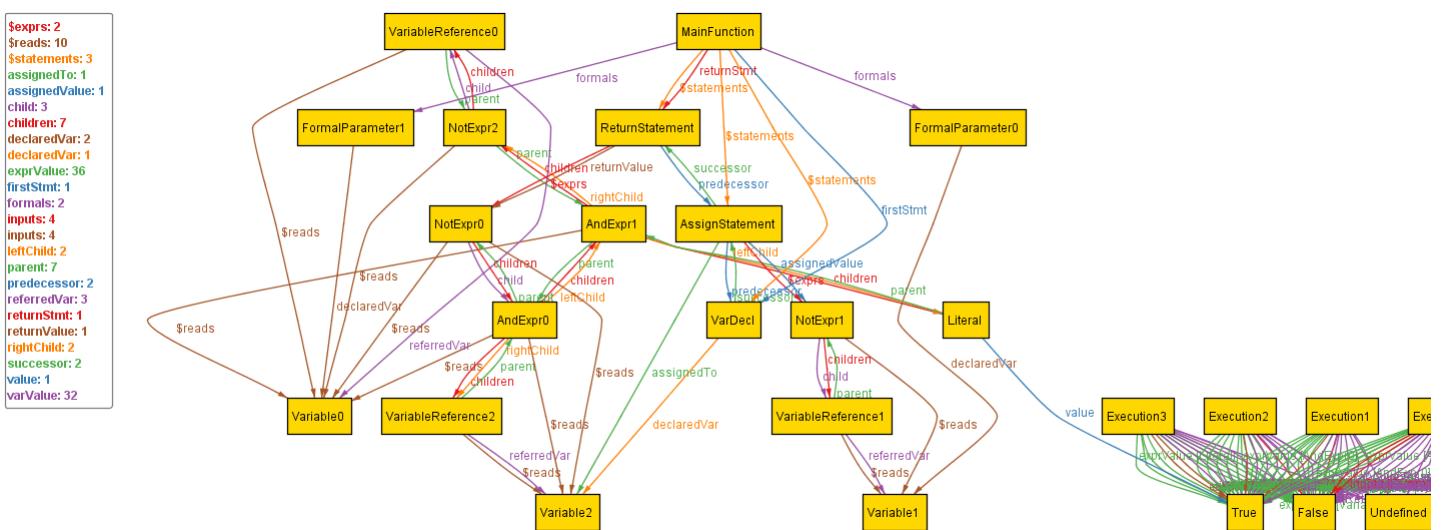


Screen 6





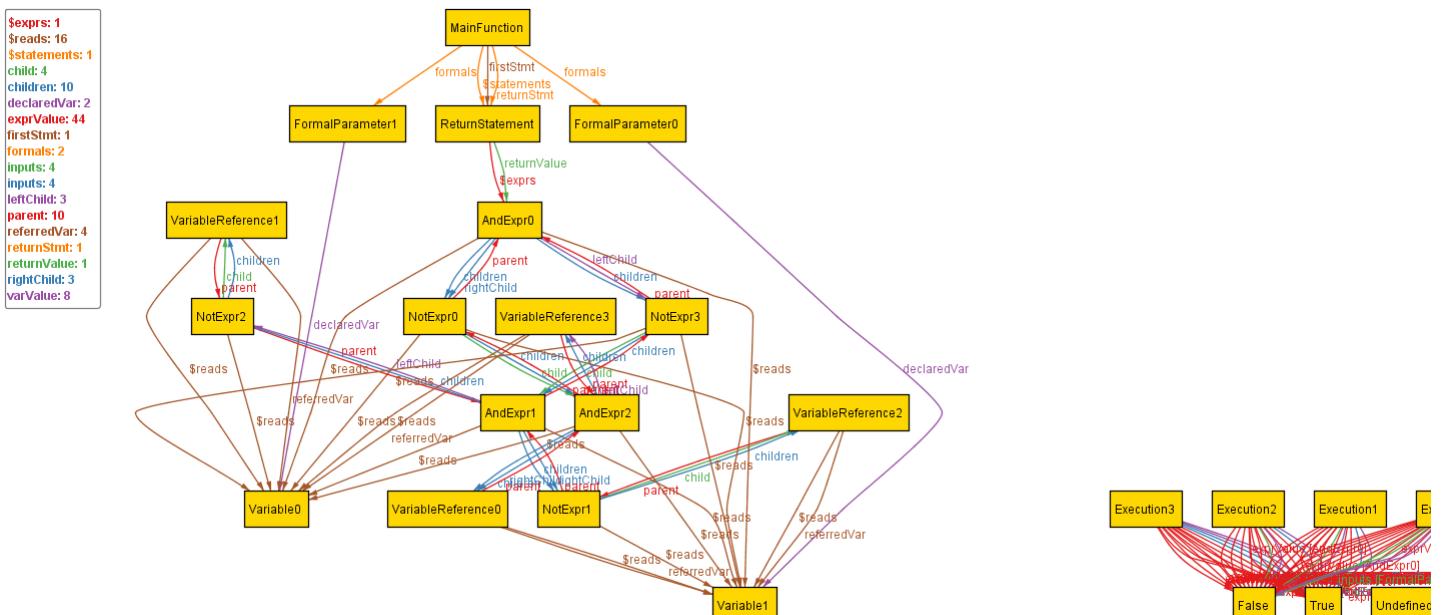
Screen 10



Instance 4

(output truncated to 10 images)

Screen 1

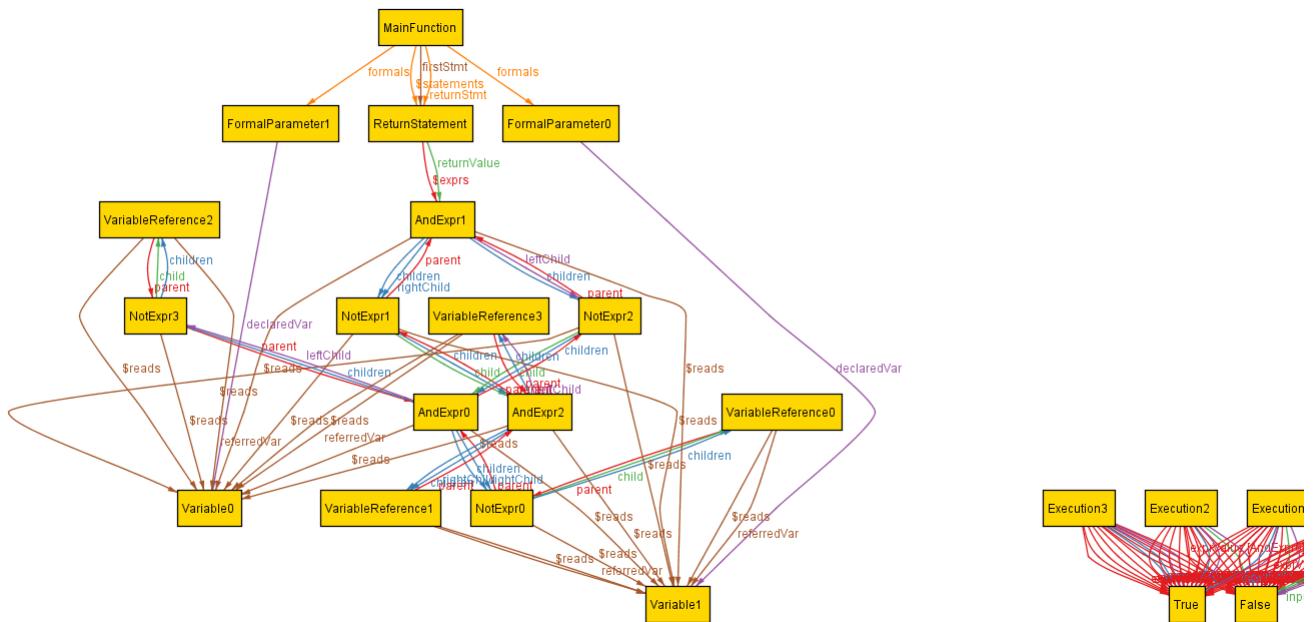


Screen 2

```

$exprs: 1
$reads: 16
$statements: 1
child: 4
children: 10
declaredVar: 2
exprValue: 44
firstStmt: 1
formals: 2
inputs: 4
inputs: 4
leftChild: 3
parent: 10
referedVar: 4
returnStmt: 1
returnValue: 1
rightChild: 3
varValue: 8

```

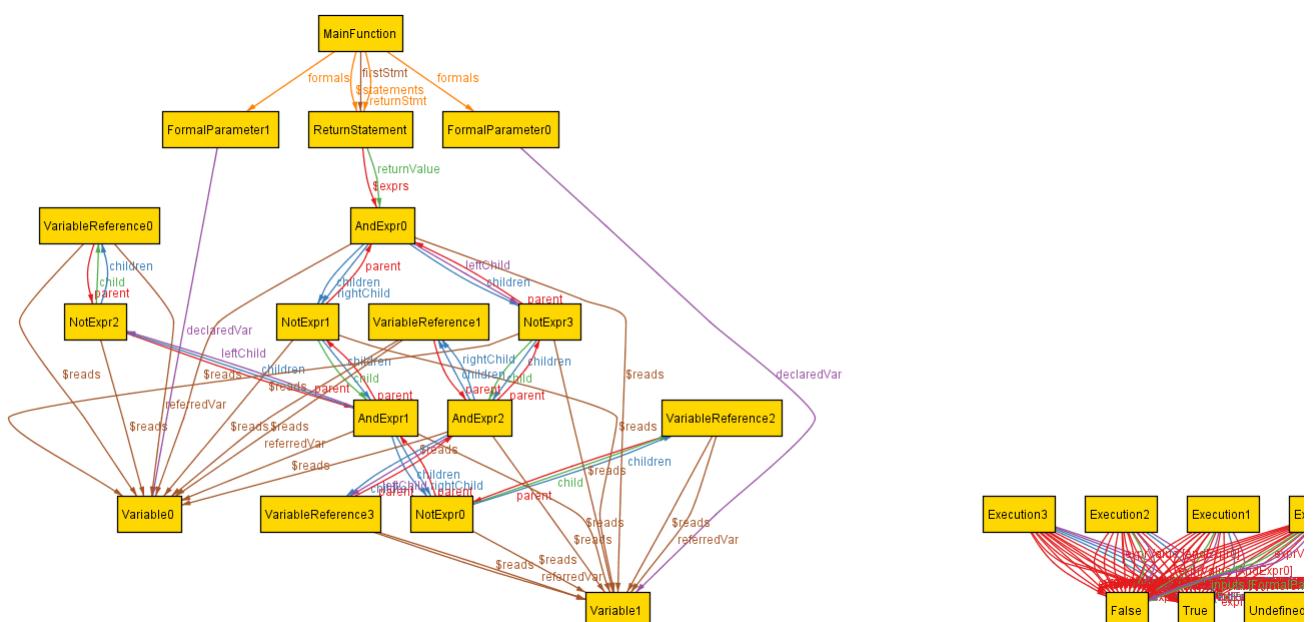


Screen 3

```

$exprs: 1
$reads: 16
$statements: 1
child: 4
children: 10
declaredVar: 2
exprValue: 44
firstStmt: 1
formals: 2
inputs: 4
inputs: 4
leftChild: 3
parent: 10
referedVar: 4
returnStmt: 1
returnValue: 1
rightChild: 3
varValue: 8

```

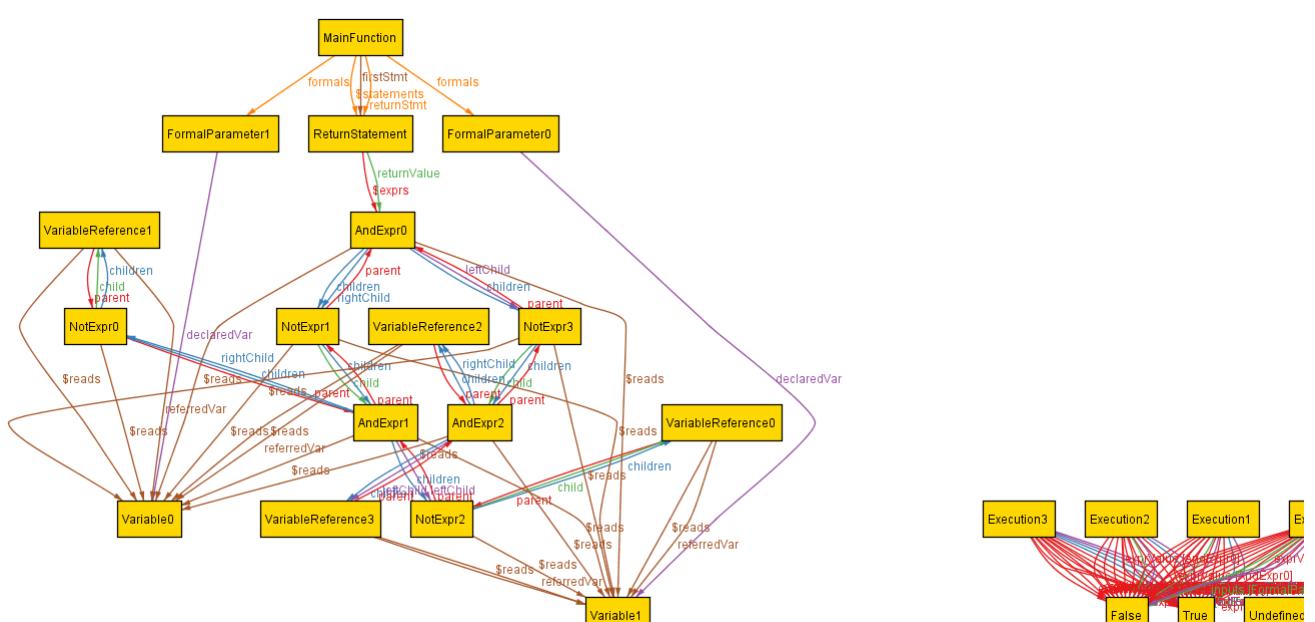


Screen 4

```

$exprs: 1
$reads: 16
$statements: 1
child: 4
children: 10
declaredVar: 2
exprValue: 44
firstStmt: 1
formals: 2
inputs: 4
inputs: 4
leftChild: 3
parent: 10
referedVar: 4
returnStmt: 1
returnValue: 1
rightChild: 3
varValue: 8

```

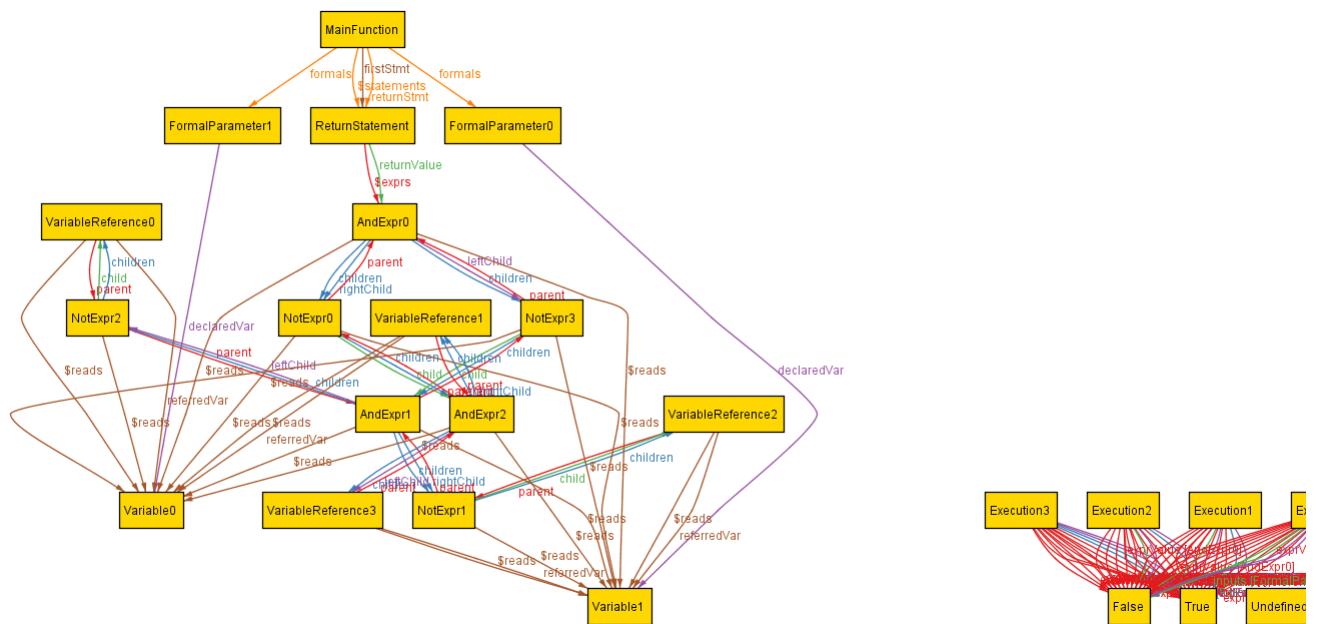


Screen 5

```

$exprs: 1
$reads: 16
$statements: 1
child: 4
children: 10
declaredVar: 2
exprValue: 44
firstStmt: 1
formals: 2
inputs: 4
inputs: 4
leftChild: 3
parent: 10
referedVar: 4
returnValue: 1
rightChild: 3
varValue: 8

```

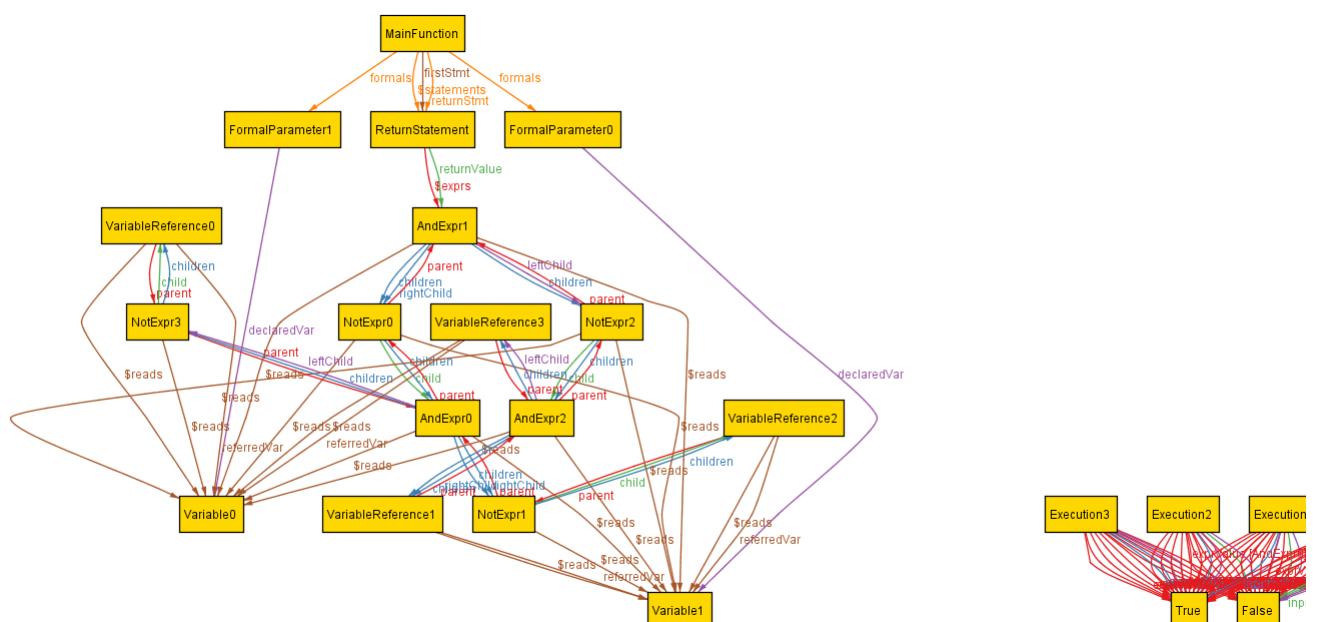


Screen 6

```

$exprs: 1
$reads: 16
$statements: 1
child: 4
children: 10
declaredVar: 2
exprValue: 44
firstStmt: 1
formals: 2
inputs: 4
inputs: 4
leftChild: 3
parent: 10
referedVar: 4
returnValue: 1
rightChild: 3
varValue: 8

```

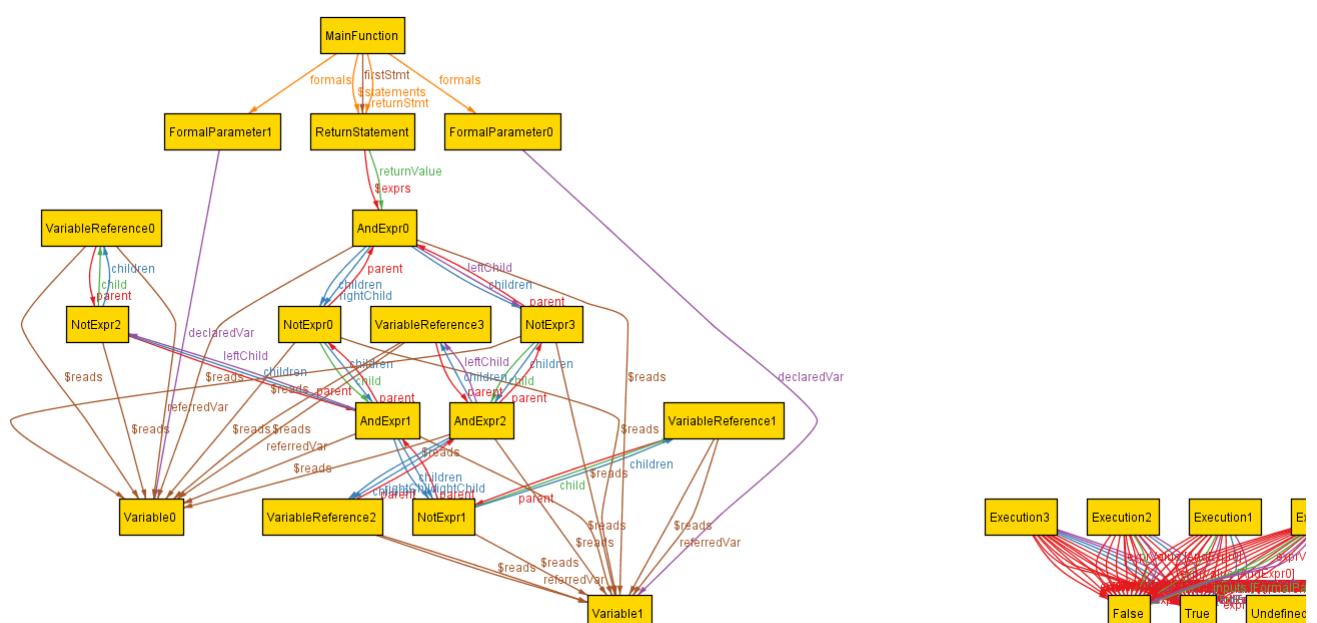


Screen 7

```

$exprs: 1
$reads: 16
$statements: 1
child: 4
children: 10
declaredVar: 2
exprValue: 44
firstStmt: 1
formals: 2
inputs: 4
inputs: 4
leftChild: 3
parent: 10
referedVar: 4
returnValue: 1
rightChild: 3
varValue: 8

```

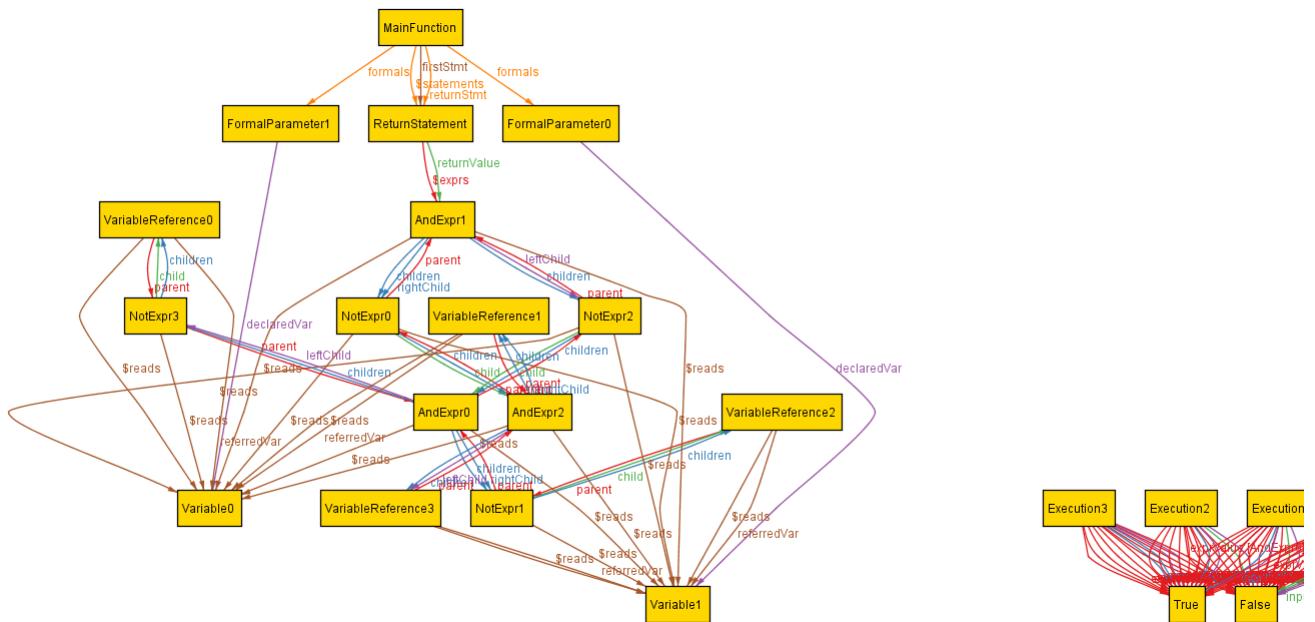


Screen 8

```

$exprs: 1
$reads: 16
$statements: 1
child: 4
children: 10
declaredVar: 2
exprValue: 44
firstStmt: 1
formals: 2
inputs: 4
inputs: 4
leftChild: 3
parent: 10
referredVar: 4
returnValue: 1
rightChild: 3
varValue: 8

```

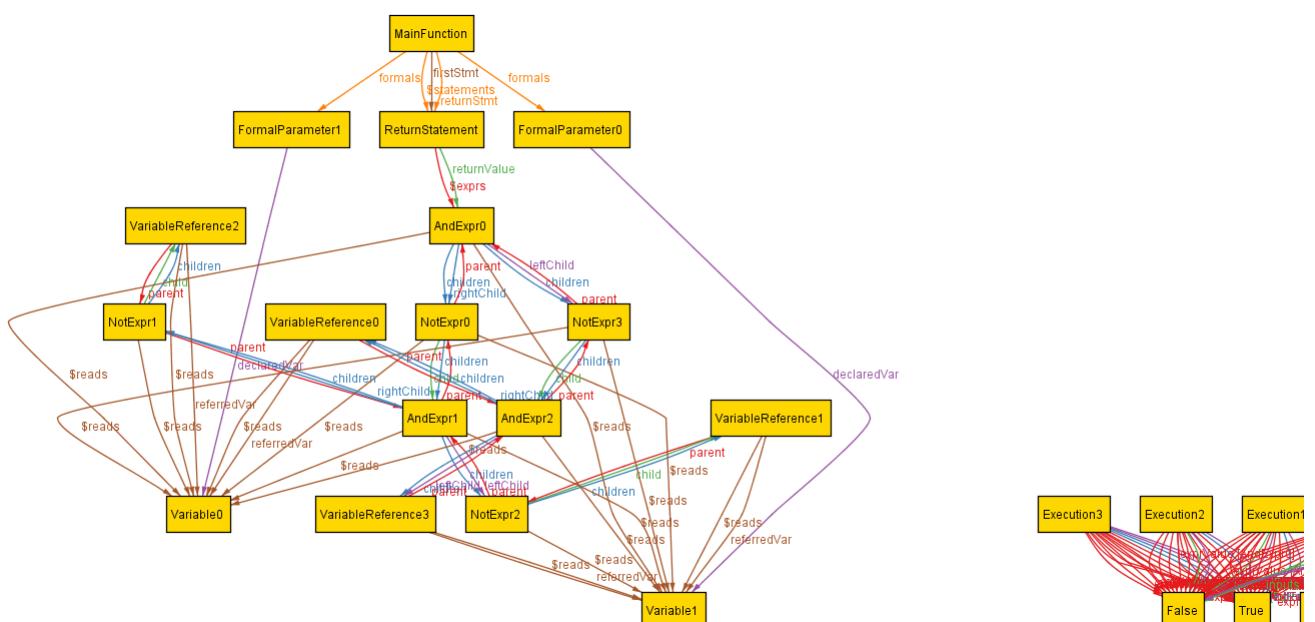


Screen 9

```

$exprs: 1
$reads: 16
$statements: 1
child: 4
children: 10
declaredVar: 2
exprValue: 44
firstStmt: 1
formals: 2
inputs: 4
inputs: 4
leftChild: 3
parent: 10
referredVar: 4
returnValue: 1
rightChild: 3
varValue: 8

```

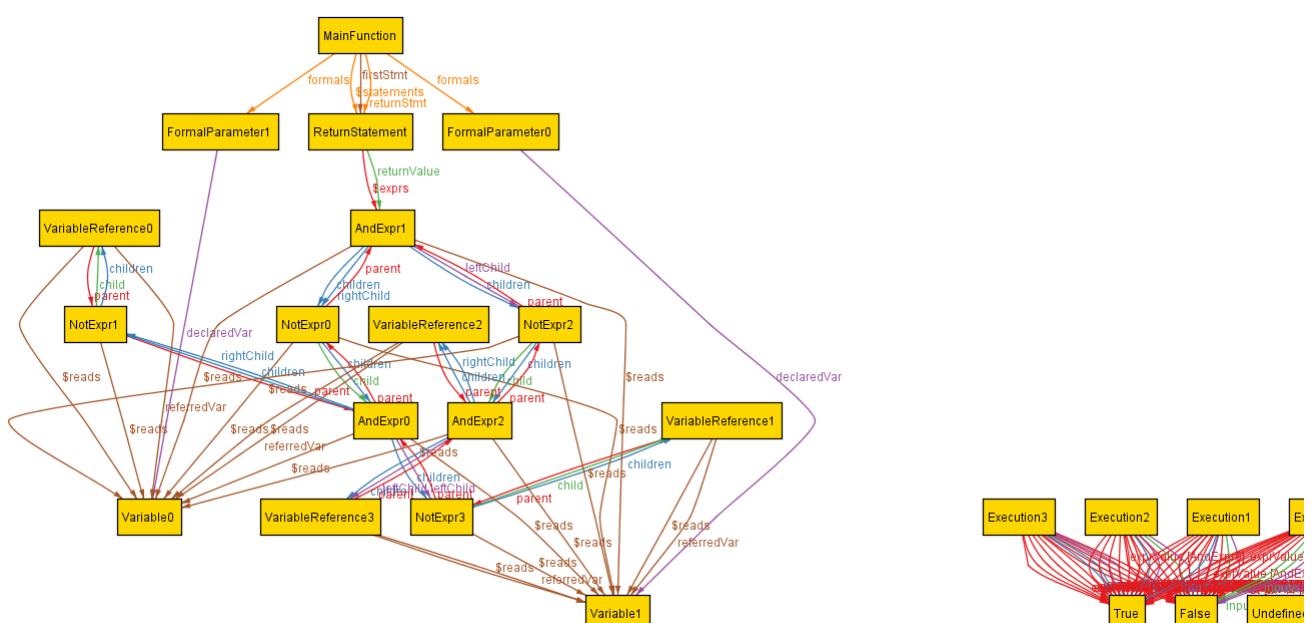


Screen 10

```

$exprs: 1
$reads: 16
$statements: 1
child: 4
children: 10
declaredVar: 2
exprValue: 44
firstStmt: 1
formals: 2
inputs: 4
inputs: 4
leftChild: 3
parent: 10
referredVar: 4
returnValue: 1
rightChild: 3
varValue: 8

```



Instance 5

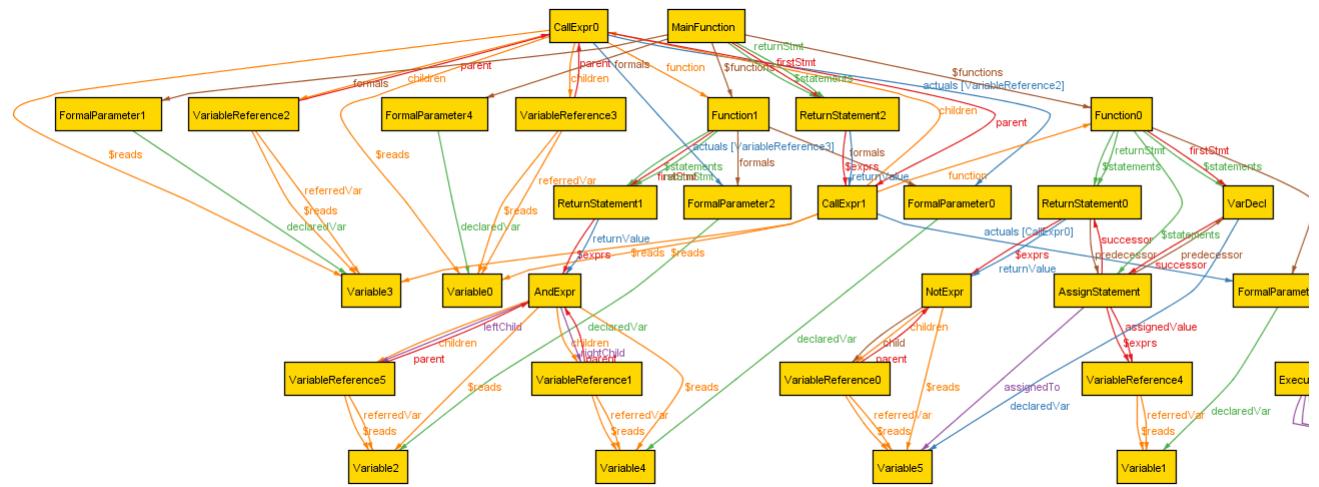
(output truncated to 10 images)

Screen 1

```

$exprs: 4
$functions: 2
$reads: 13
$statements: 5
actuals: 3
assignedTo: 1
assignedValue: 1
child: 1
children: 6
declaredVar: 5
declaredVar: 1
exprValue: 40
firstStmt: 3
formals: 5
function: 2
inputs: 4
inputs: 4
leftChild: 1
parent: 6
predecessor: 2
referredVar: 6
returnStmt: 3
returnValue: 3
rightChild: 1
successor: 2
varValue: 46

```

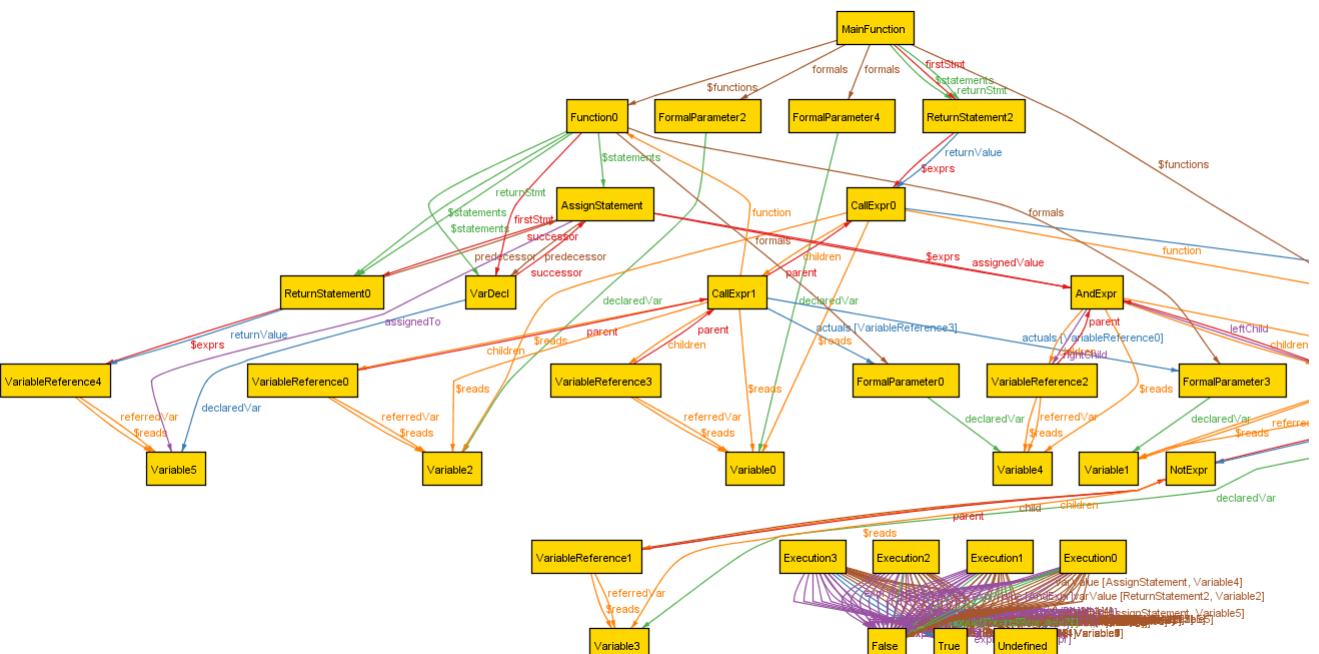


Screen 2

```

$exprs: 4
$functions: 2
$reads: 13
$statements: 5
actuals: 3
assignedTo: 1
assignedValue: 1
child: 1
children: 6
declaredVar: 5
declaredVar: 1
exprValue: 40
firstStmt: 3
formals: 5
function: 2
inputs: 4
inputs: 4
leftChild: 1
parent: 6
predecessor: 2
referredVar: 6
returnStmt: 3
returnValue: 3
rightChild: 1
successor: 2
varValue: 48

```

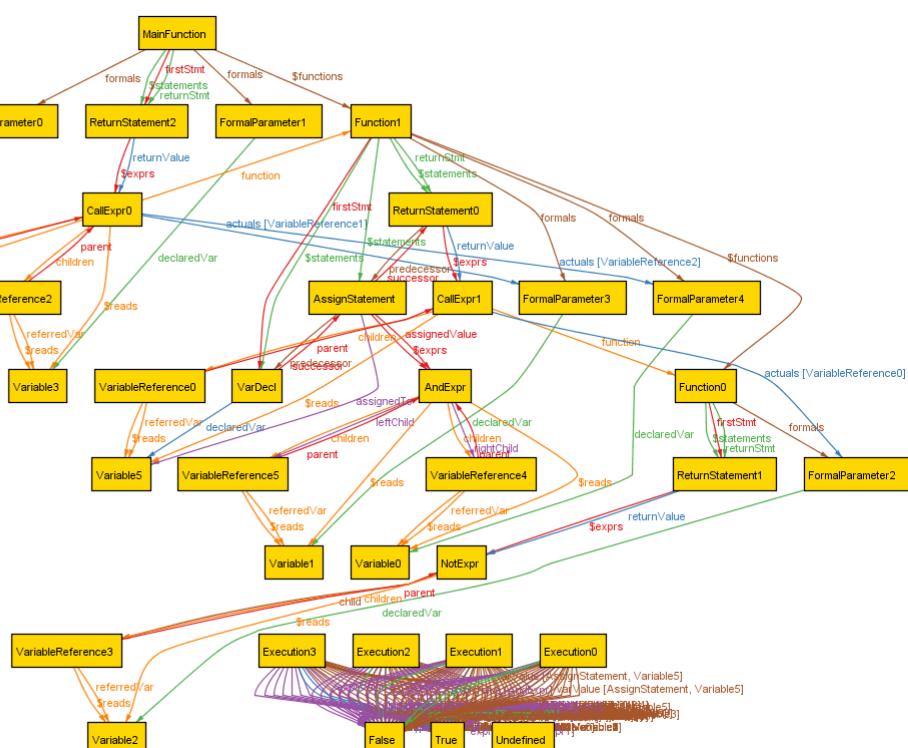


Screen 3

```

$exprs: 4
$functions: 2
$reads: 12
$statements: 5
actuals: 3
assignedTo: 1
assignedValue: 1
child: 1
children: 6
declaredVar: 5
declaredVar: 1
exprValue: 40
firstStmt: 3
formals: 5
function: 2
inputs: 4
inputs: 4
leftChild: 1
parent: 6
predecessor: 2
referredVar: 6
returnStmt: 3
returnValue: 3
rightChild: 4
successor: 2
varValue: 82

```

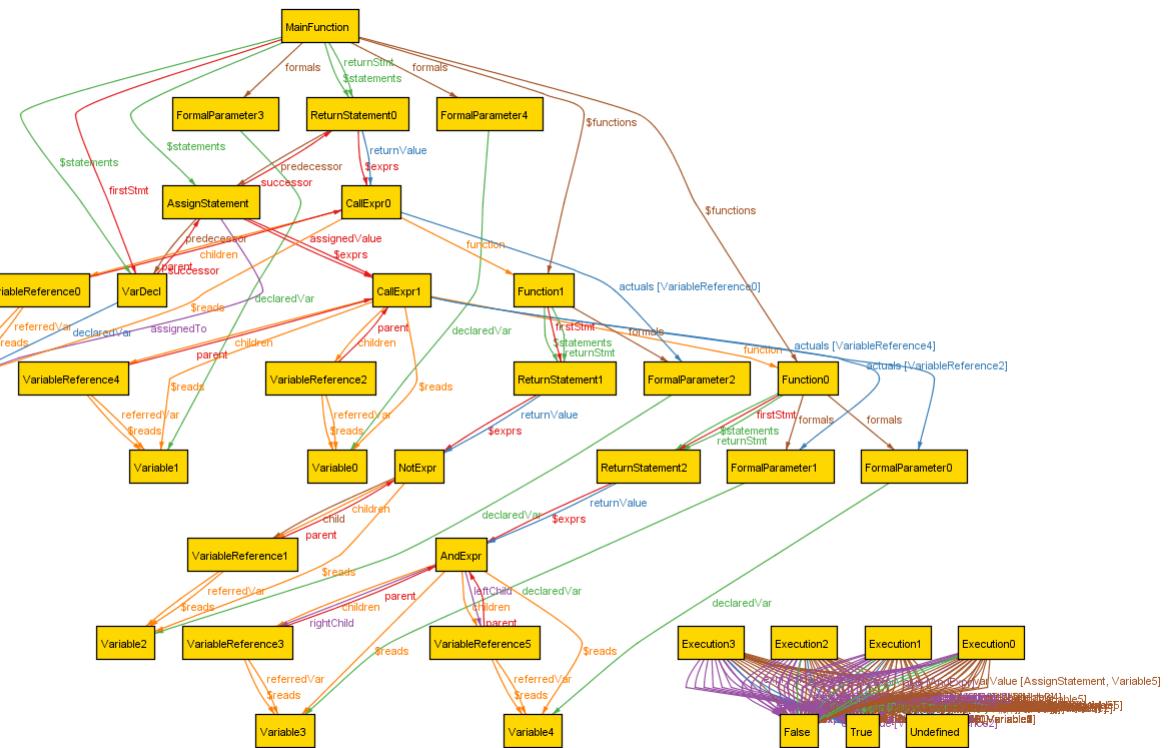


Screen 4

```

$exprs: 4
$functions: 2
$reads: 12
$statements: 5
actuals: 3
assignedTo: 1
assignedValue: 1
child: 1
children: 6
declaredVar: 5
declarVar: 1
exprValue: 40
firstStmt: 3
formals: 5
function: 2
inputs: 4
inputs: 4
leftChild: 1
parent: 6
predecessor: 2
referedVar: 6
returnStmt: 3
returnValue: 3
rightChild: 1
successor: 2
varValue: 64

```

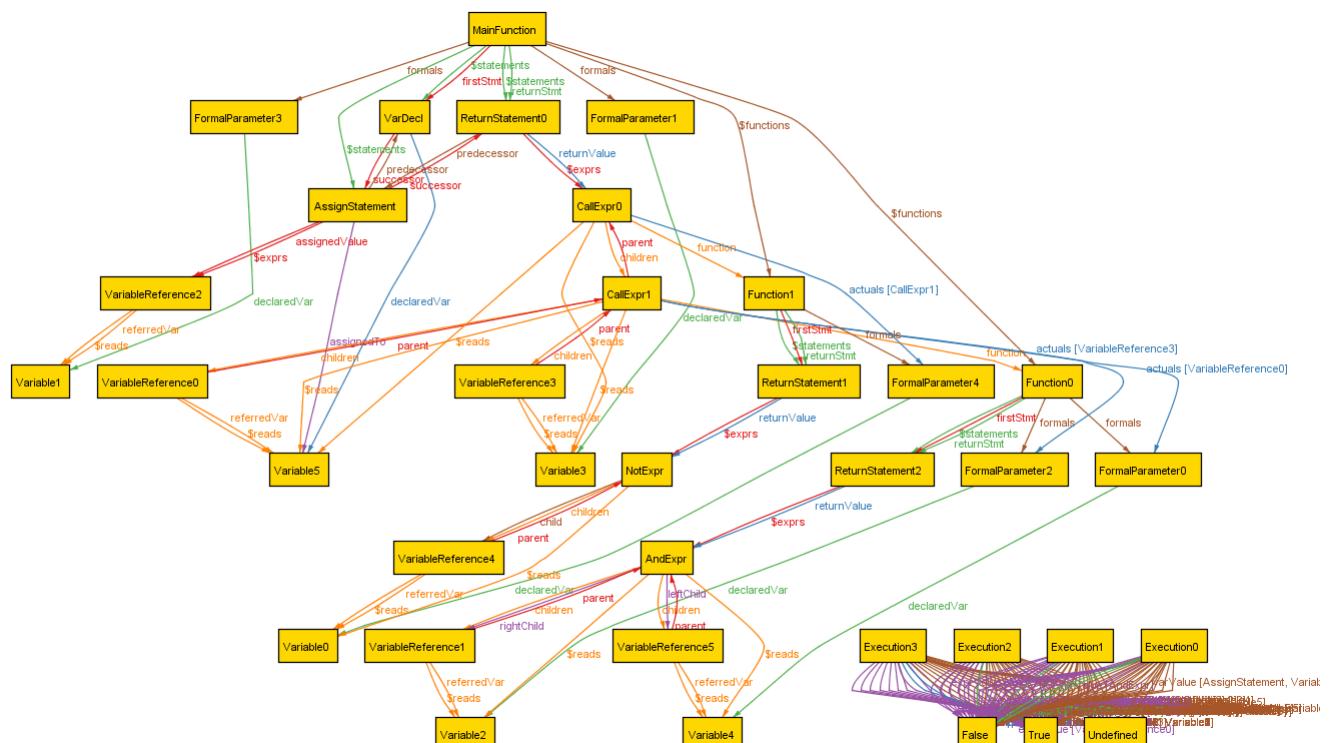


Screen 5

```

$exprs: 4
$functions: 2
$reads: 13
$statements: 5
actuals: 3
assignedTo: 1
assignedValue: 1
child: 1
children: 6
declaredVar: 5
declarVar: 1
exprValue: 40
firstStmt: 3
formals: 5
function: 2
inputs: 4
inputs: 4
leftChild: 1
parent: 6
predecessor: 2
referedVar: 6
returnStmt: 3
returnValue: 3
rightChild: 1
successor: 2
varValue: 70

```

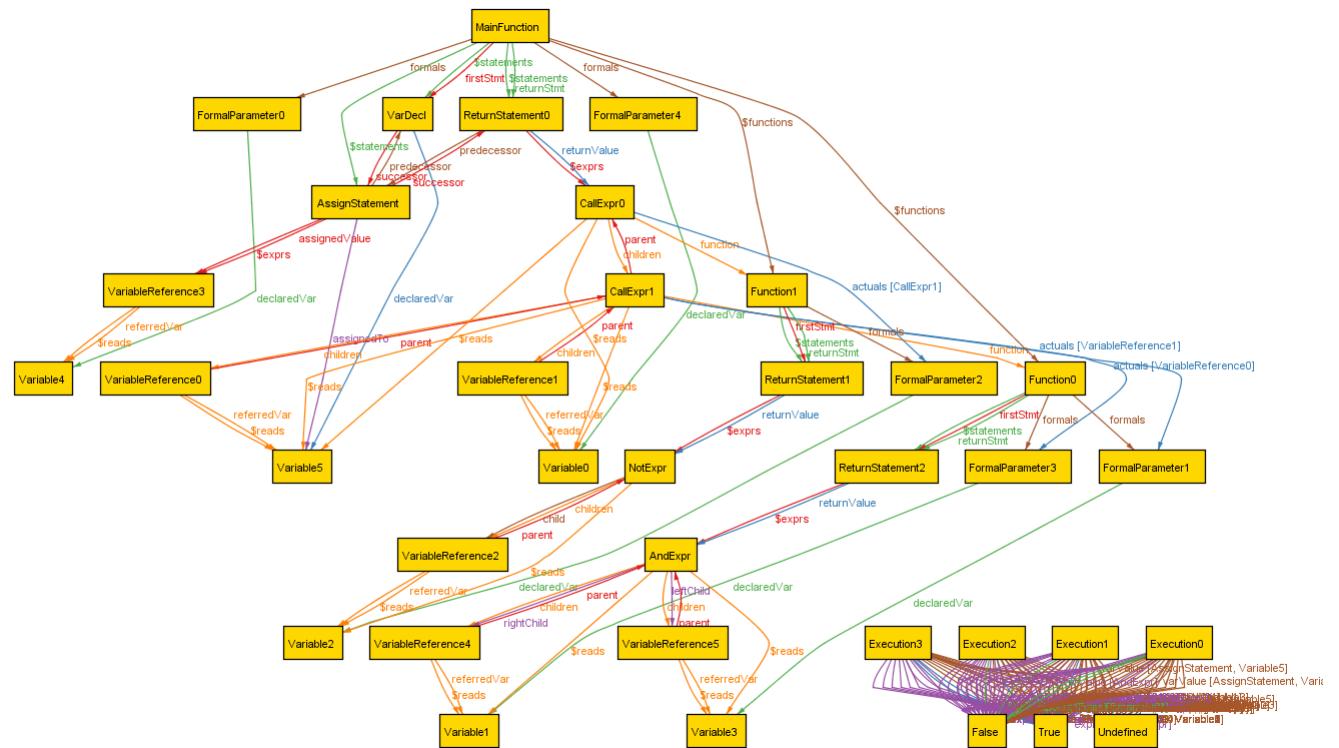


Screen 6

```

$exprs: 4
$functions: 2
$reads: 13
$statements: 5
actuals: 3
assignedTo: 1
assignedValue: 1
child: 1
children: 6
declaredVar: 5
declaredVar: 1
exprValue: 40
firstStmt: 3
formals: 5
function: 2
inputs: 4
inputs: 4
leftChild: 1
parent: 6
predecessor: 2
referredVar: 6
returnStmt: 3
returnValue: 3
rightChild: 1
successor: 2
varValue: 59

```

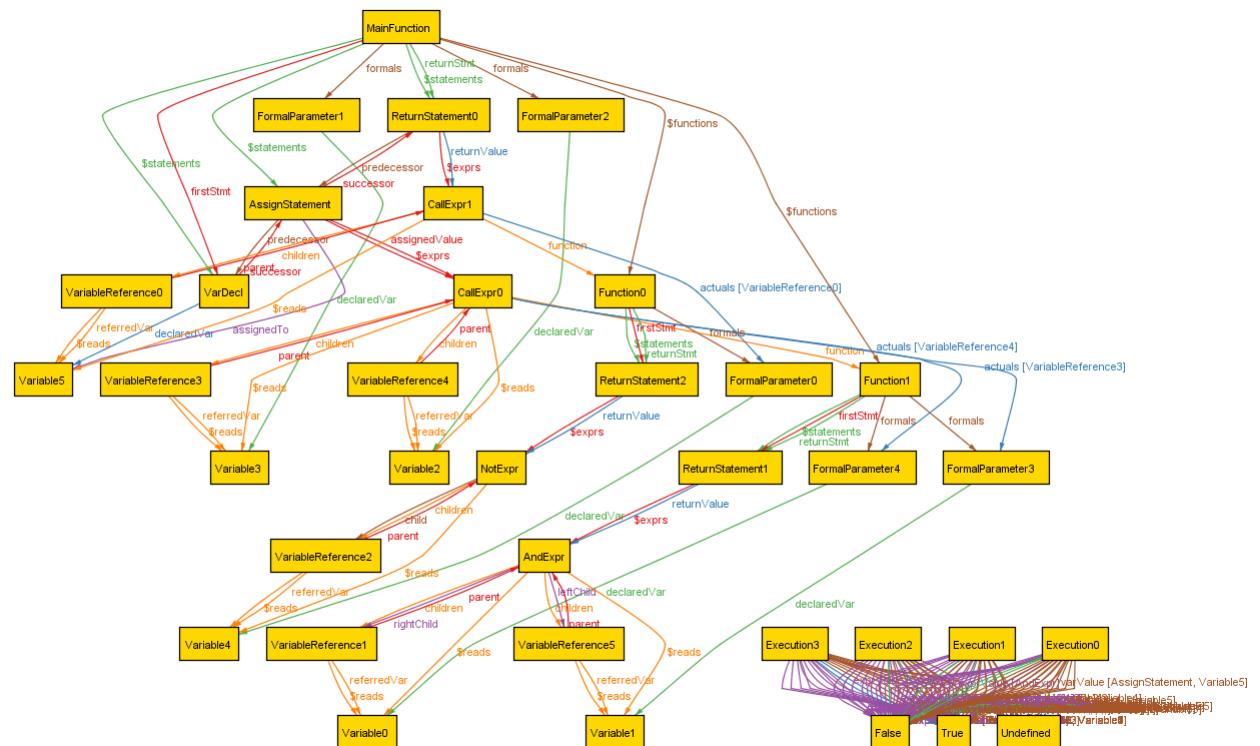


Screen 7

```

$exprs: 4
$functions: 2
$reads: 12
$statements: 5
actuals: 3
assignedTo: 1
assignedValue: 1
child: 1
children: 6
declaredVar: 5
declaredVar: 1
exprValue: 40
firstStmt: 3
formals: 5
function: 2
inputs: 4
inputs: 4
leftChild: 1
parent: 6
predecessor: 2
referredVar: 6
returnStmt: 3
returnValue: 3
rightChild: 1
successor: 2
varValue: 54

```



Screen 8

