Enhancing Control Flow Graph Based Binary Function Identification

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Chair for IT Security

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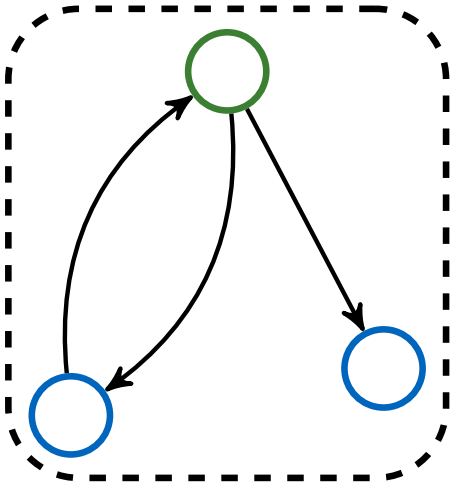
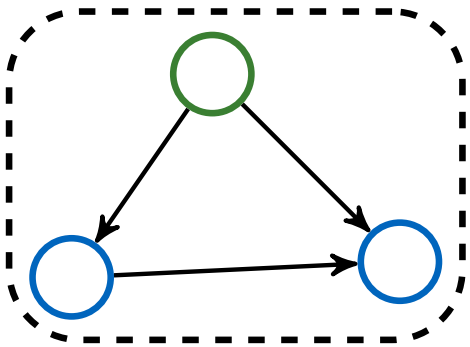
Motivation

"I just wasted 3 hours of my life...
...because I reversed $foo once again"

Motivation





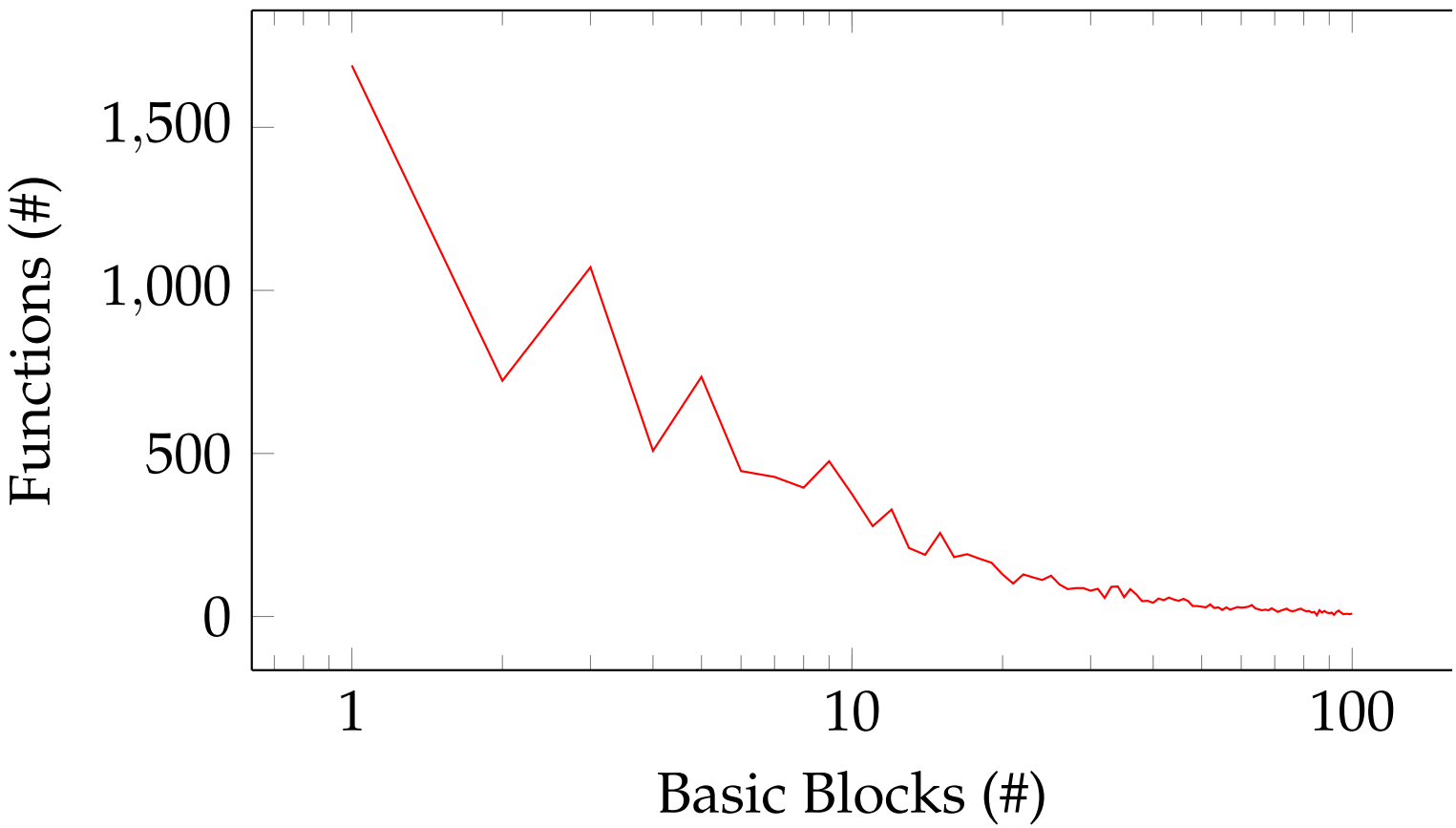
Problem:

- Recover function labels

Existing Technology:

- Pattern Matching (F.L.I.R.T)
- BinDiff
- Diaphora

Problems of CFGs



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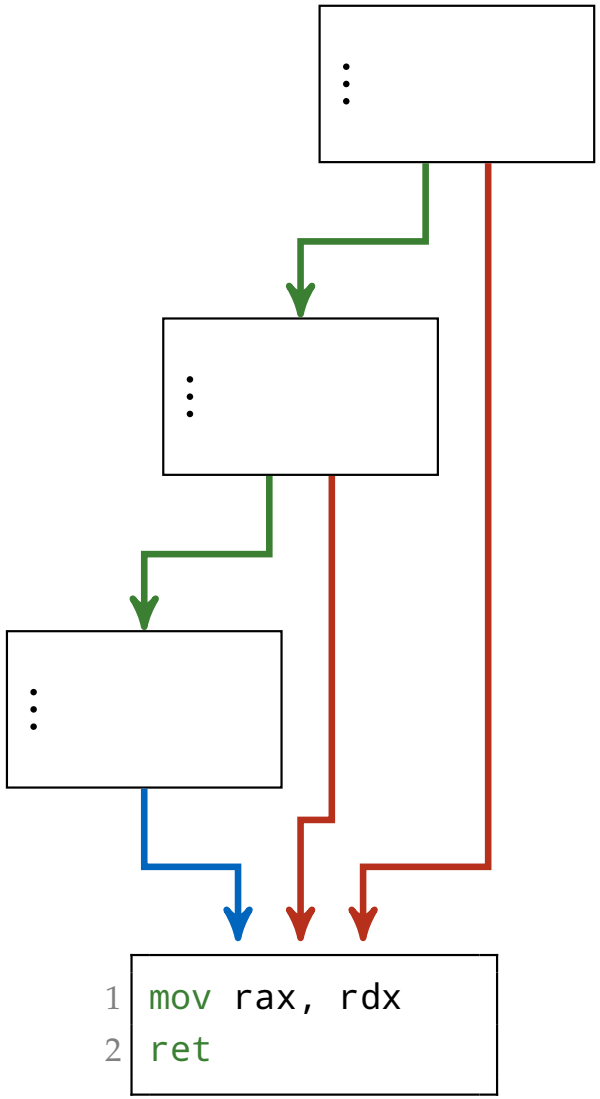

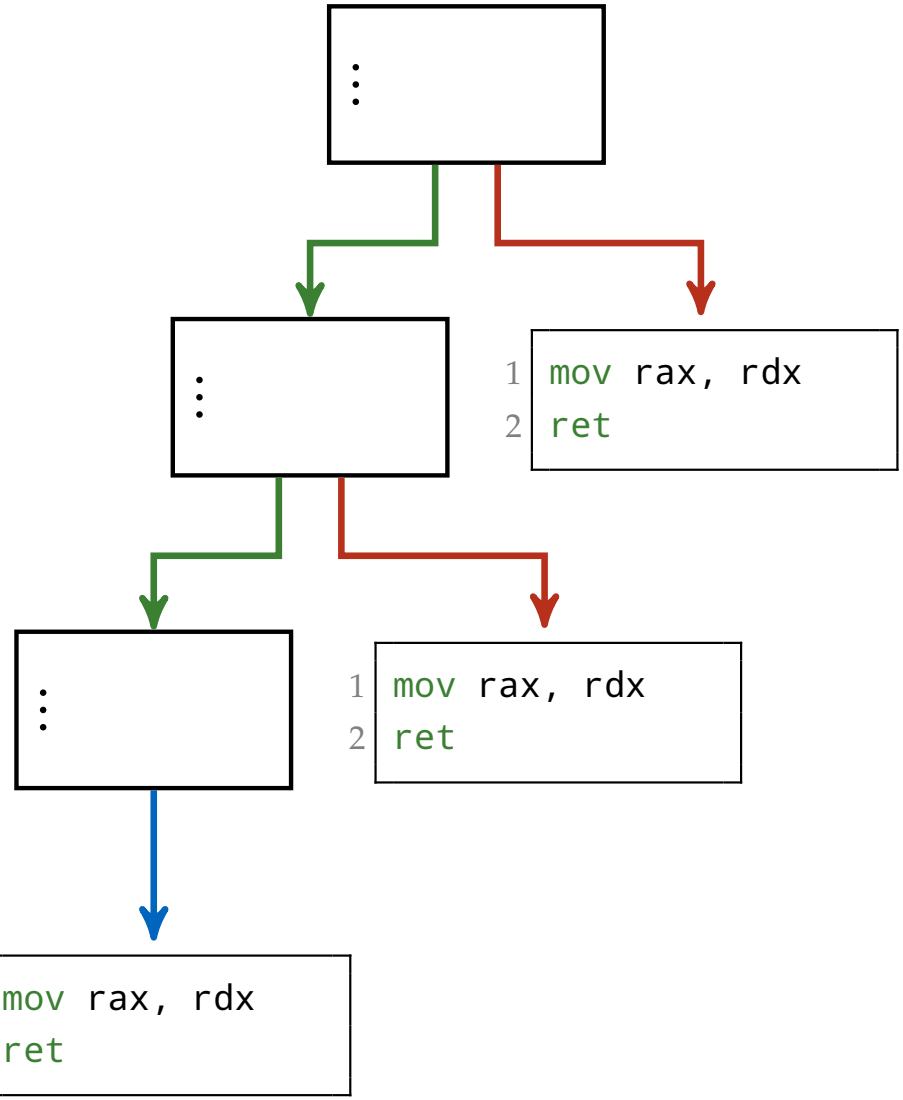

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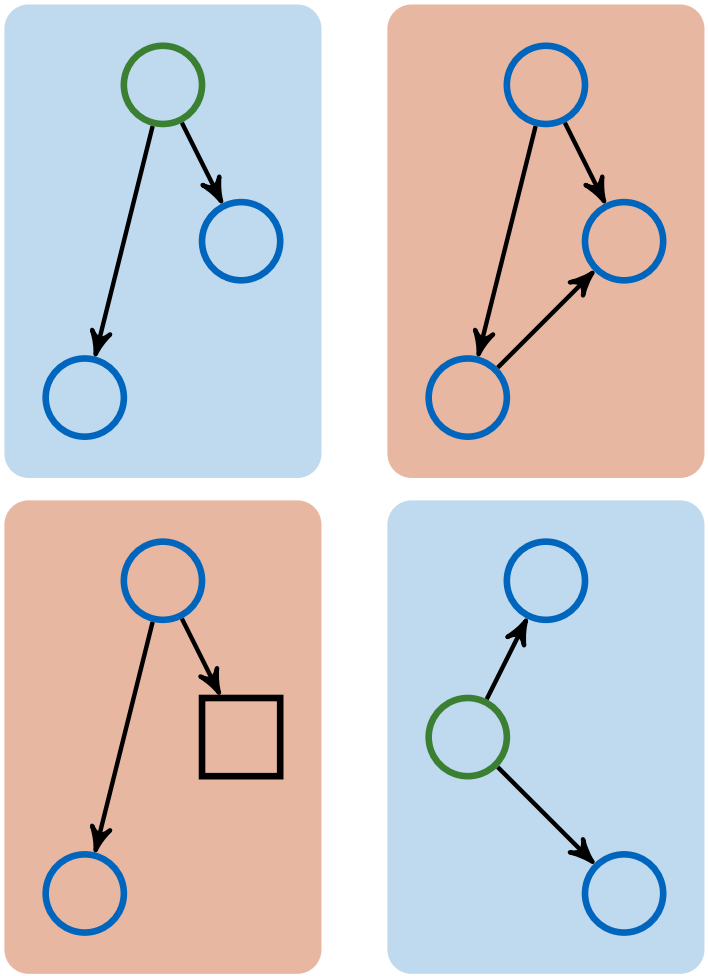


Goal:

- Differentiate similar CFGs
- Resistence against changes

Problems of CFGs

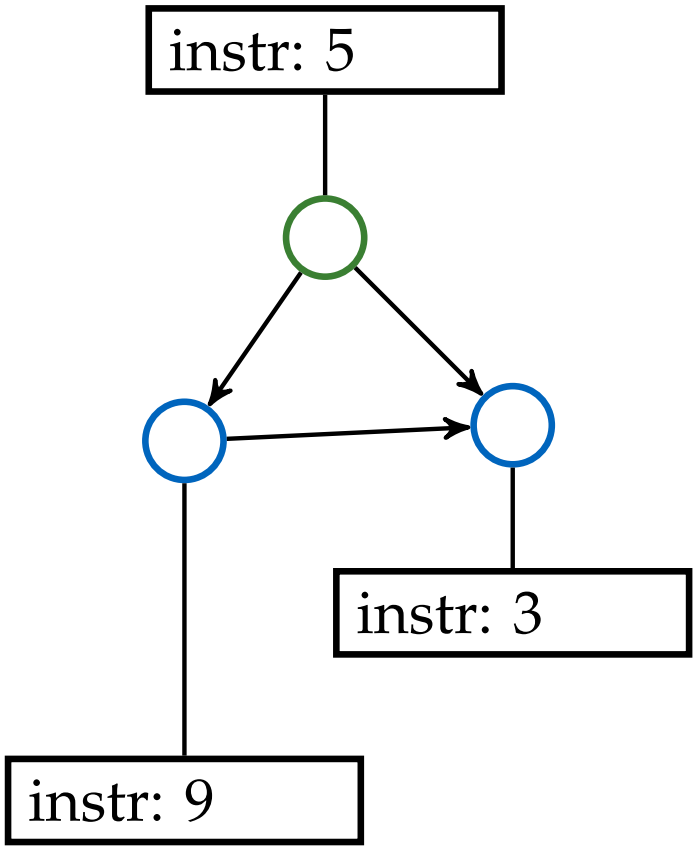
Problem:

- Small Functions: Many functions share the same CFG
- Large Functions: Many different CFGs possible per function

Idea:

- Checking basic block level information
- Normalize CFGs

Normalization



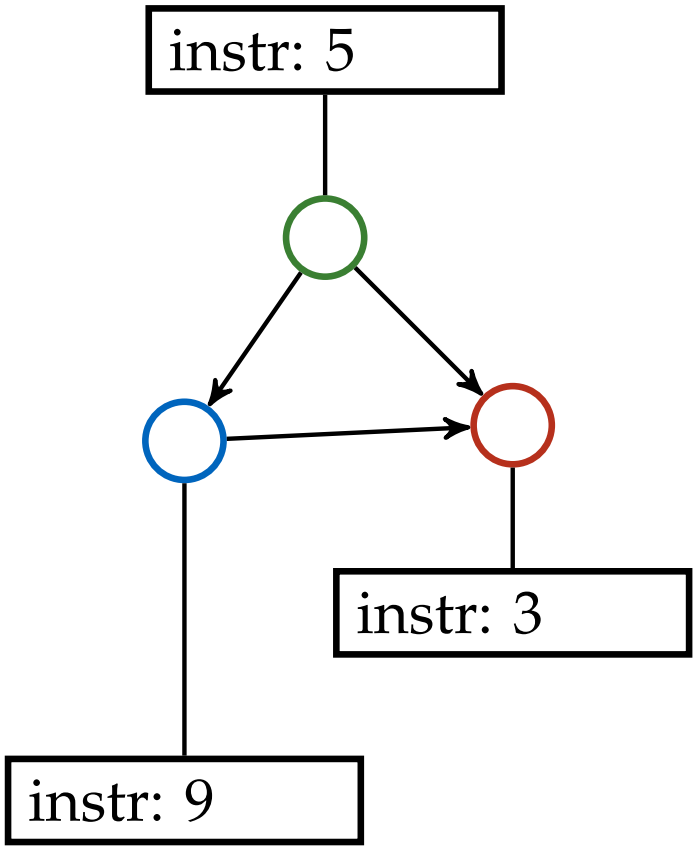
Leaf Inlining:

- Detect Leafs
- Duplicate per parent

Combining Nodes:

- Detect Nodes with one parent
- Filter parents to only have one child
- Combine attributes

Normalization



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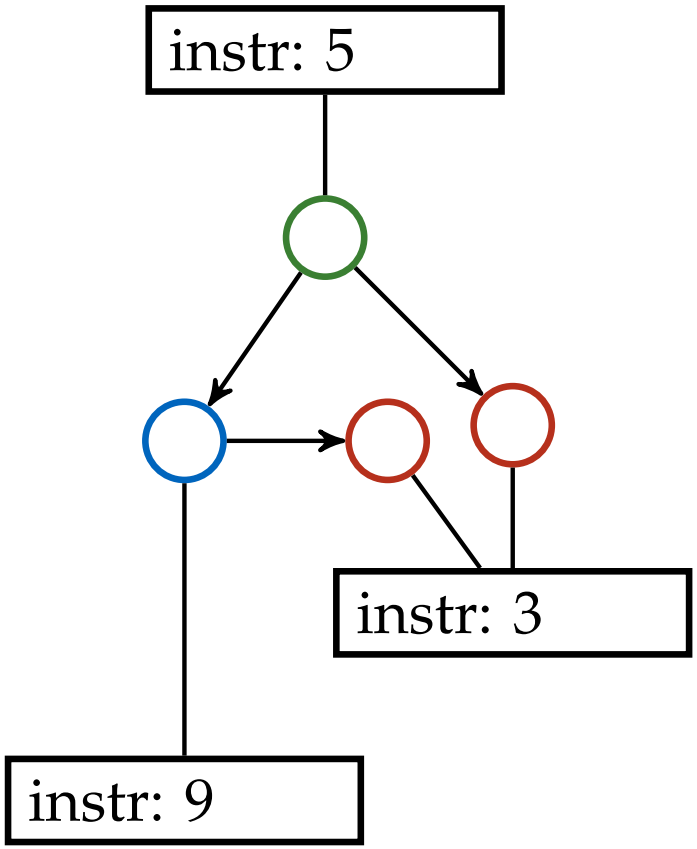

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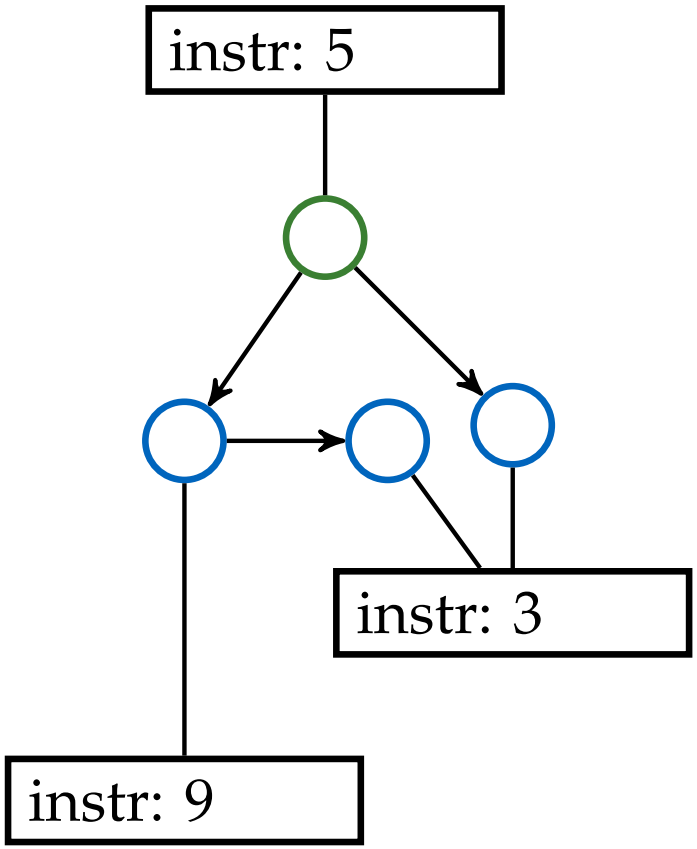

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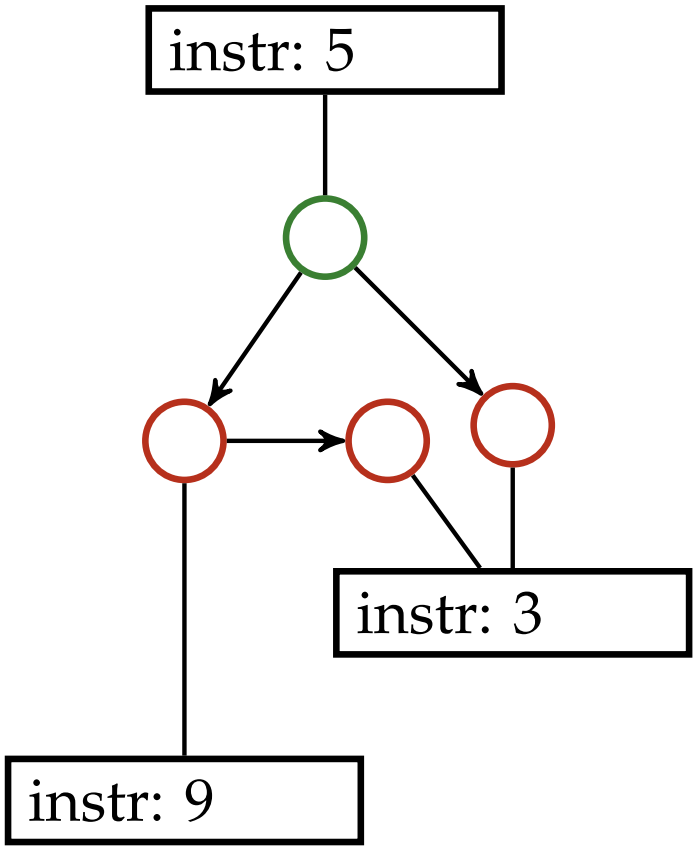

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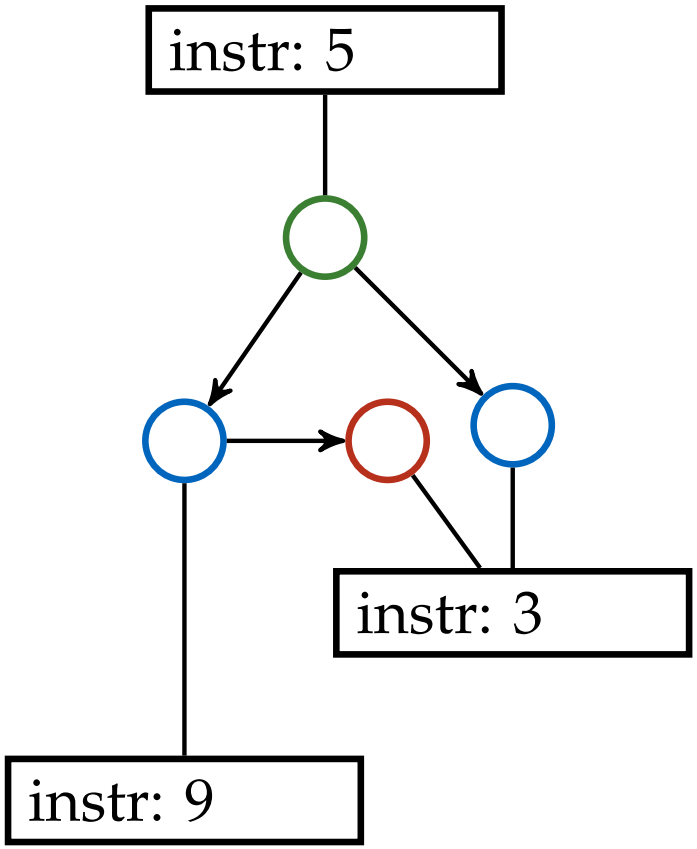

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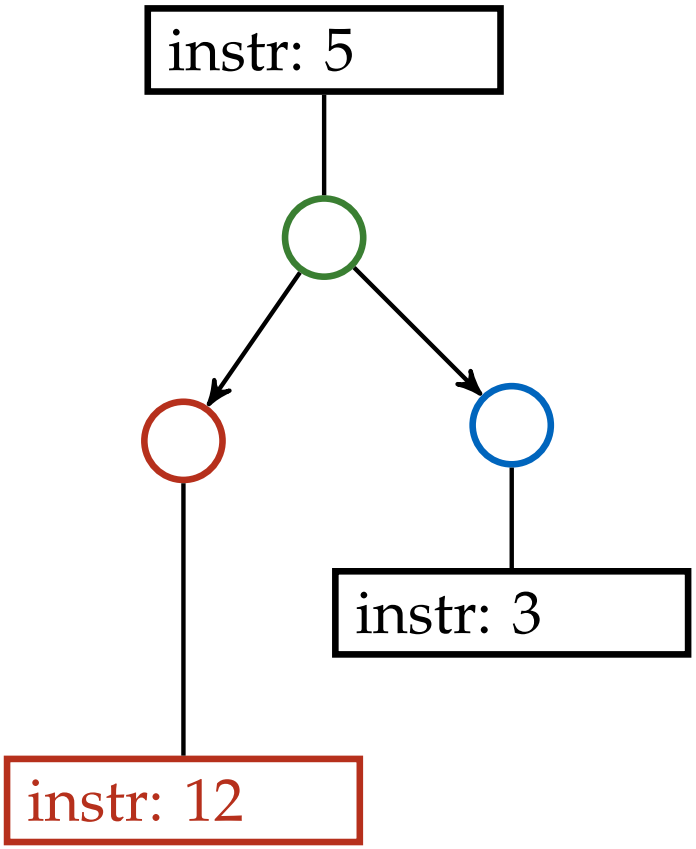

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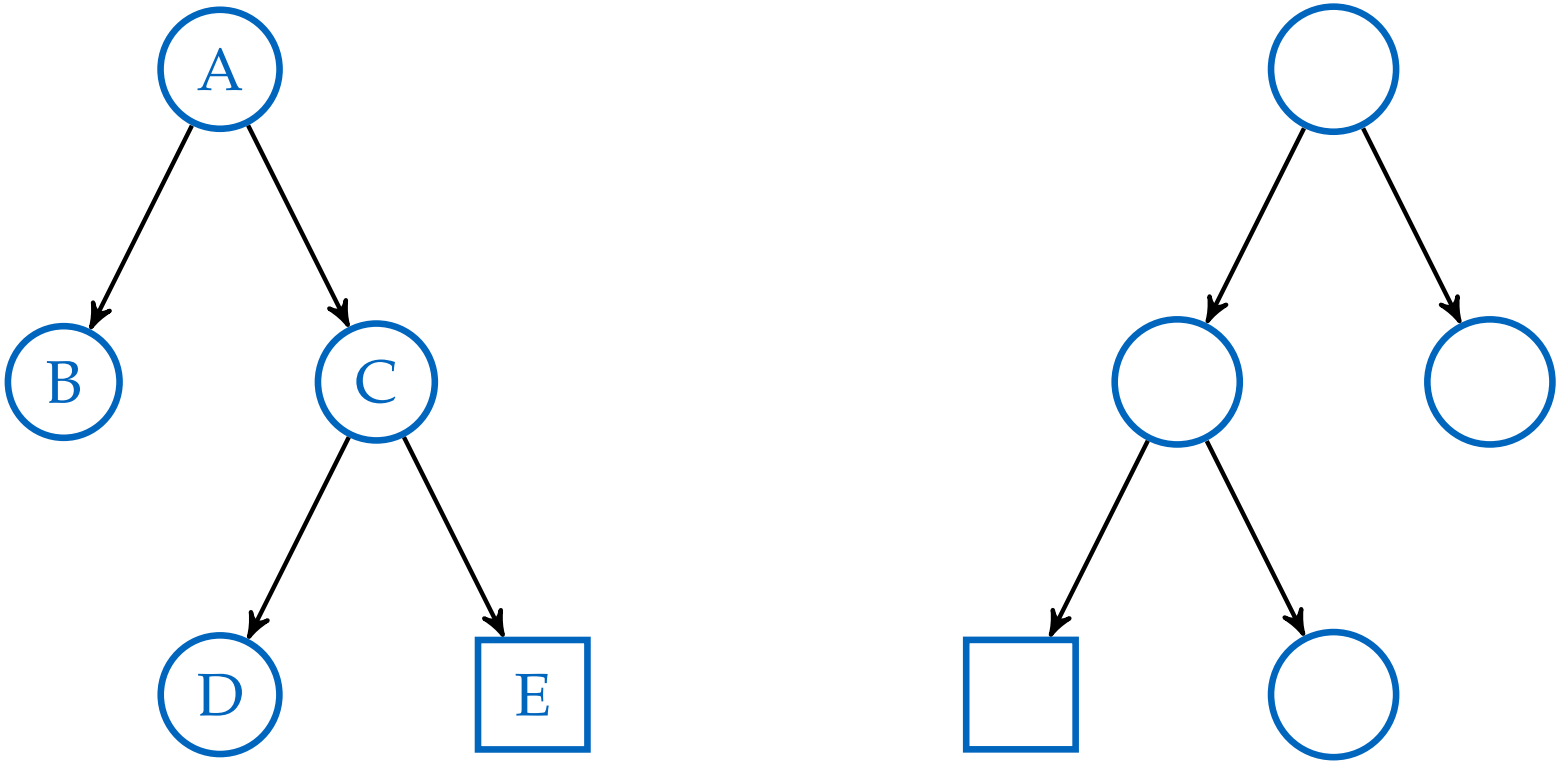
Graph Comparison



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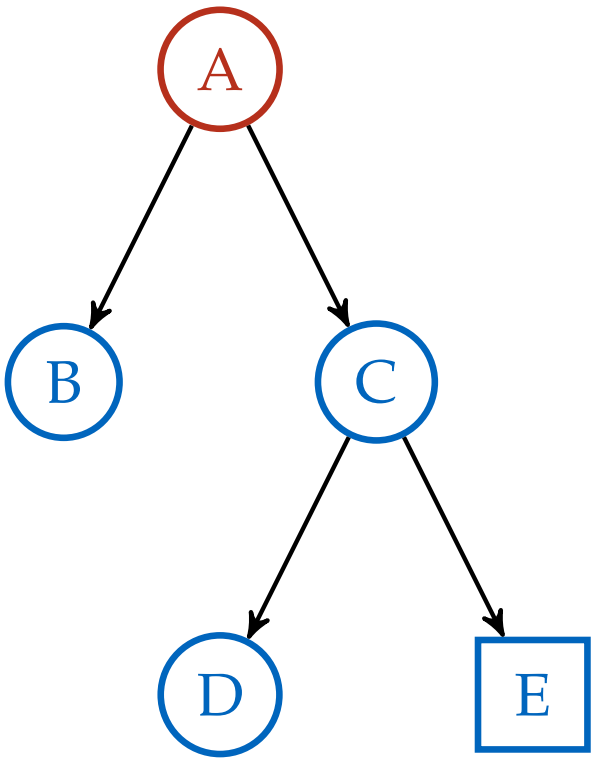

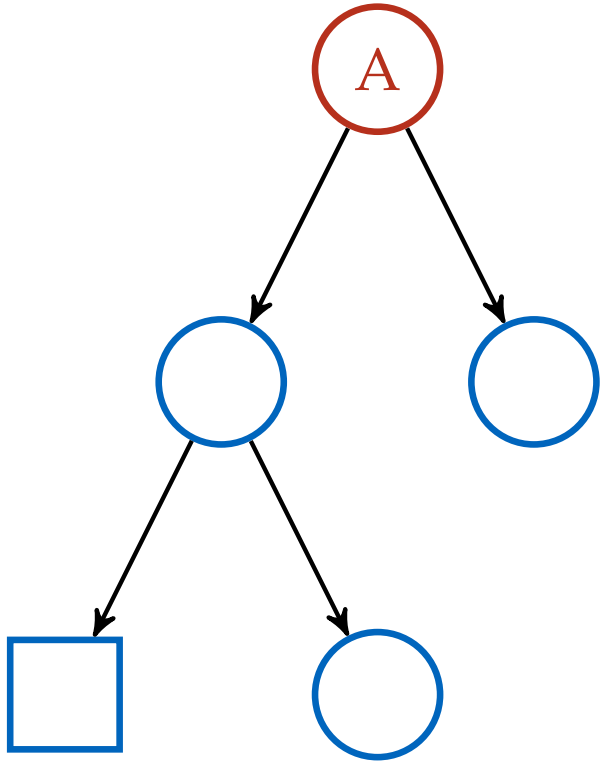

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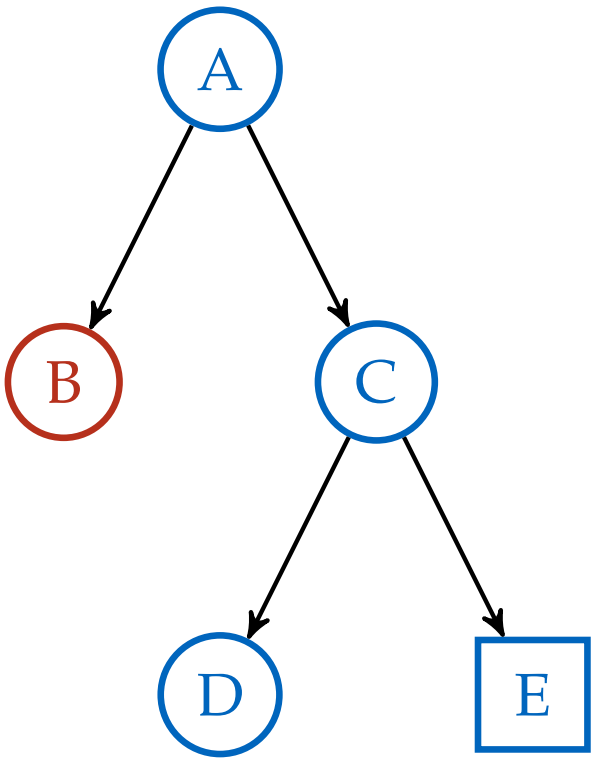

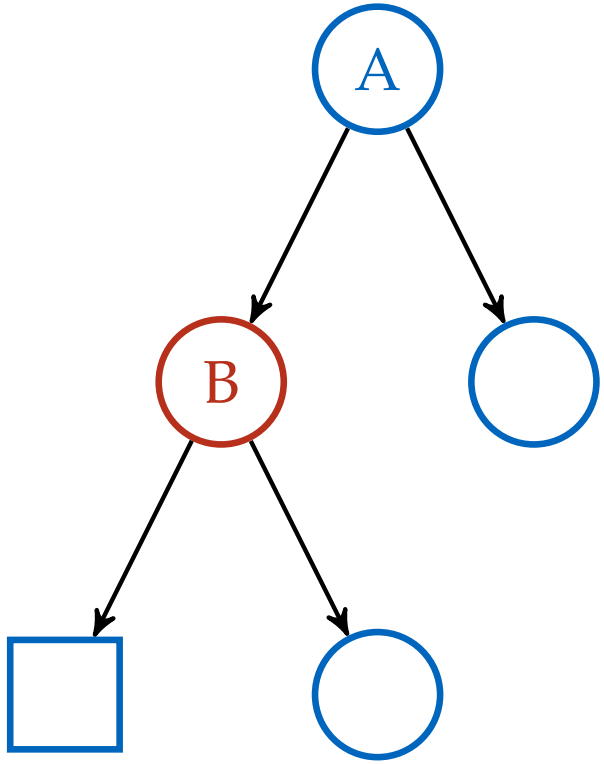

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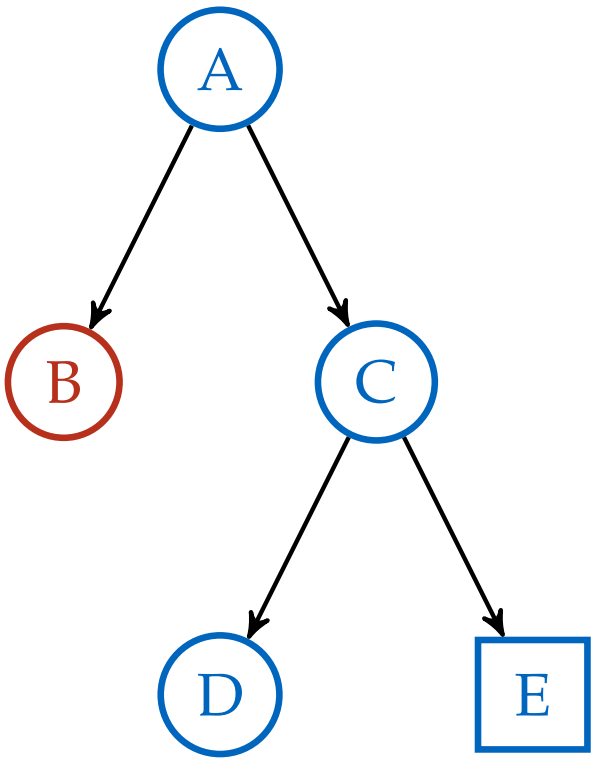

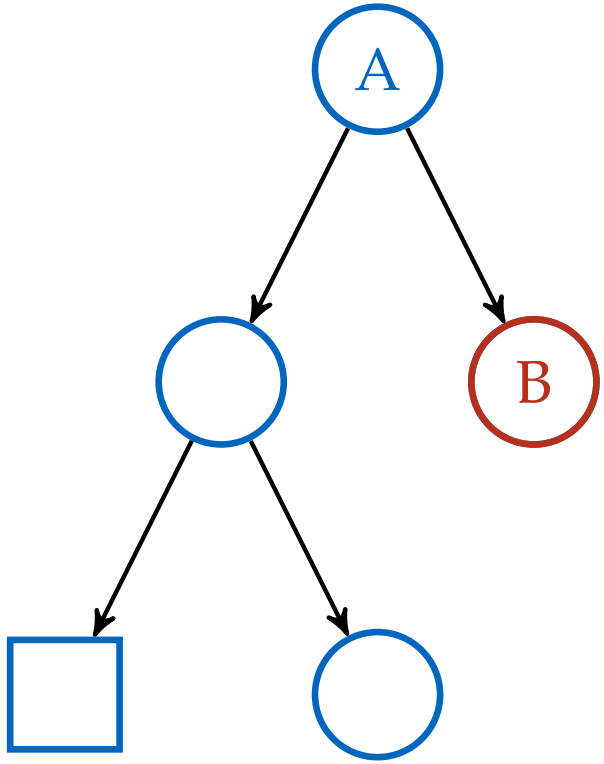

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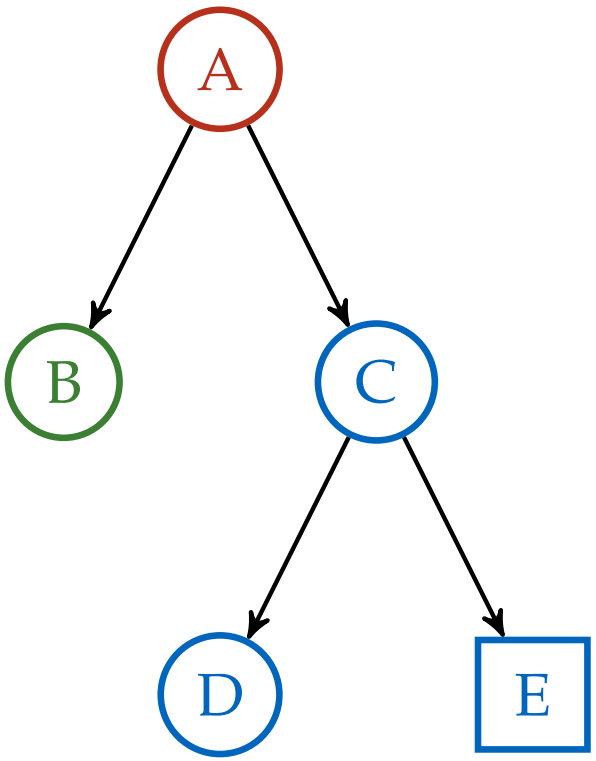

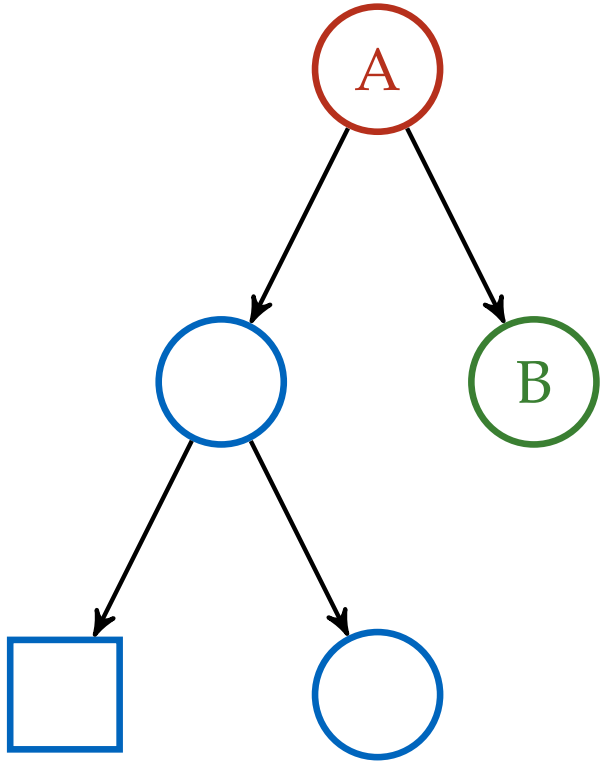

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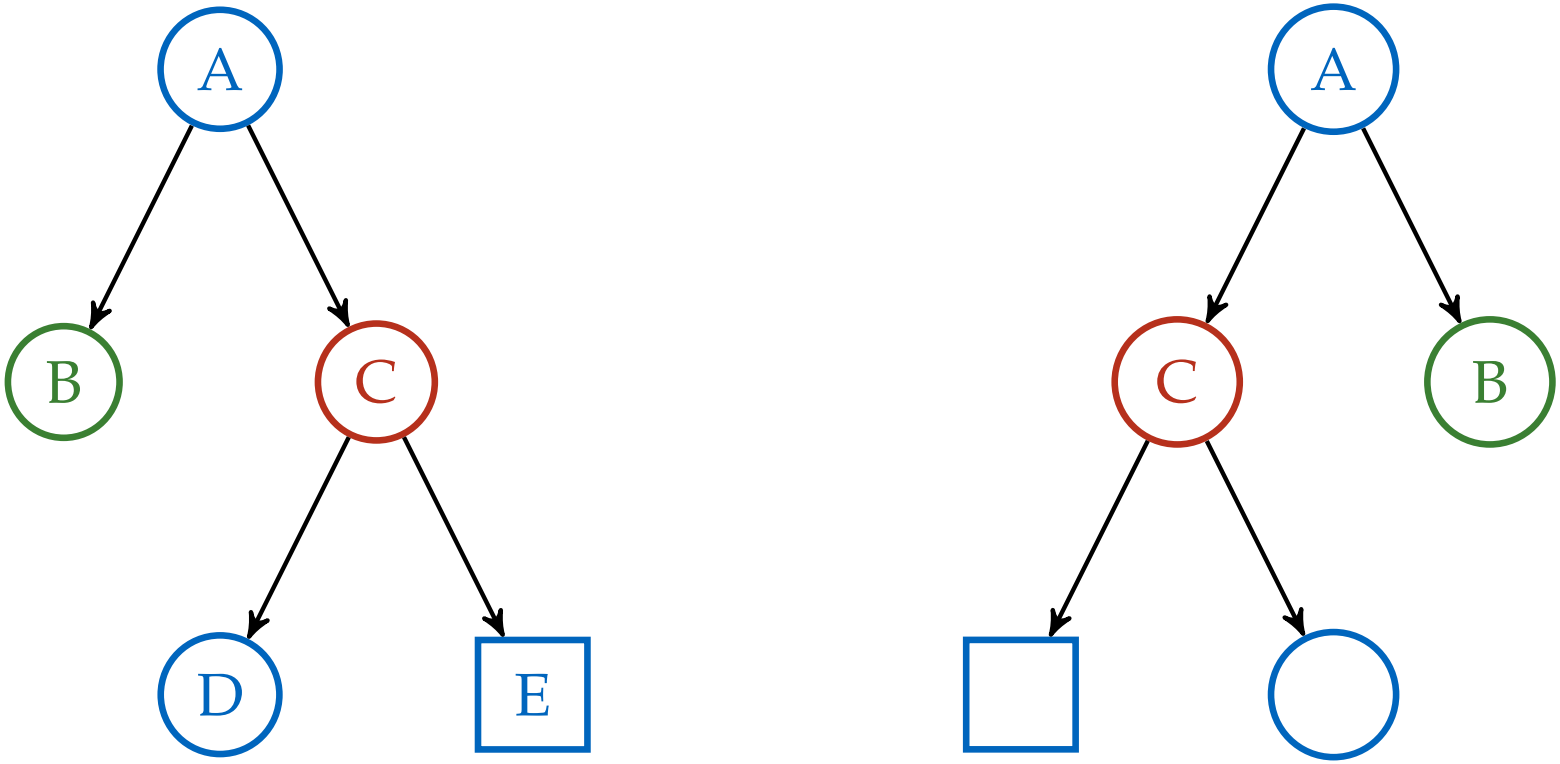

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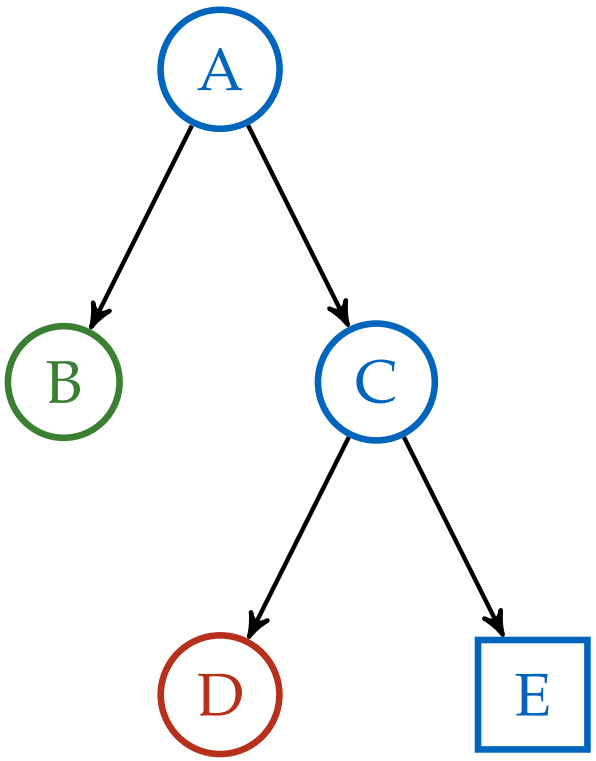

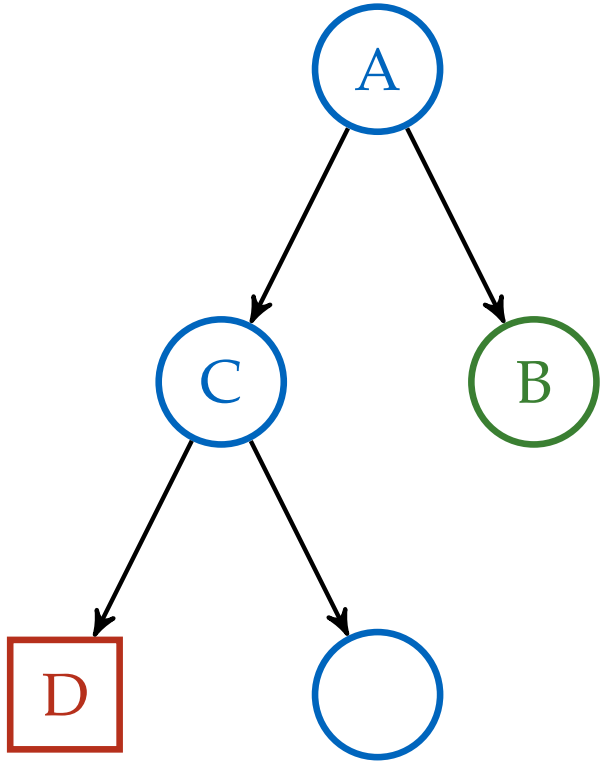

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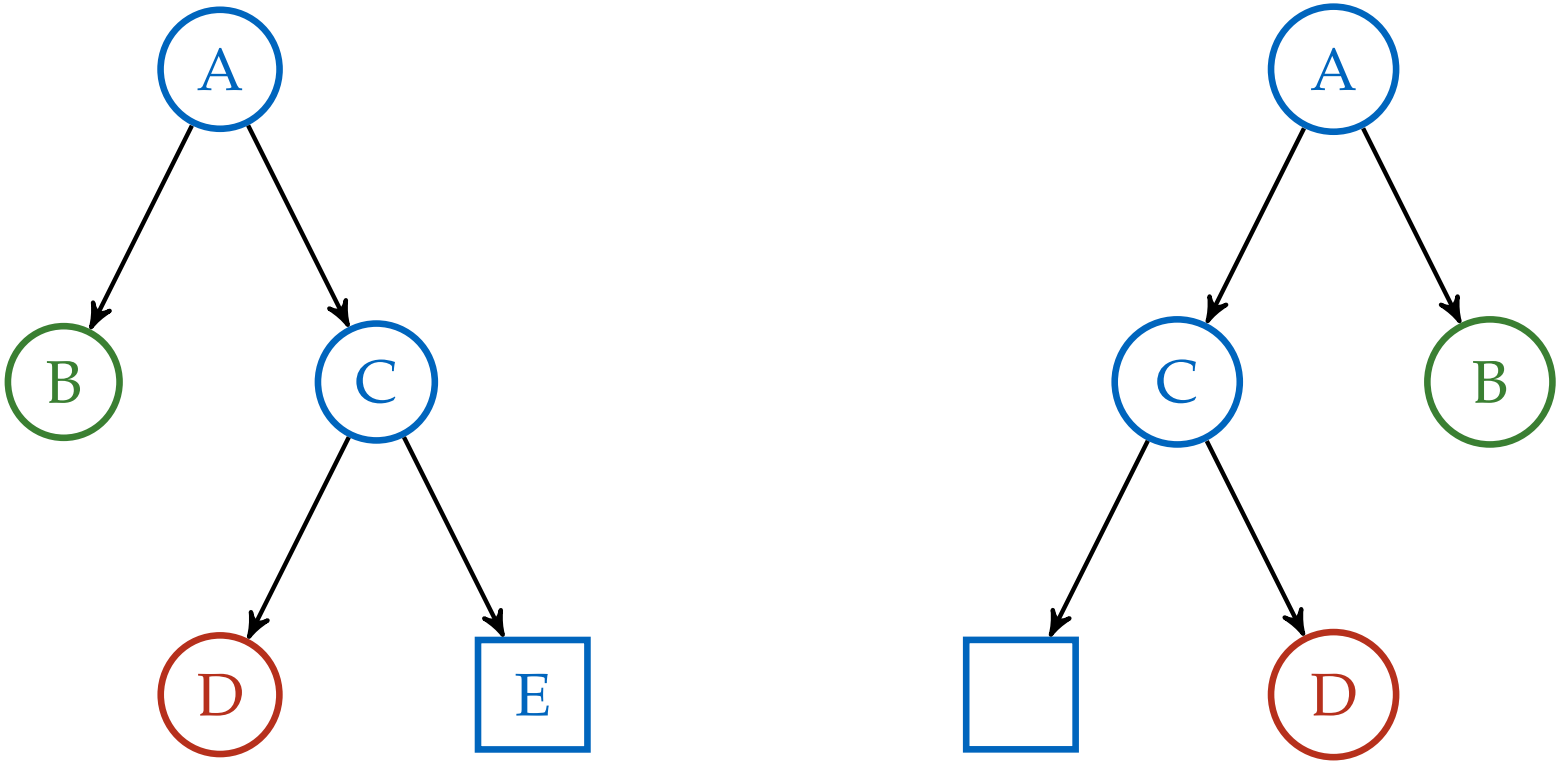

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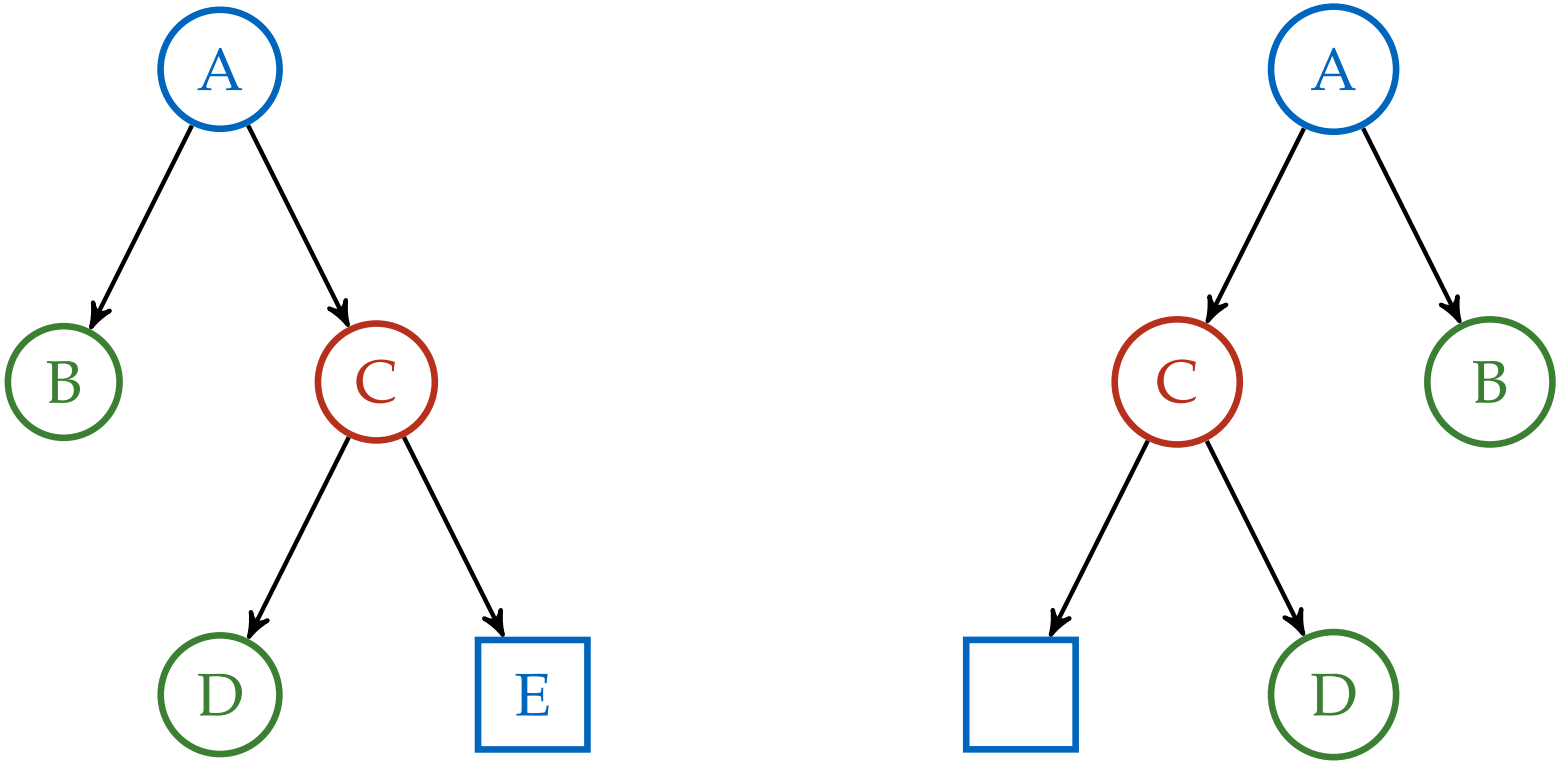
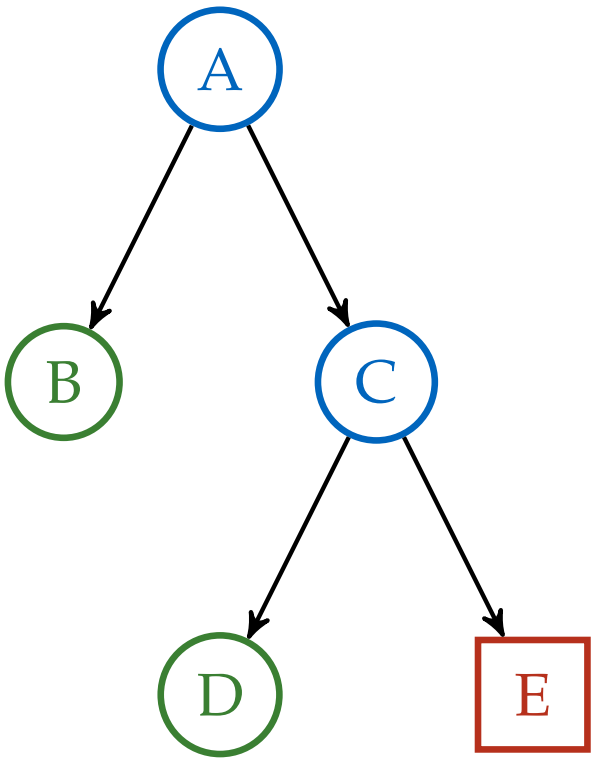
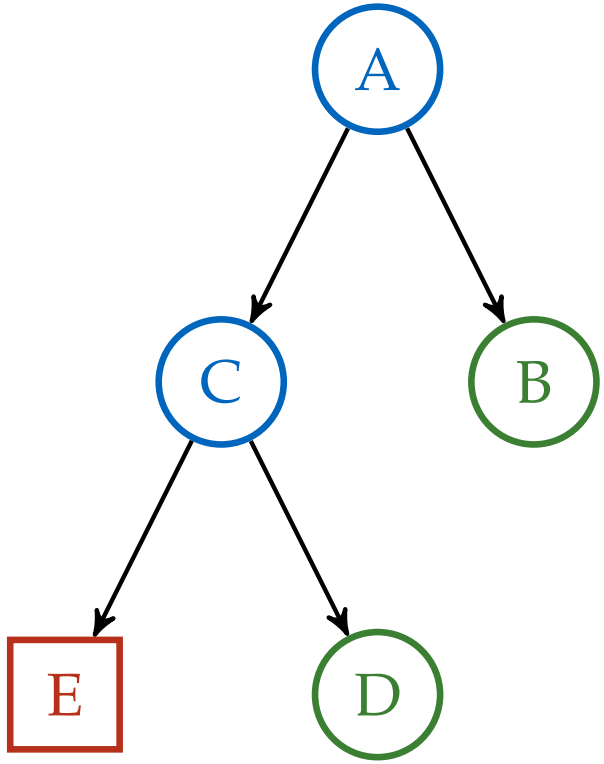


Graph Comparison





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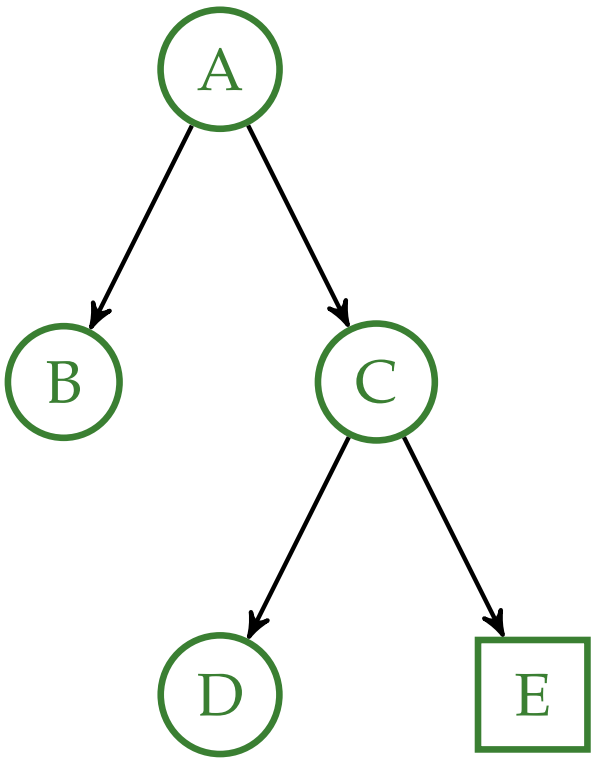
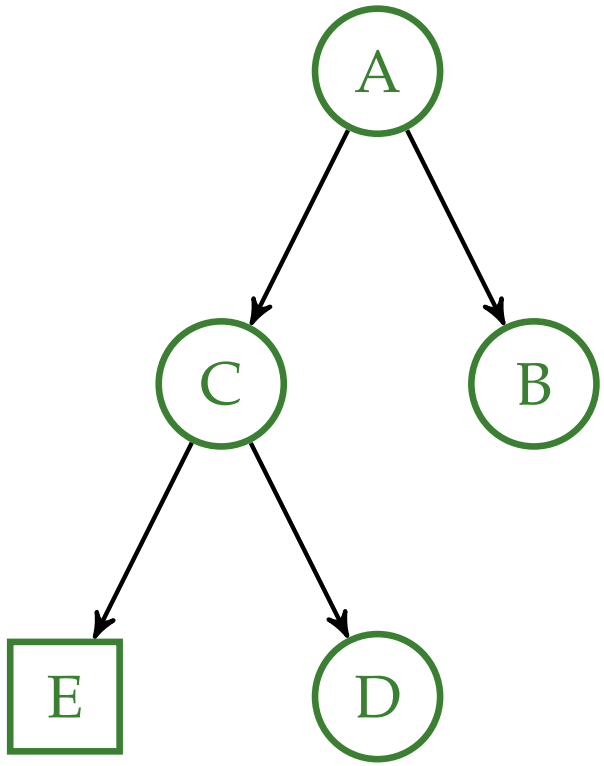
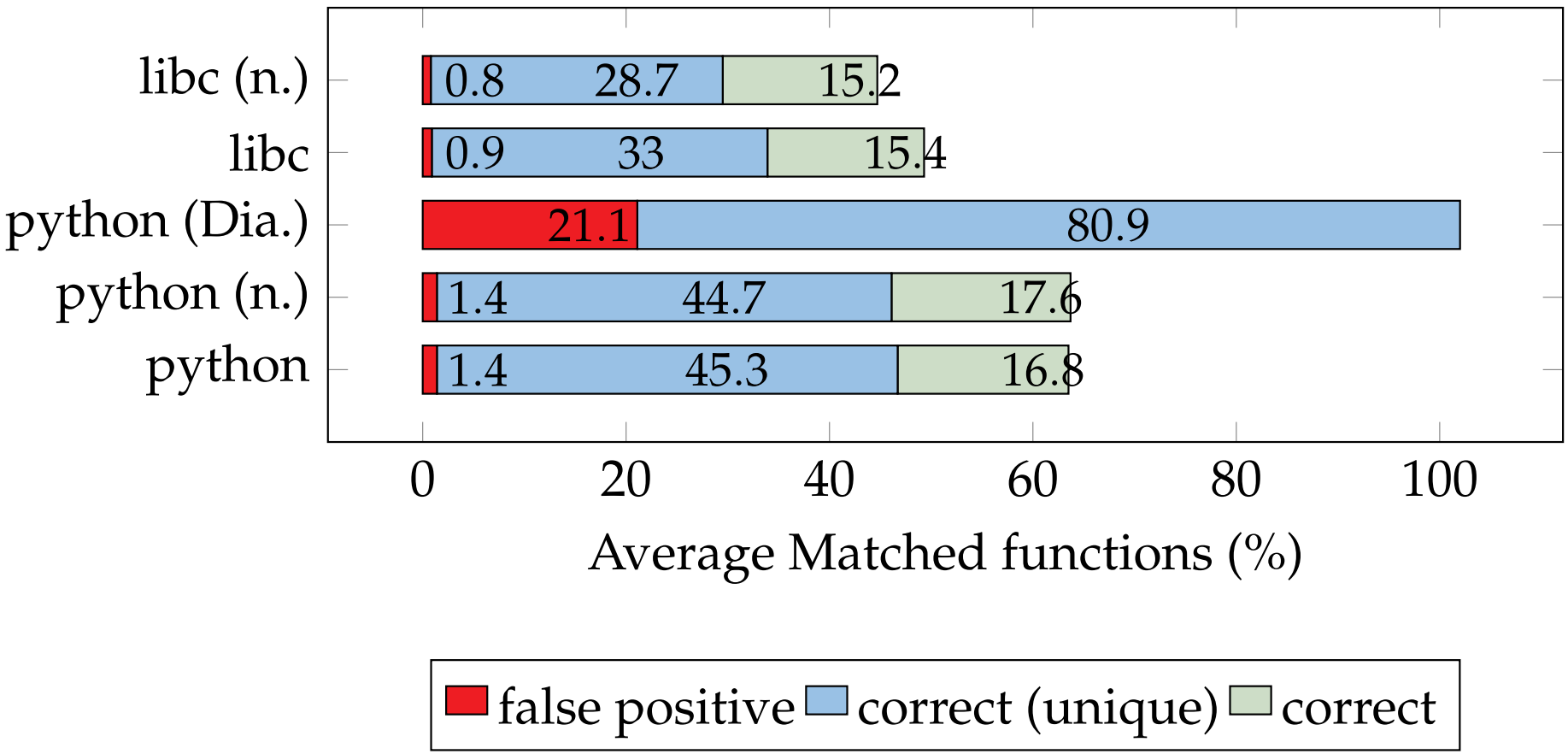
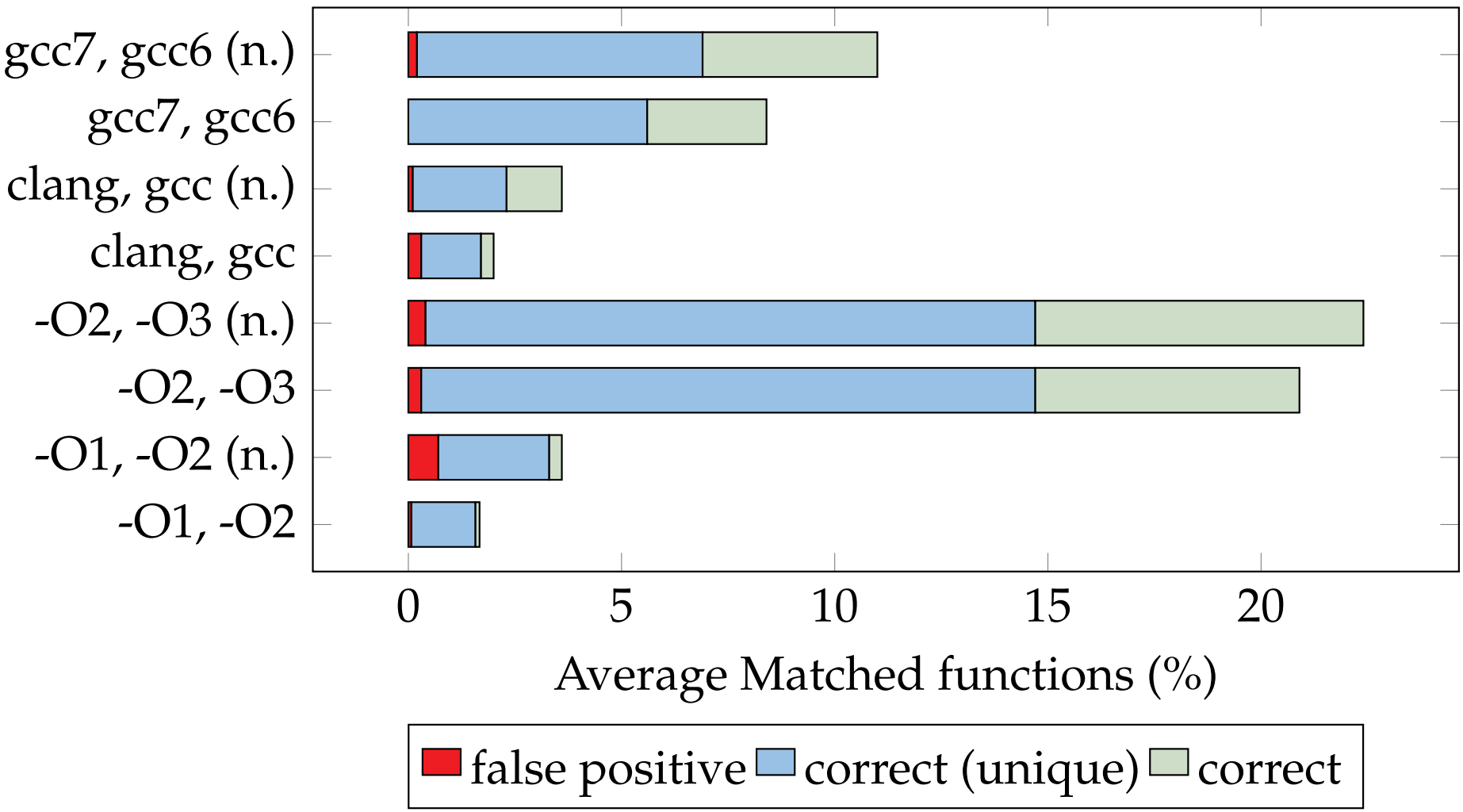




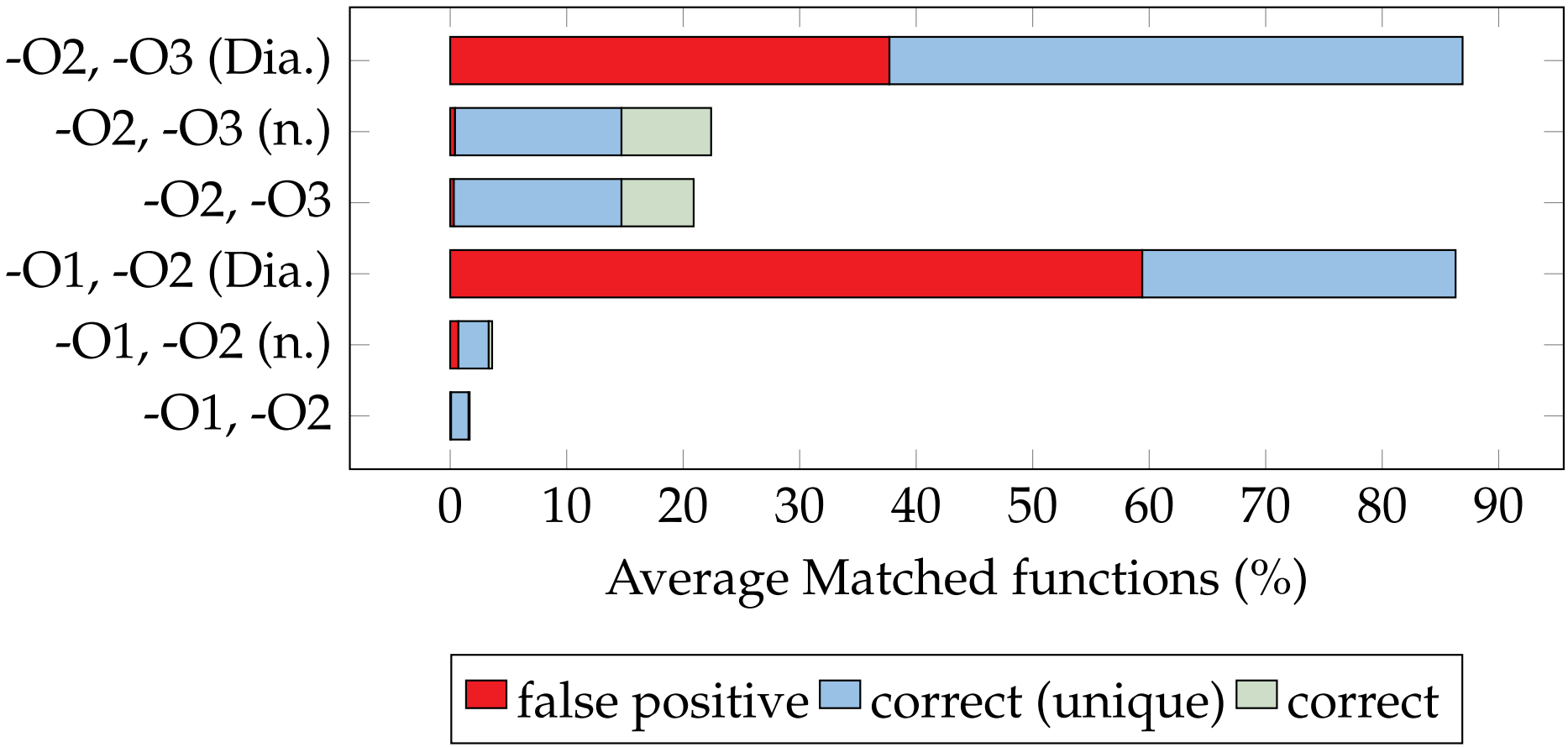
Results


libc (n.)
libc
python (Dia.)
python (n.)
python
0.8
28.7
15.2
0.9
33
15.4
21.1
80.9
1.4
44.7
17.6
1.4
45.3
16.8
0
20
40
60
80
100
Average Matched functions (%)
false positive
correct (unique)
correct

Results


gcc7, gcc6 (n.)
gcc7, gcc6
clang, gcc (n.)
clang, gcc
-O2, -O3 (n.)
-O2, -O3
-O1, -O2 (n.)
-O1, -O2
0
5
10
15
20
Average Matched functions (%)
false positive
correct (unique)
correct

Results


-O2, -O3 (Dia.)
-O2, -O3 (n.)
-O2, -O3
-O1, -O2 (Dia.)
-O1, -O2 (n.)
-O1, -O2
0
10
20
30
40
50
60
70
80
90
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Thanks

jonischk [at] sec.in.tum.de `https://github.com/leetonidas/signatures`