Constant Propagation

overview of algorithm

- Build control flow graph
- Perform symbolic evaluation
  - Keep track of whether variables are constant or not
- Replace constant-valued variable uses with their values, try to simplify expressions and control flow

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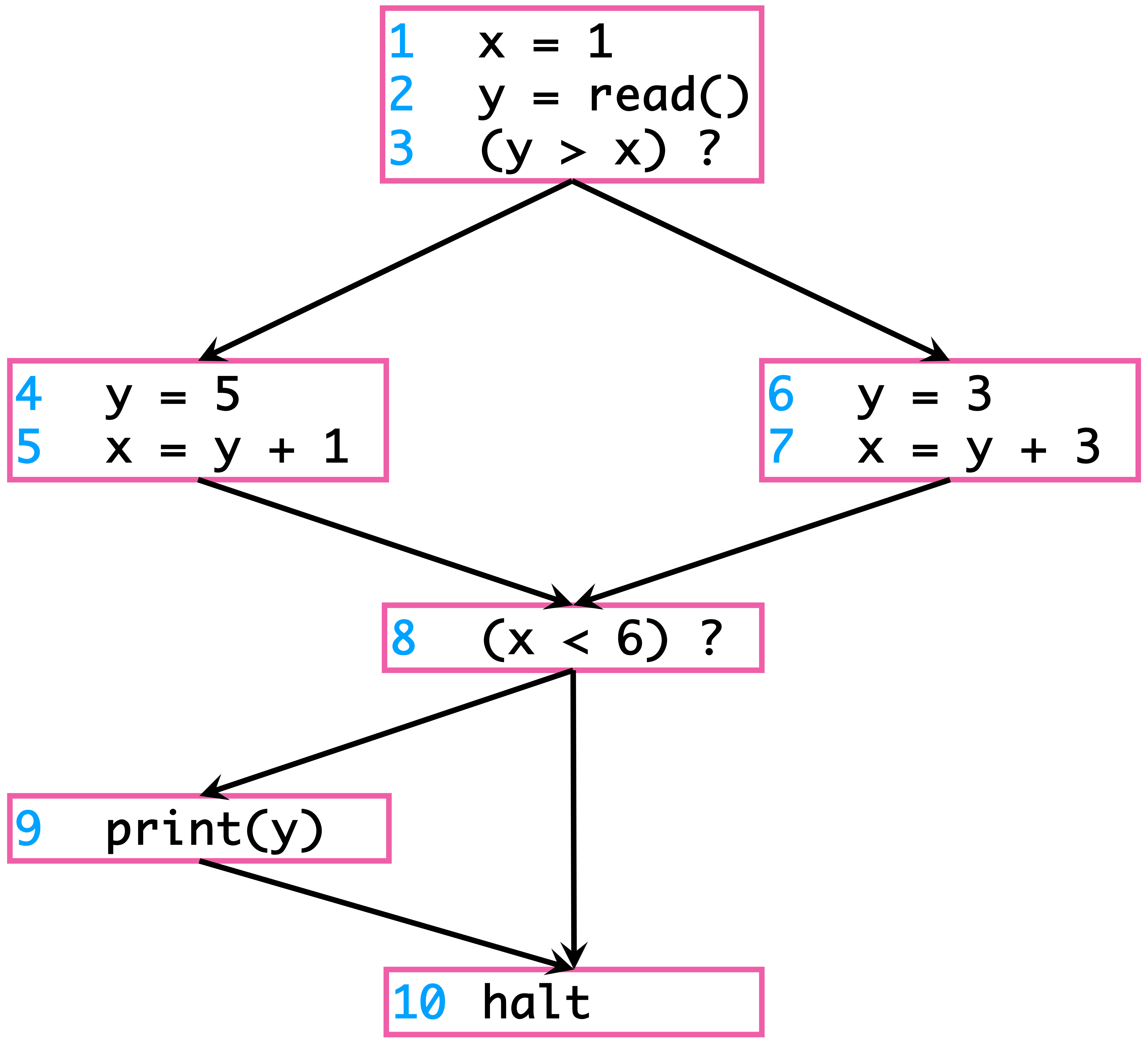
build control flow graph

```
x = 1;
y = read()
if (y > x)
  y = 5;
  x = y + 1;
else
  y = 3;
  x = y + 3;
if (x < 6)
  print(y);
```



statement level cfg

- When evaluating a piece of code, we care about individual statements, not basic blocks
    - Need to know the value of variables *right before a statement executes* to figure out what the statement does
- Create a new version of the CFG with one node per *statement* instead of per basic block
    - Also helpful to explicitly mark where control flow paths *merge*

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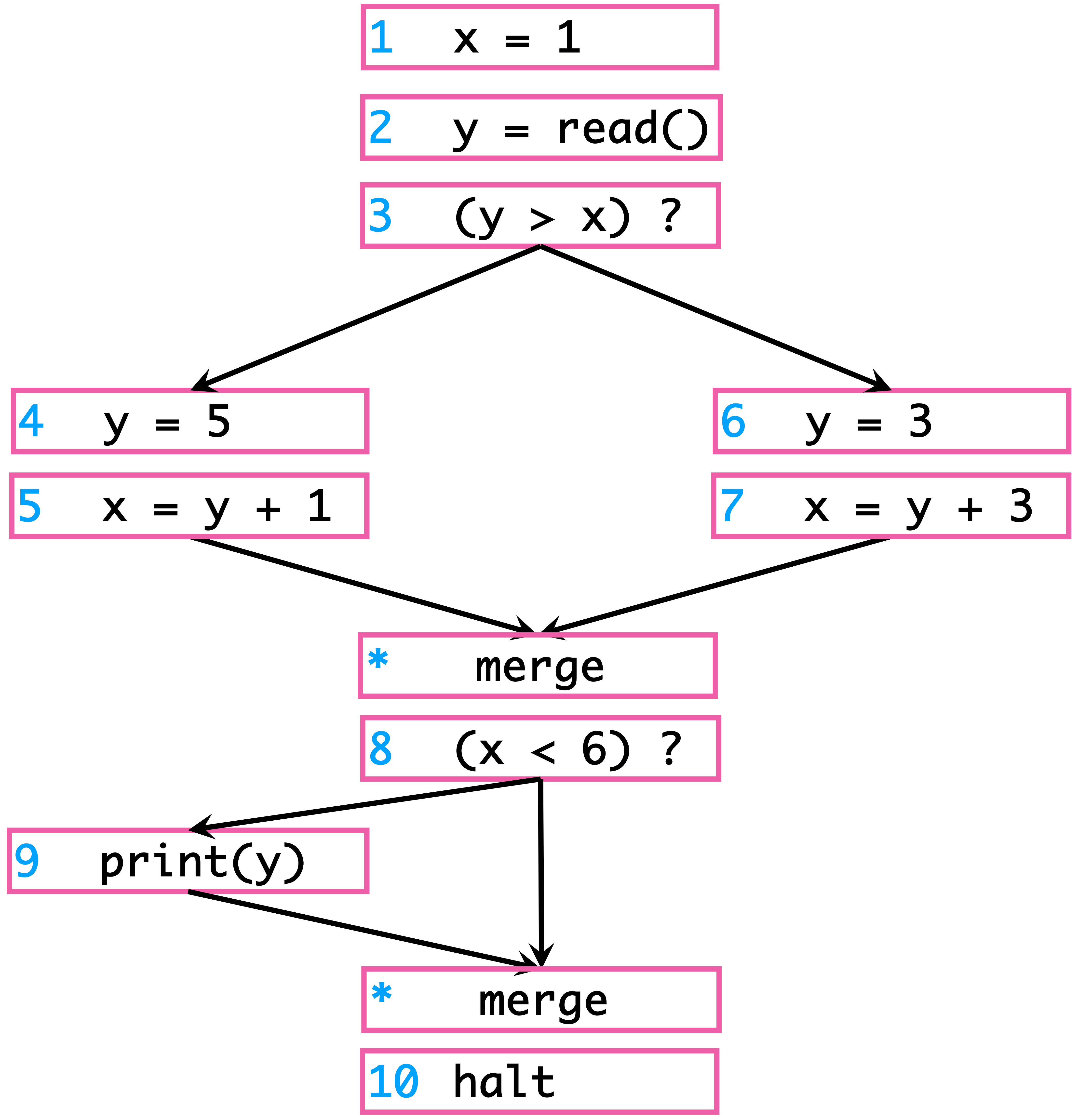
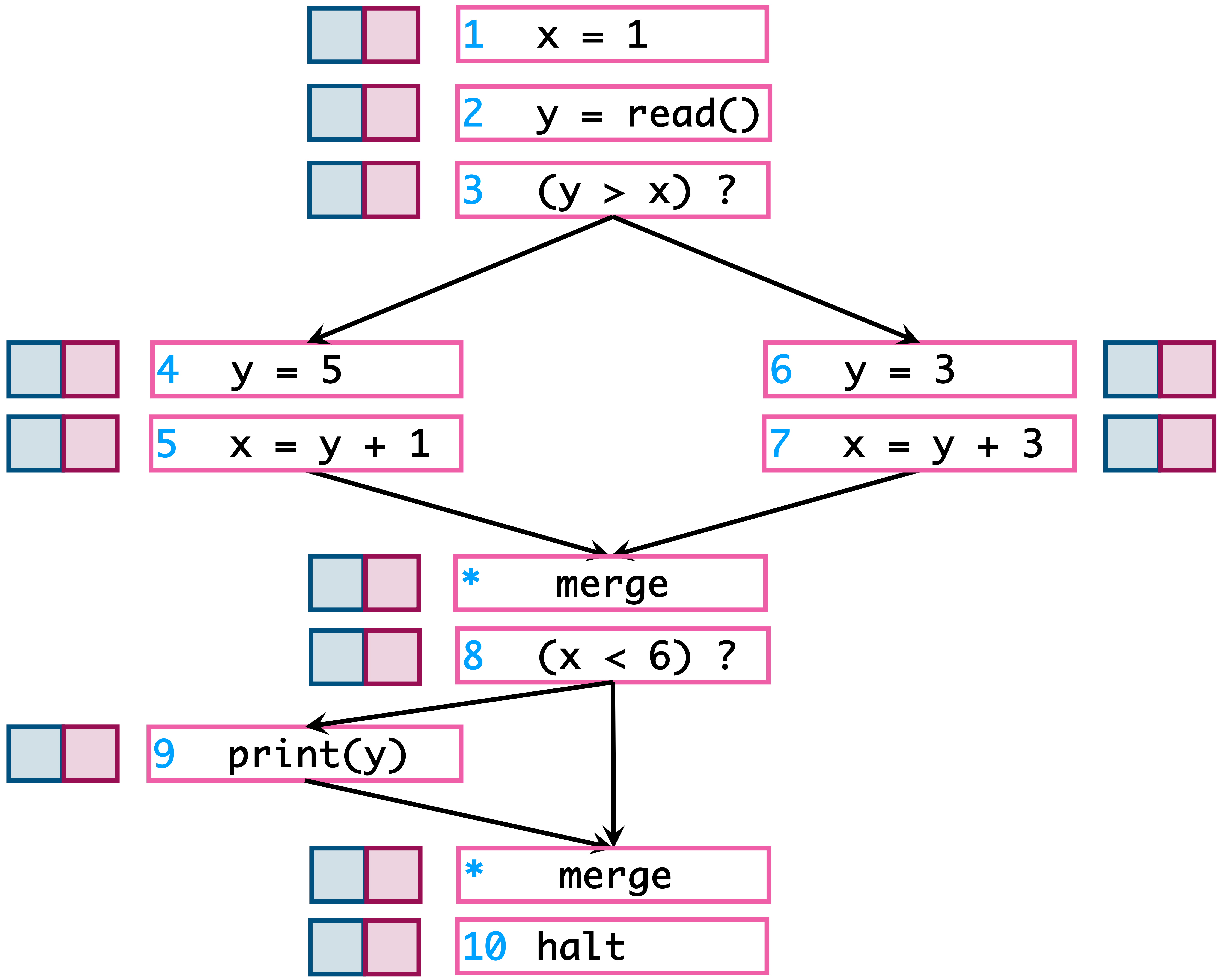


executing a cfg

- When we *concretely* execute a CFG, we are executing a program
- Keep track of values of variables before each statement
- Execute statement to determine values after the statement executes
- Evaluate conditionals to choose which path to take



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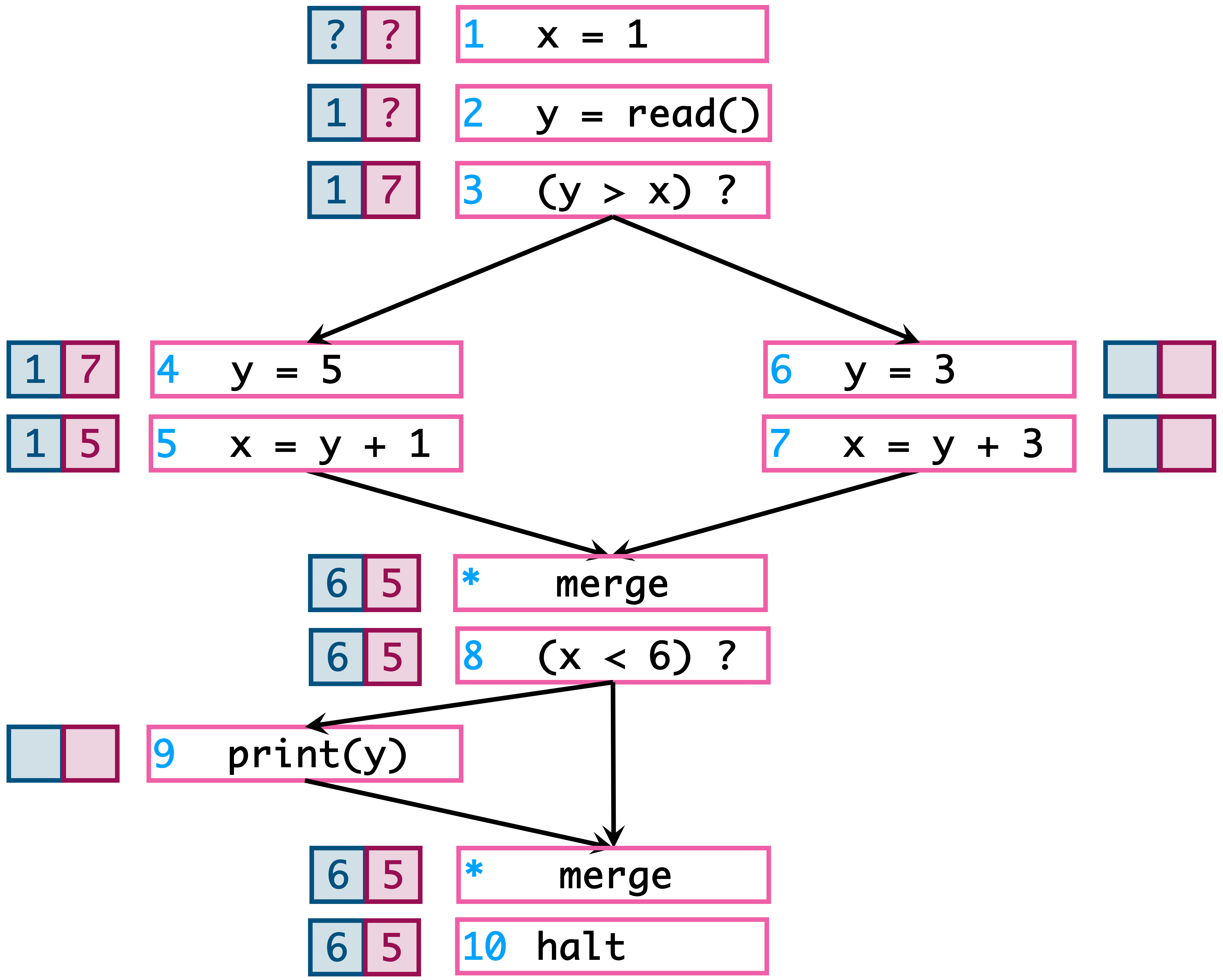

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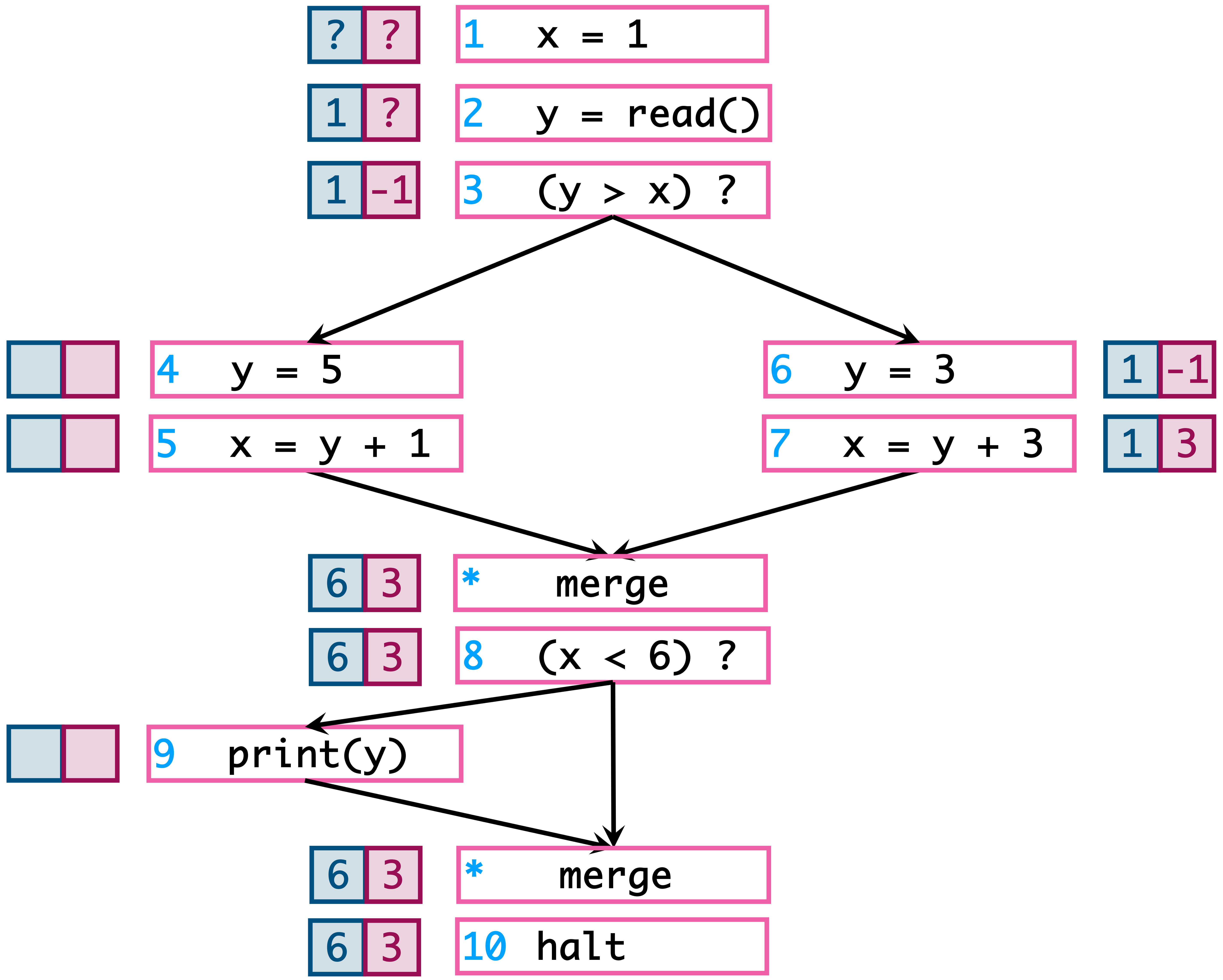
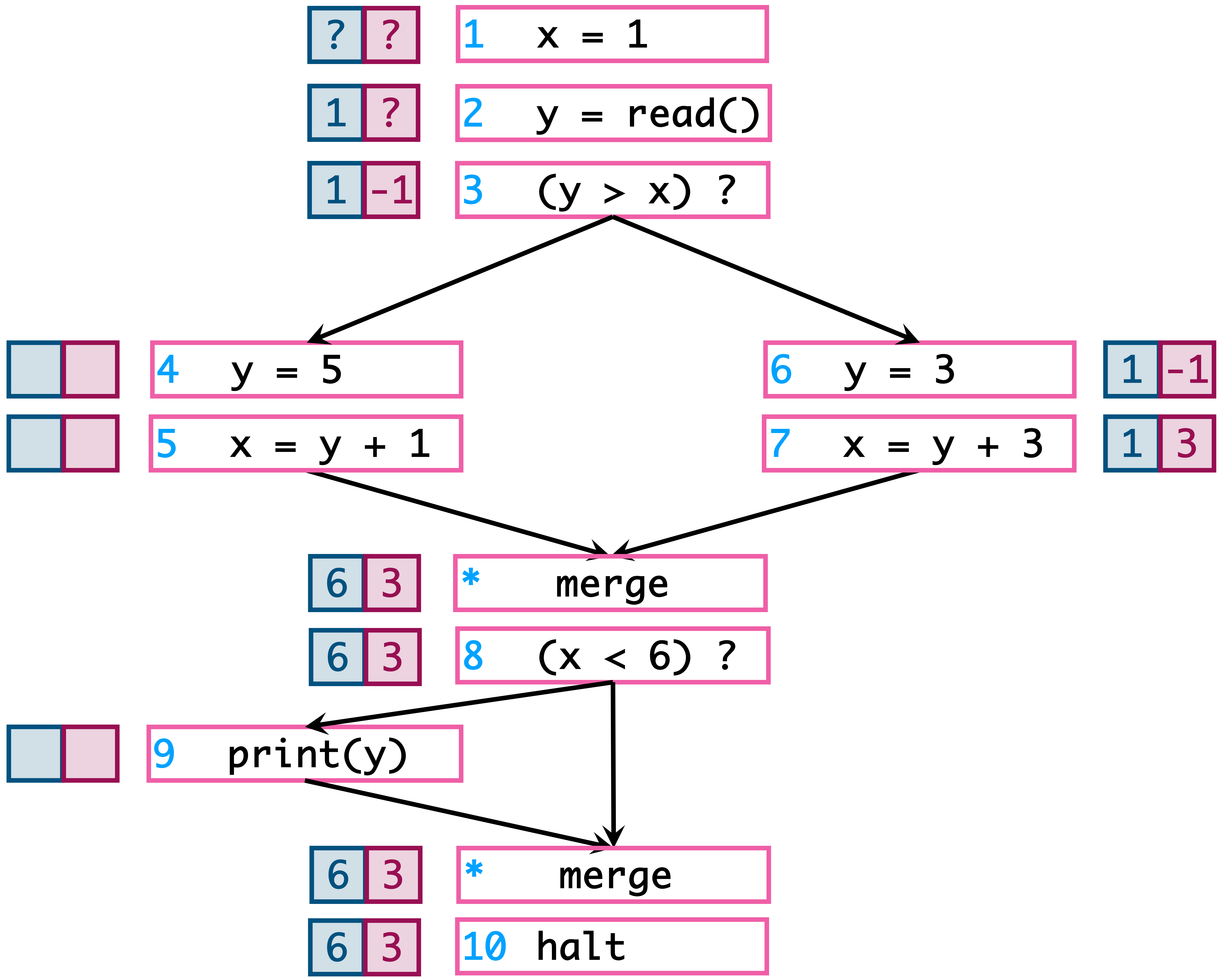


executing a cfg

- No matter what line 2 does, x always has the value 6 at line 8
- print statement never executes
- How can we figure this out?



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next: symbolic evaluation