Conditionals

Control Flow Statements

Thus far, all our programs execute in a linear fashion

Control flow statements enable our programs to have various types of branching

We'll see three types of control flow statements

- conditionals
- loops
- methods

Conditional Statements

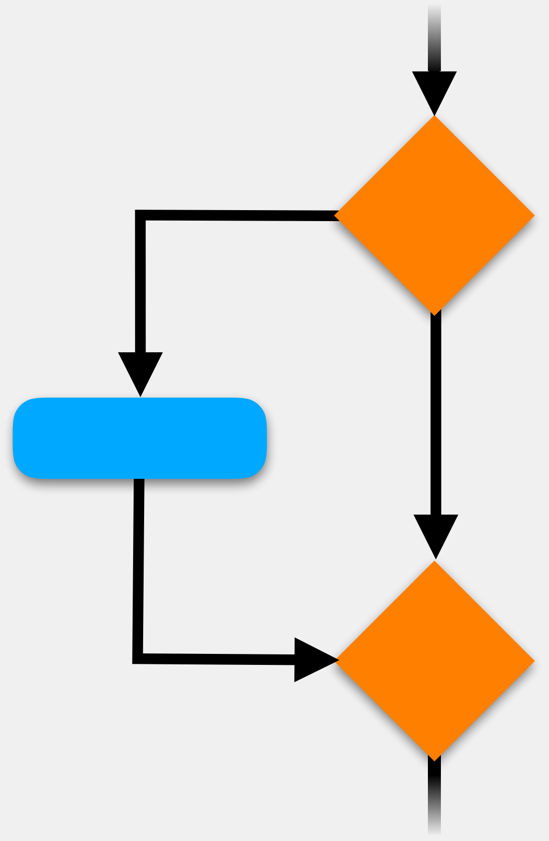
Basic premise: *if* some expression is true, then execute this code

- “If the user’s purchase is more than $50, do not charge shipping”

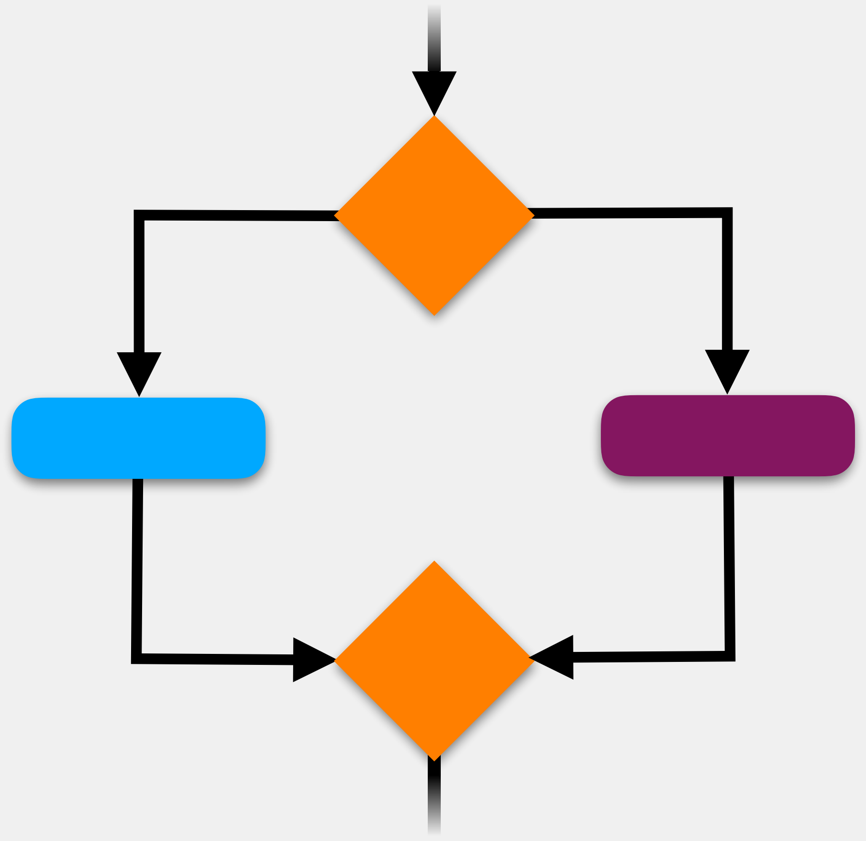
More complex conditional statements enable different logic

- “If there are 8 or more people eating, then charge 20% gratuity. Otherwise, charge 15% gratuity.”
- “If income is less than $25,000, tax at a rate of 15%. If income is $25,000-$50,000, tax at a rate of 20%. If income is greater than $50,000, tax at a rate of 25%.”

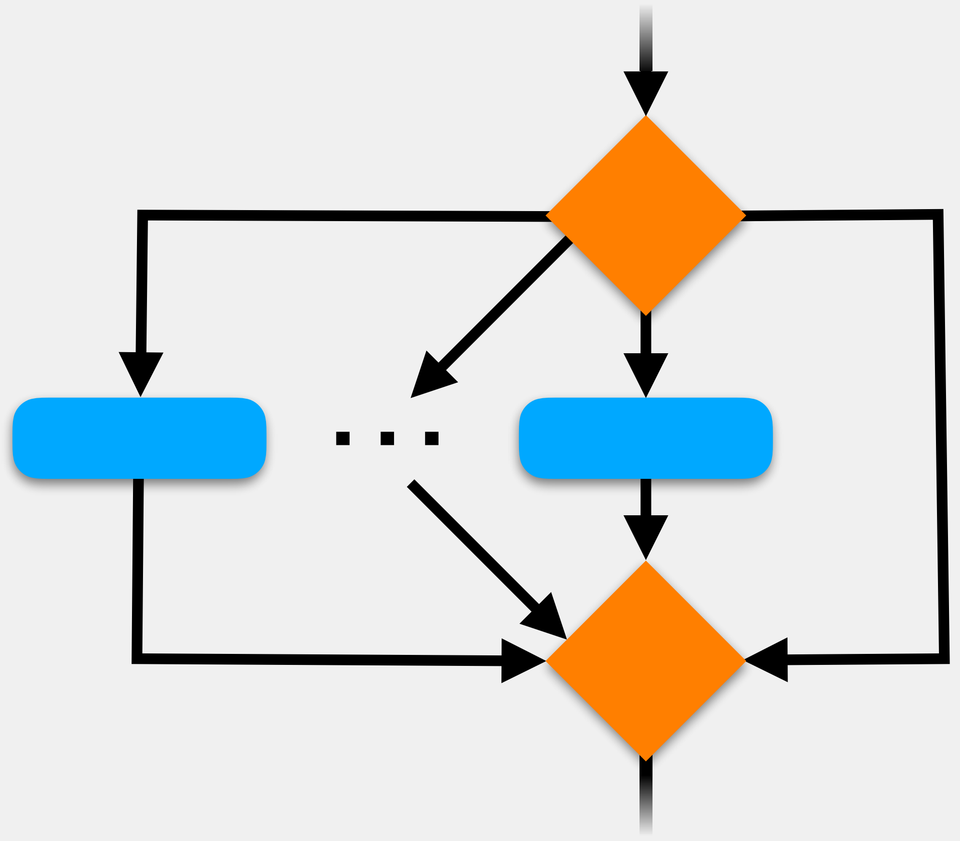
Types of Conditional Statements



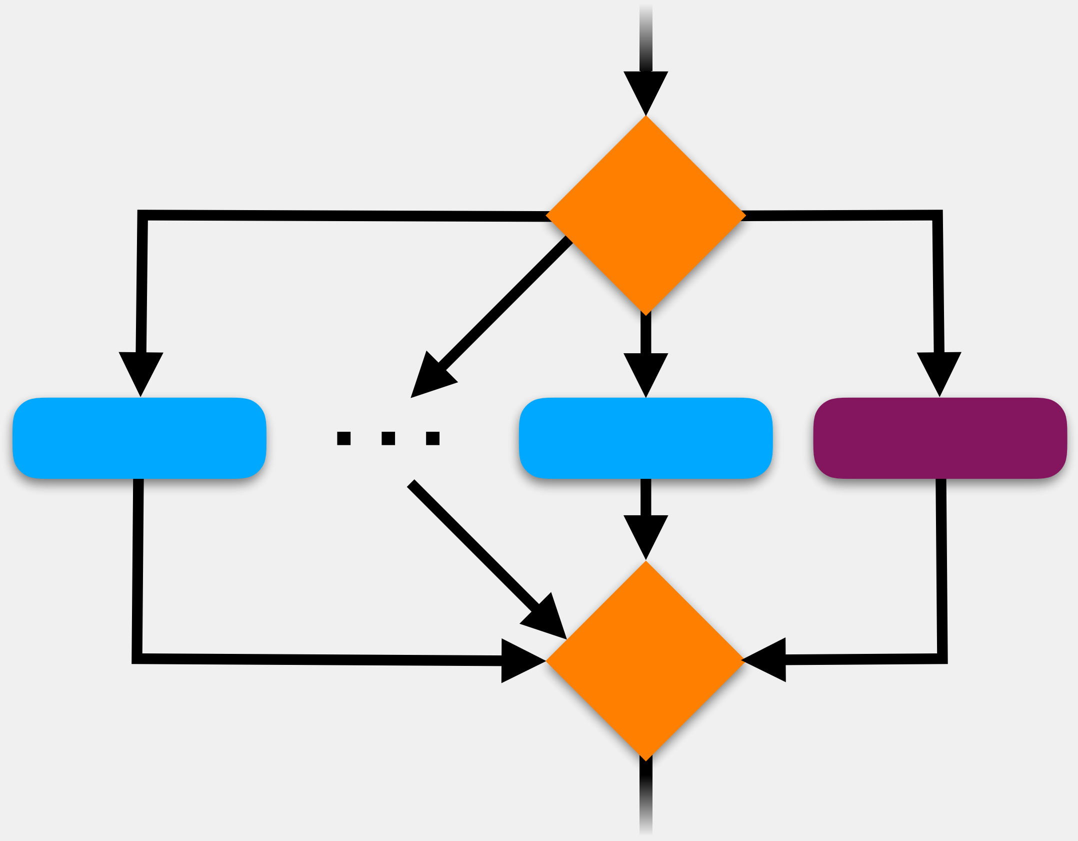
`if` statements



`if-else` statements

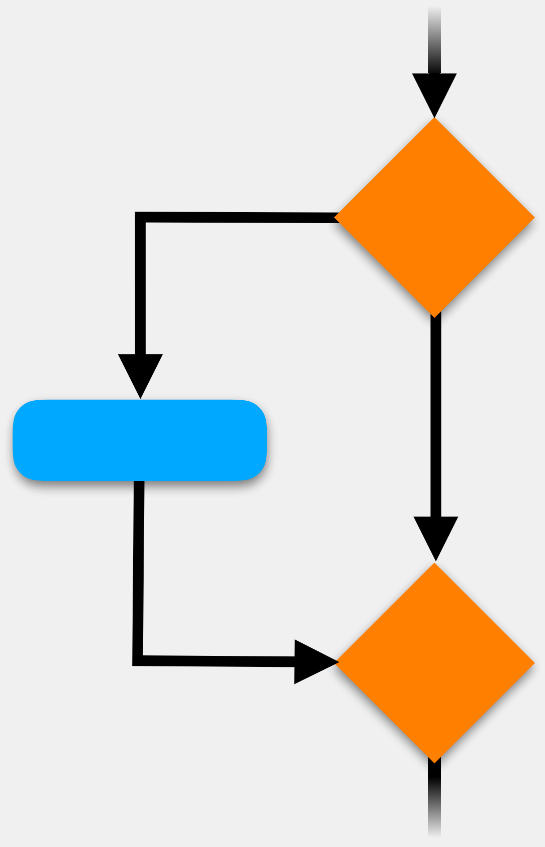


`if-else if` statements

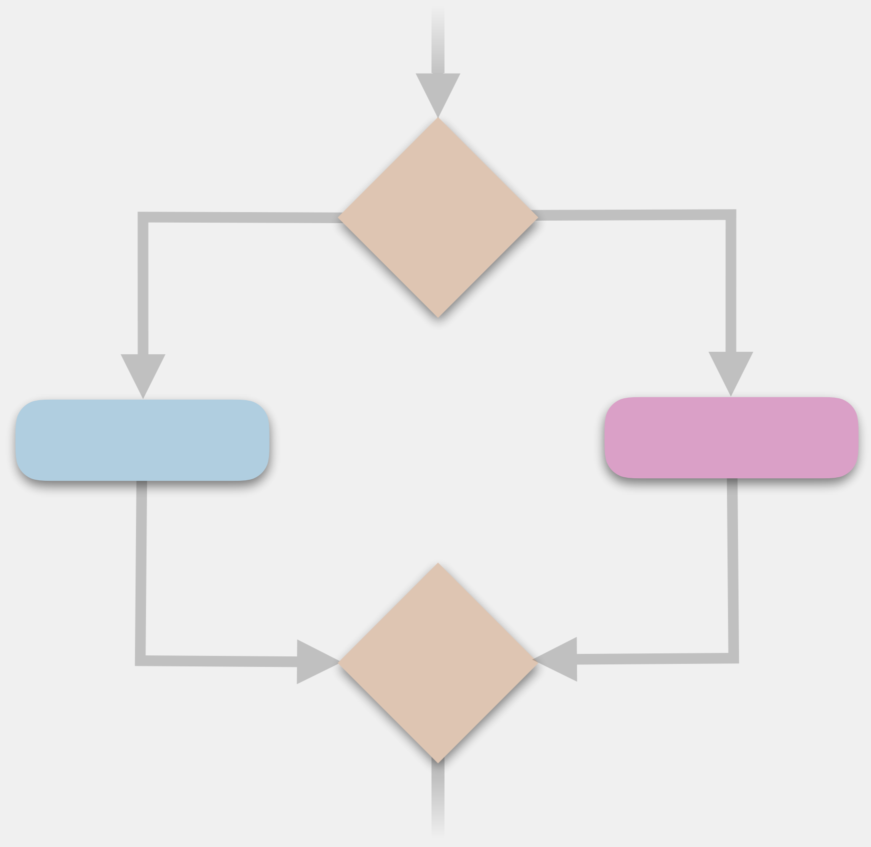


`if-else if-else` statements

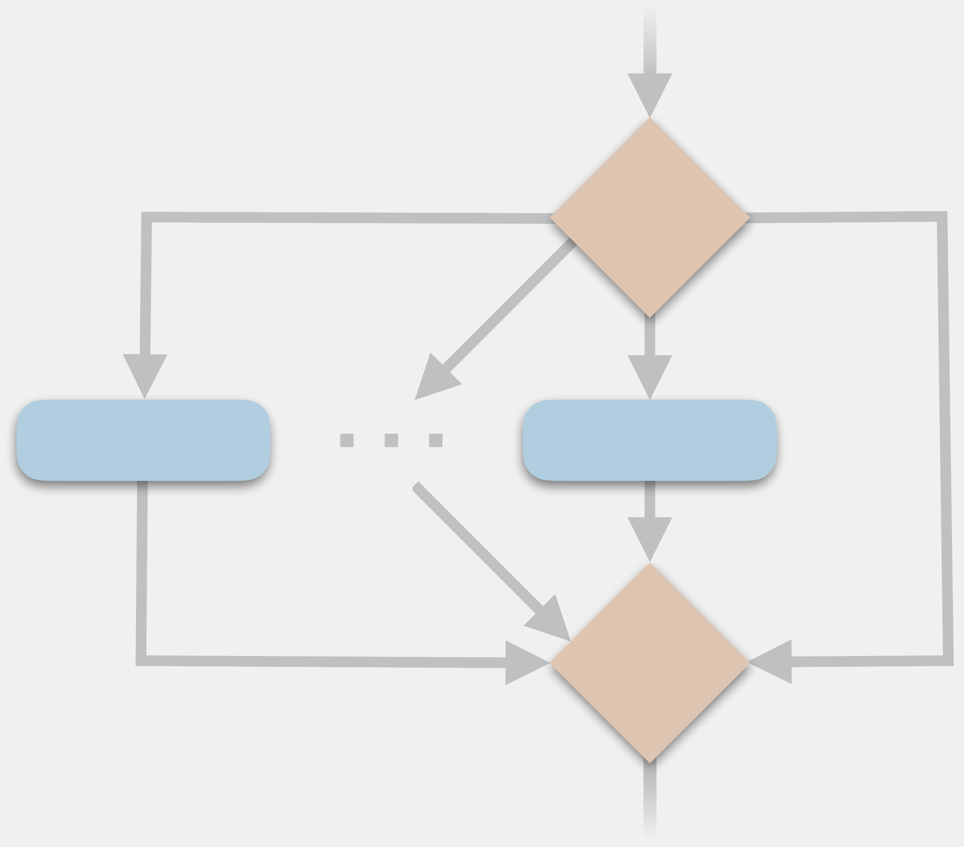
Types of Conditional Statements



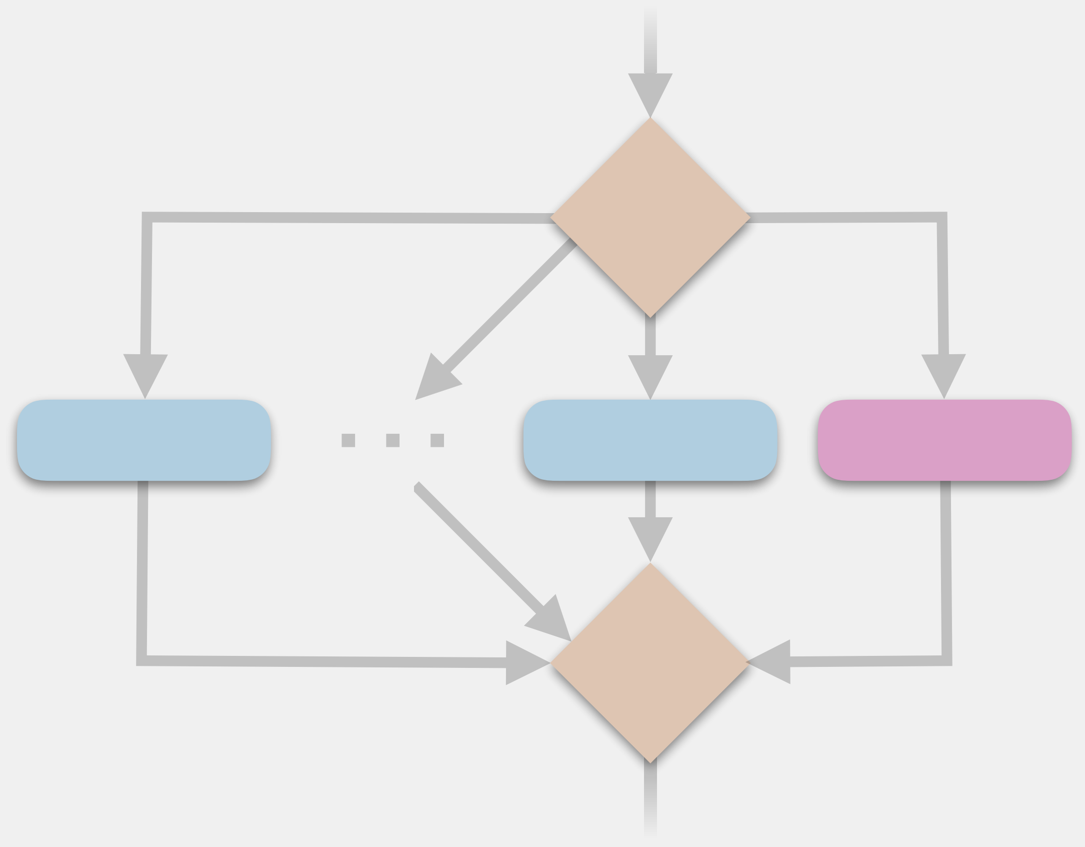
`if` statements



`if-else` statements



`if-else if` statements



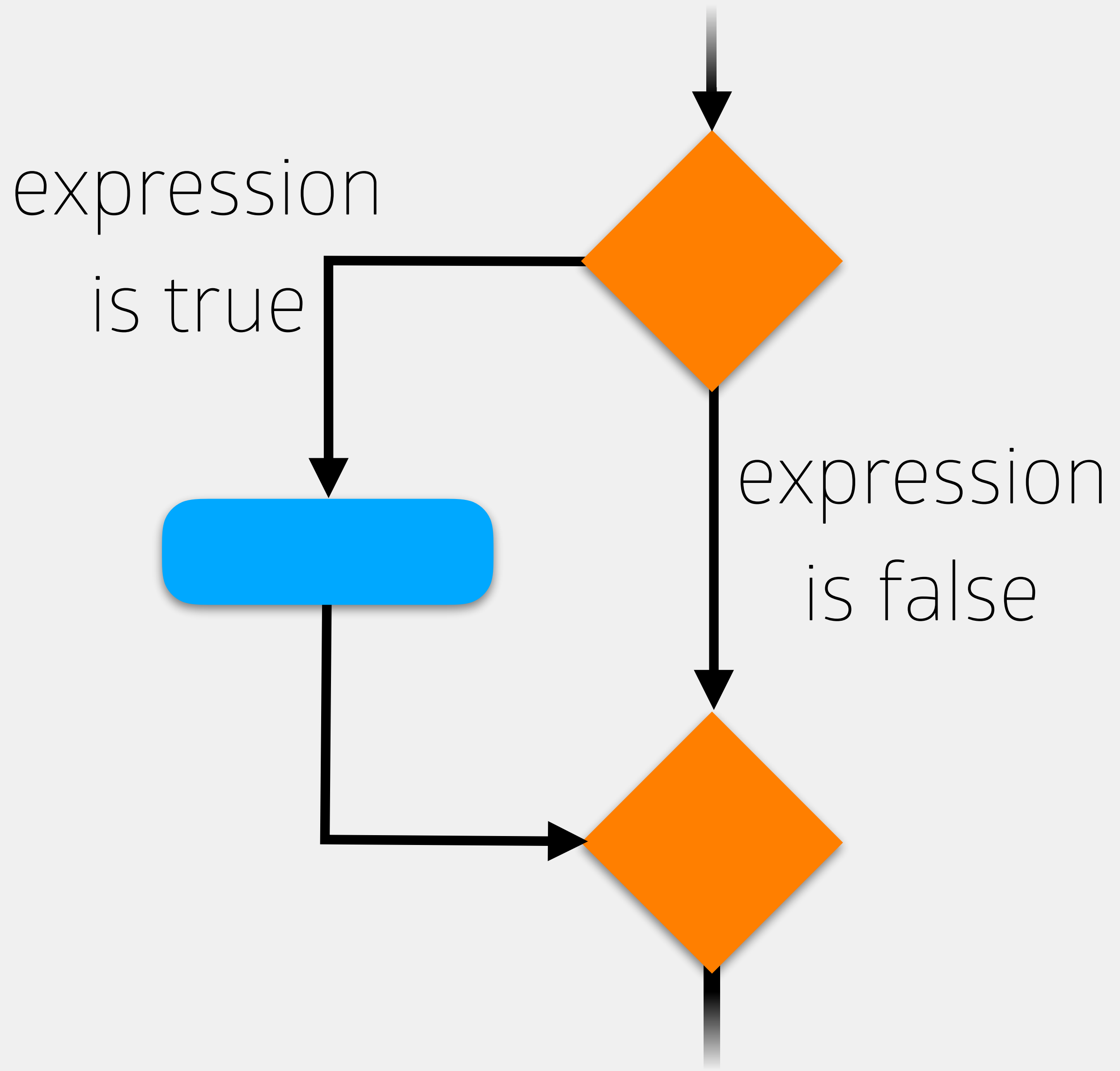
`if-else if-else` statements

if Statements

Allows us to make a decision on whether or not to execute some code

if the boolean expression is true, execute the code in the brackets

otherwise (i.e., if the boolean expression is false), skip the code in the brackets



```
if (<boolean expression>) {
    //code to execute if boolean expression is true
}

//code to execute after if statement
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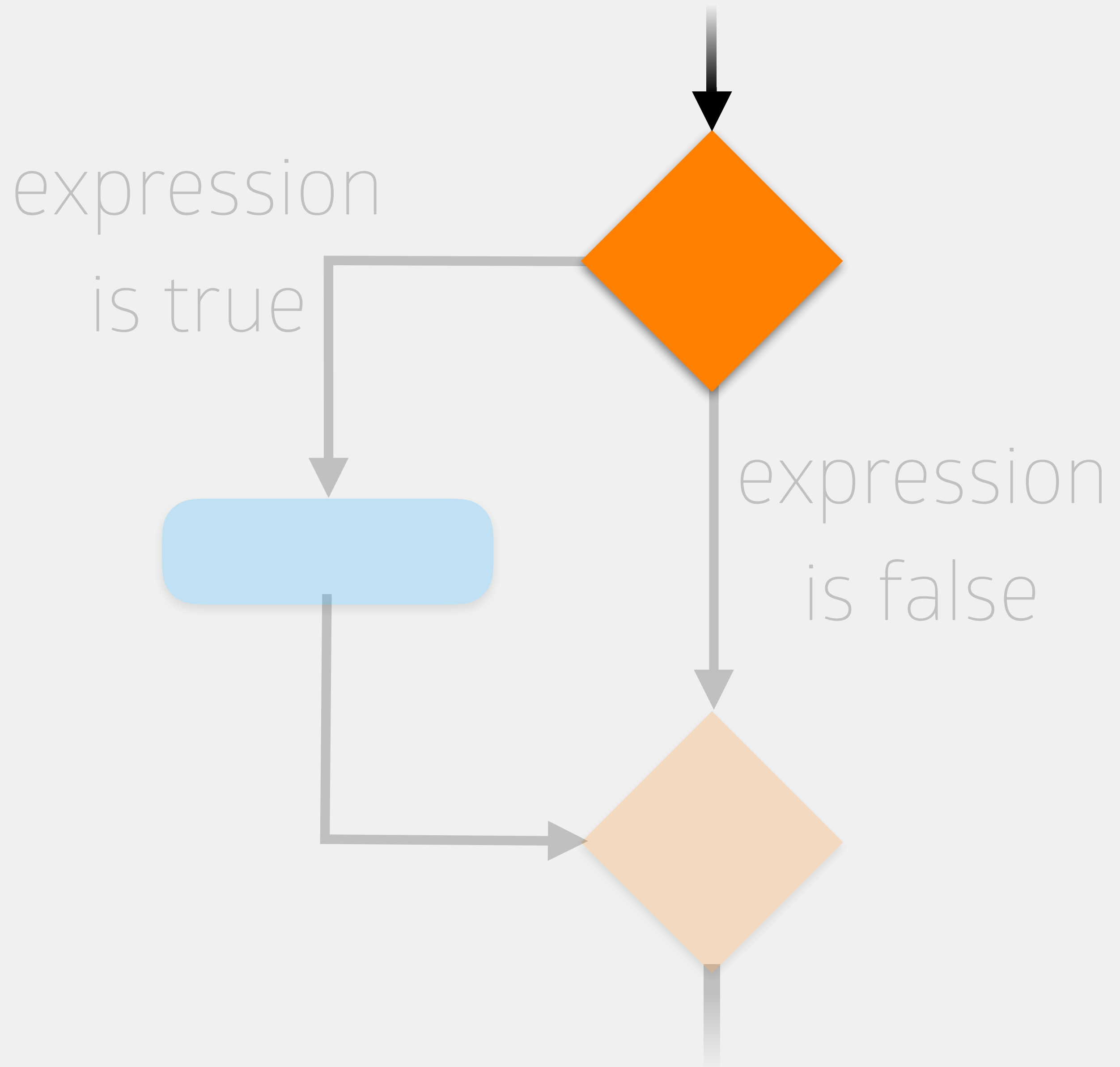

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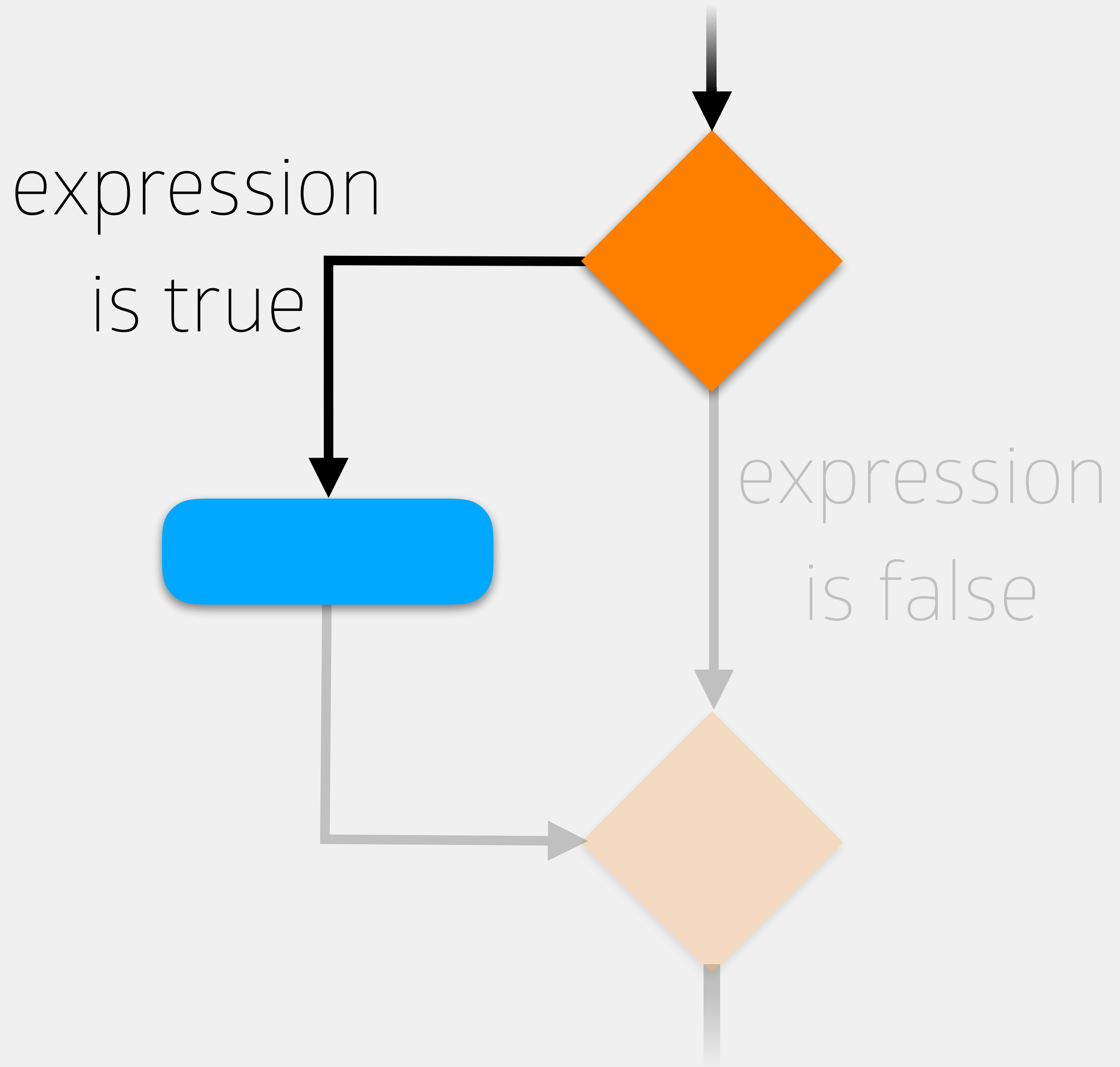

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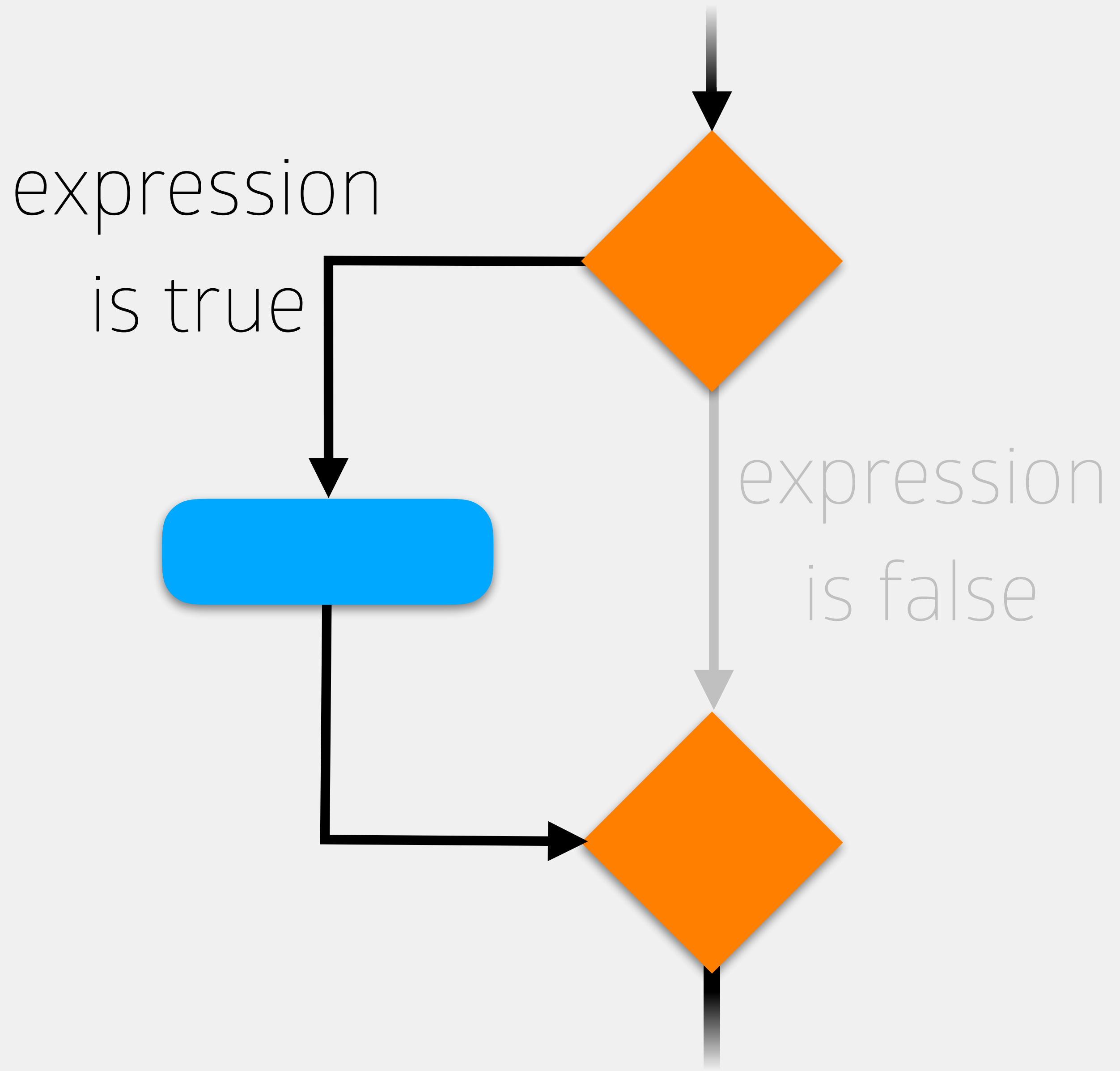

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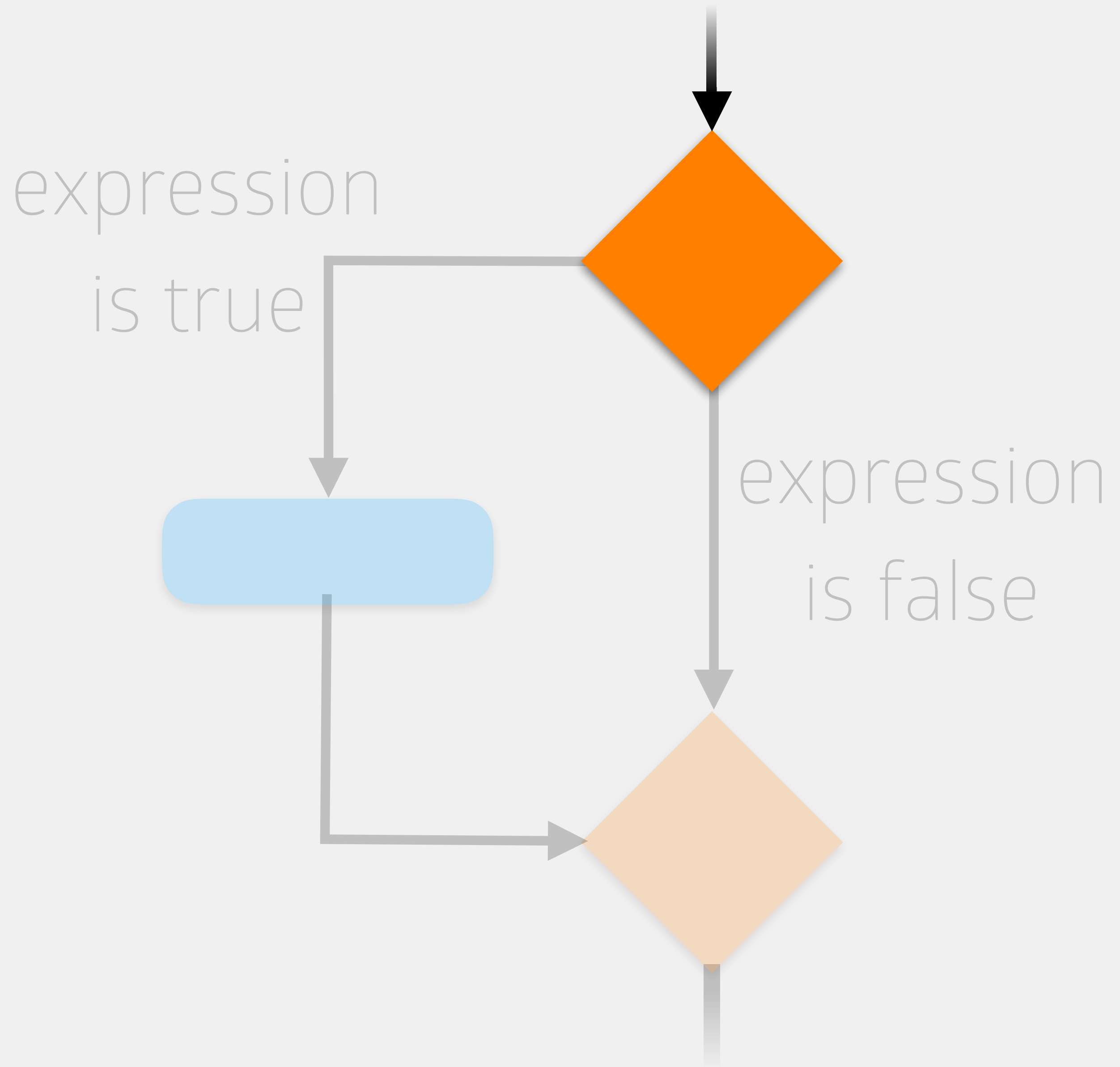

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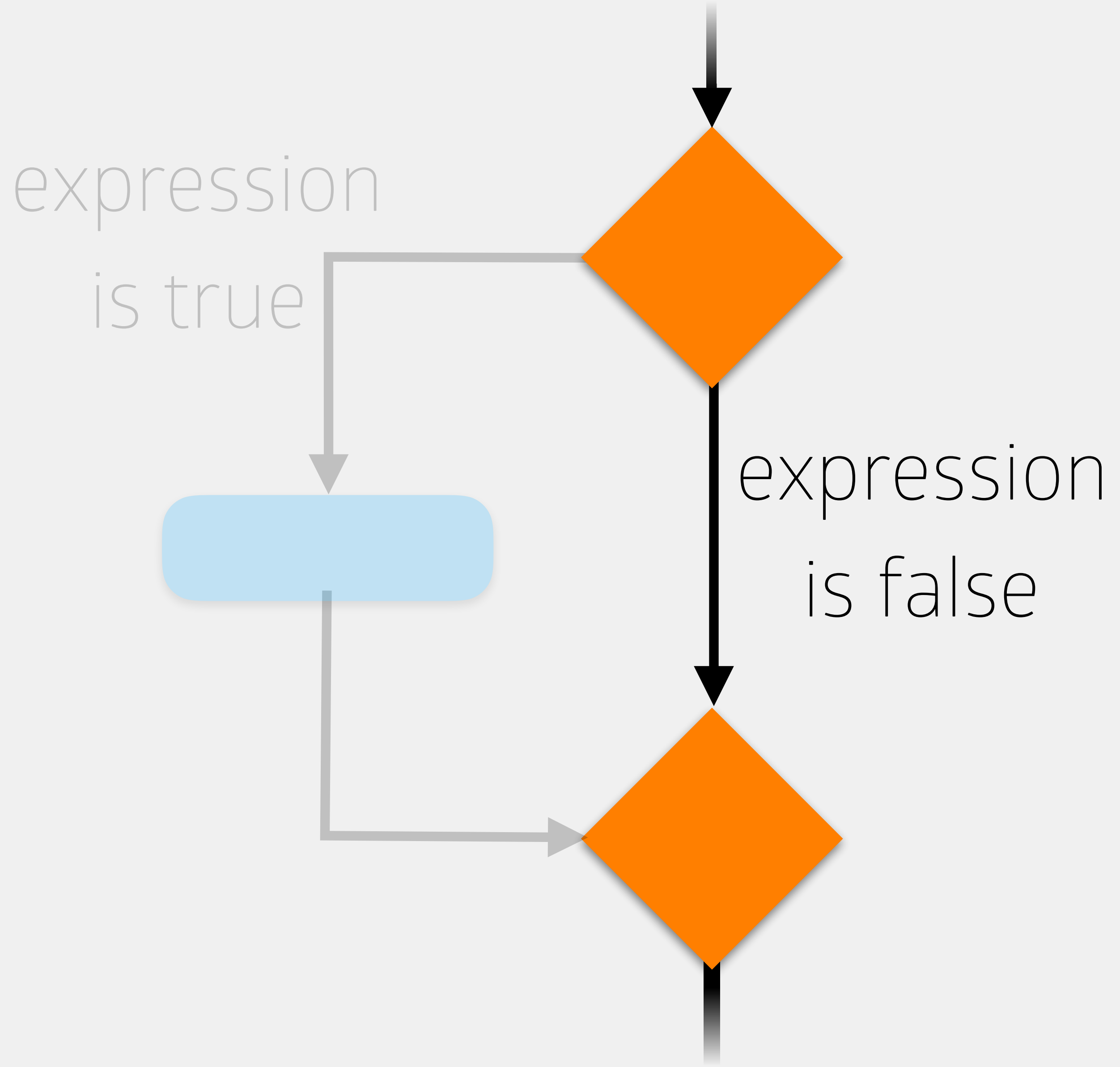

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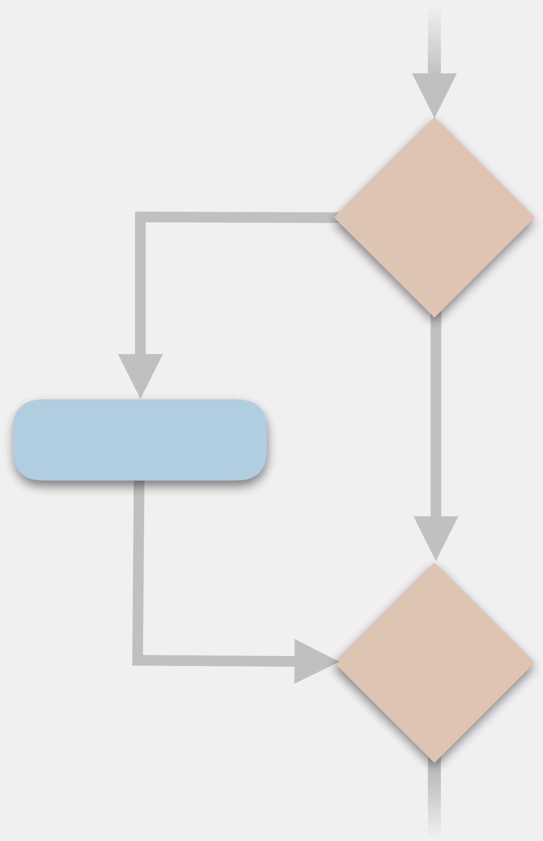
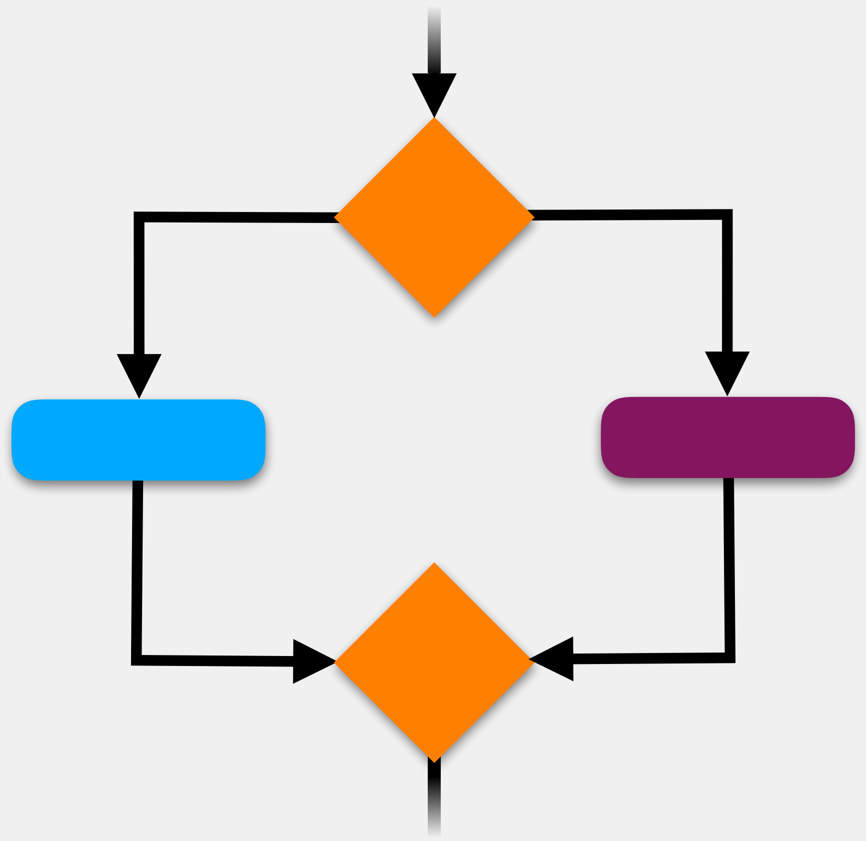
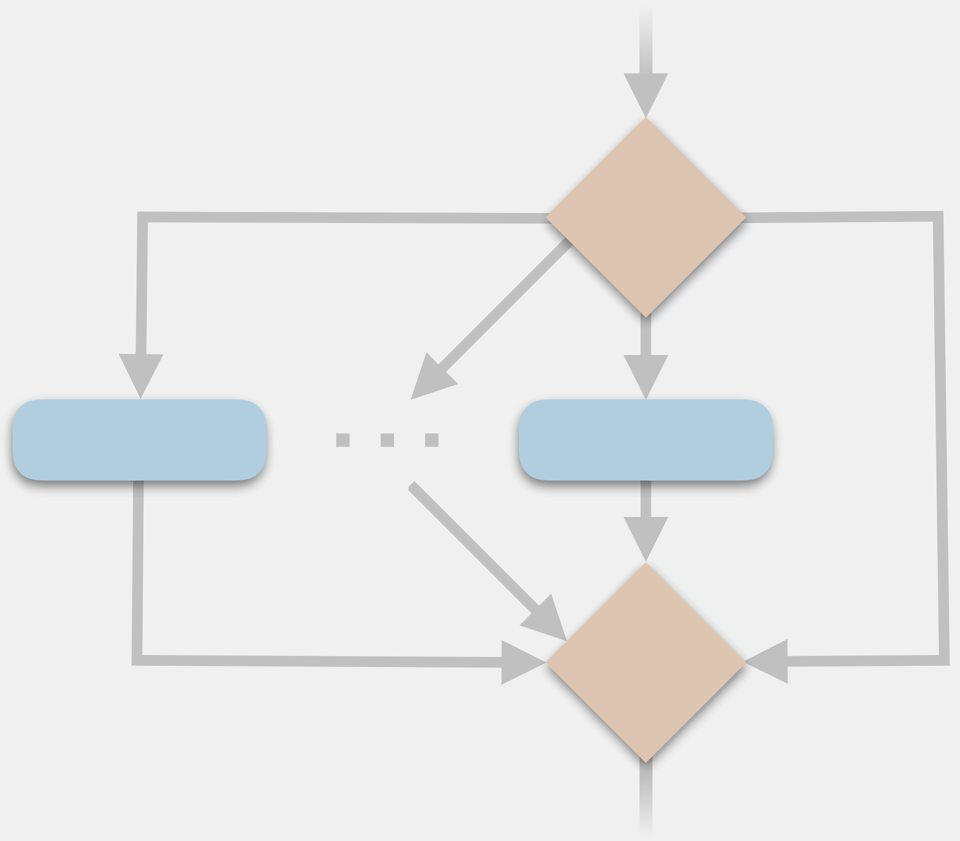
Types of Conditional Statements



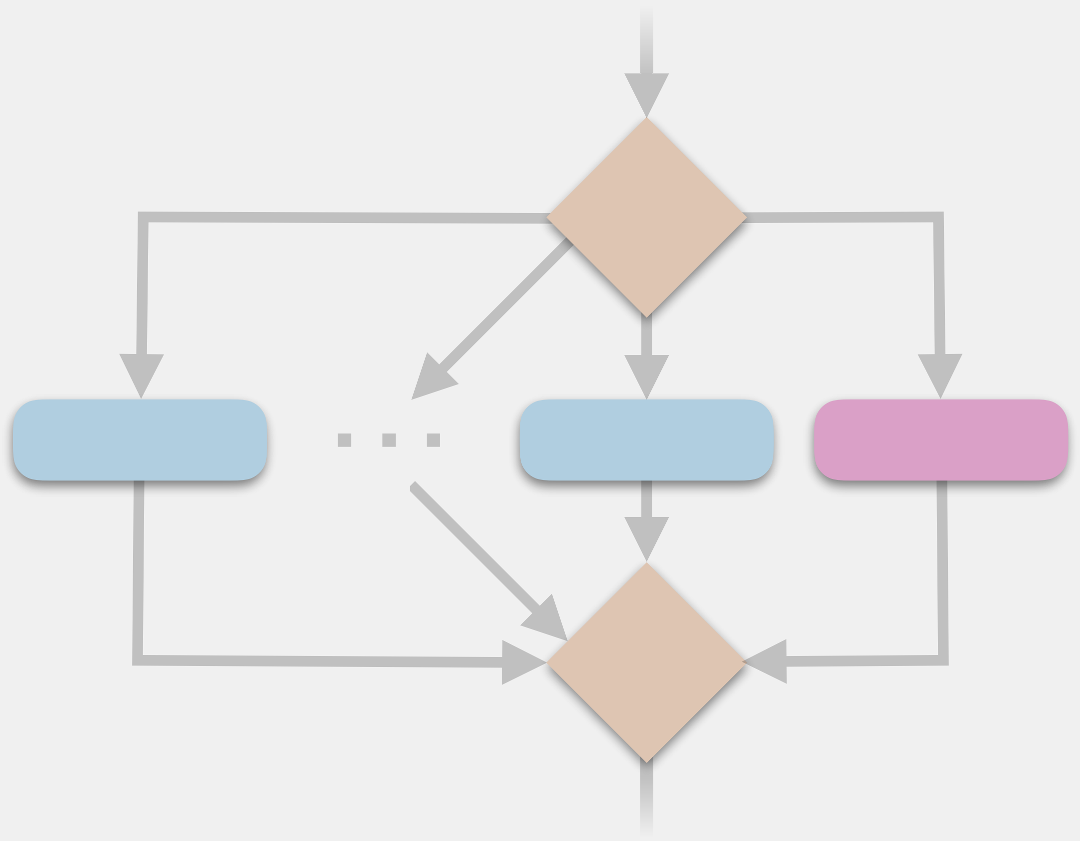
`if` statements



`if-else` statements



`if-else if` statements



`if-else if-else` statements

`if-else` Statements

Makes a decision to execute one block of code or another block of code

- *if* the boolean expression is true, execute the code in the block underneath the `if`
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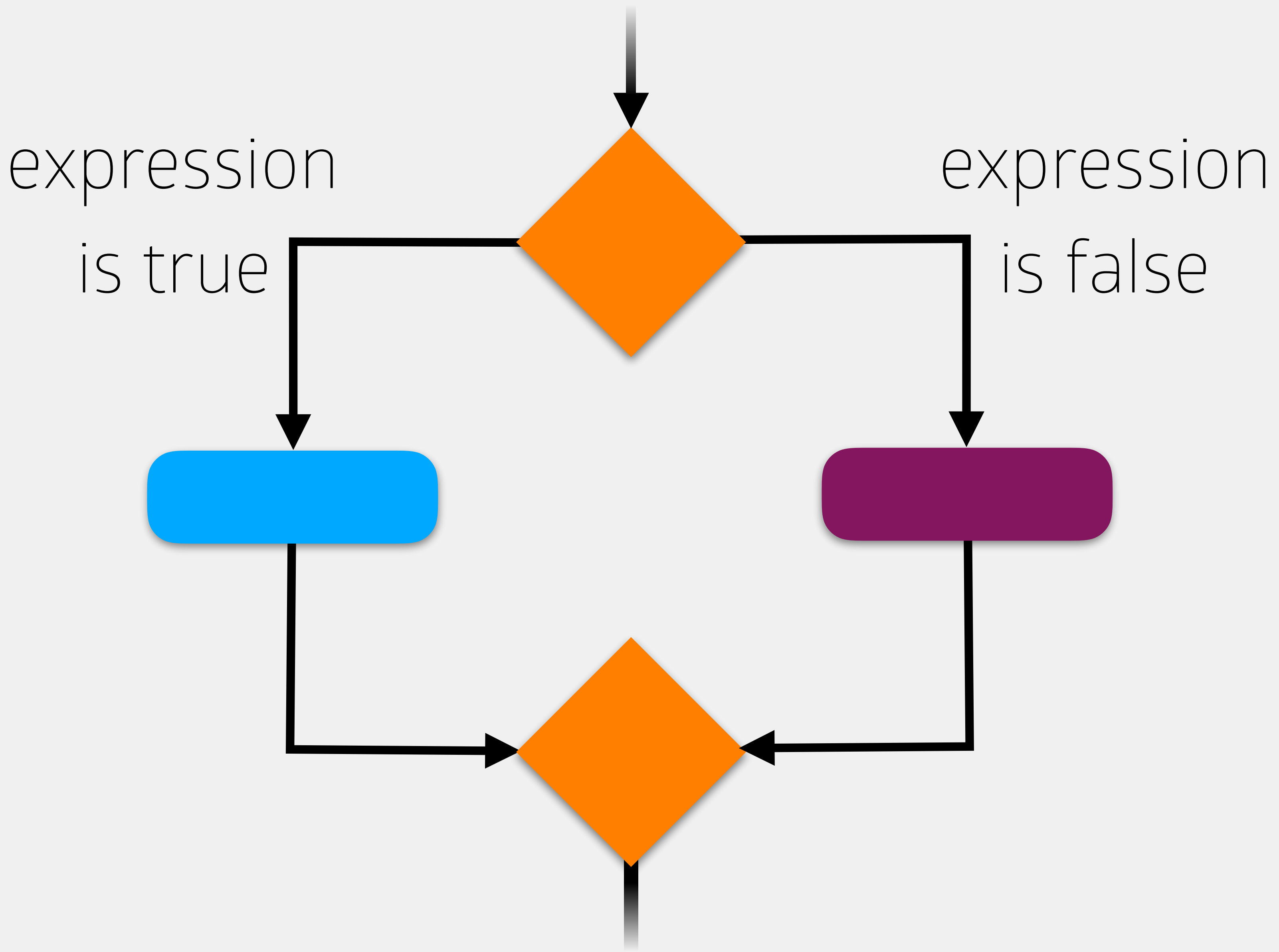

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//code to execute after if-else statement
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N.B.: notice the lack of boolean expression with the else block!

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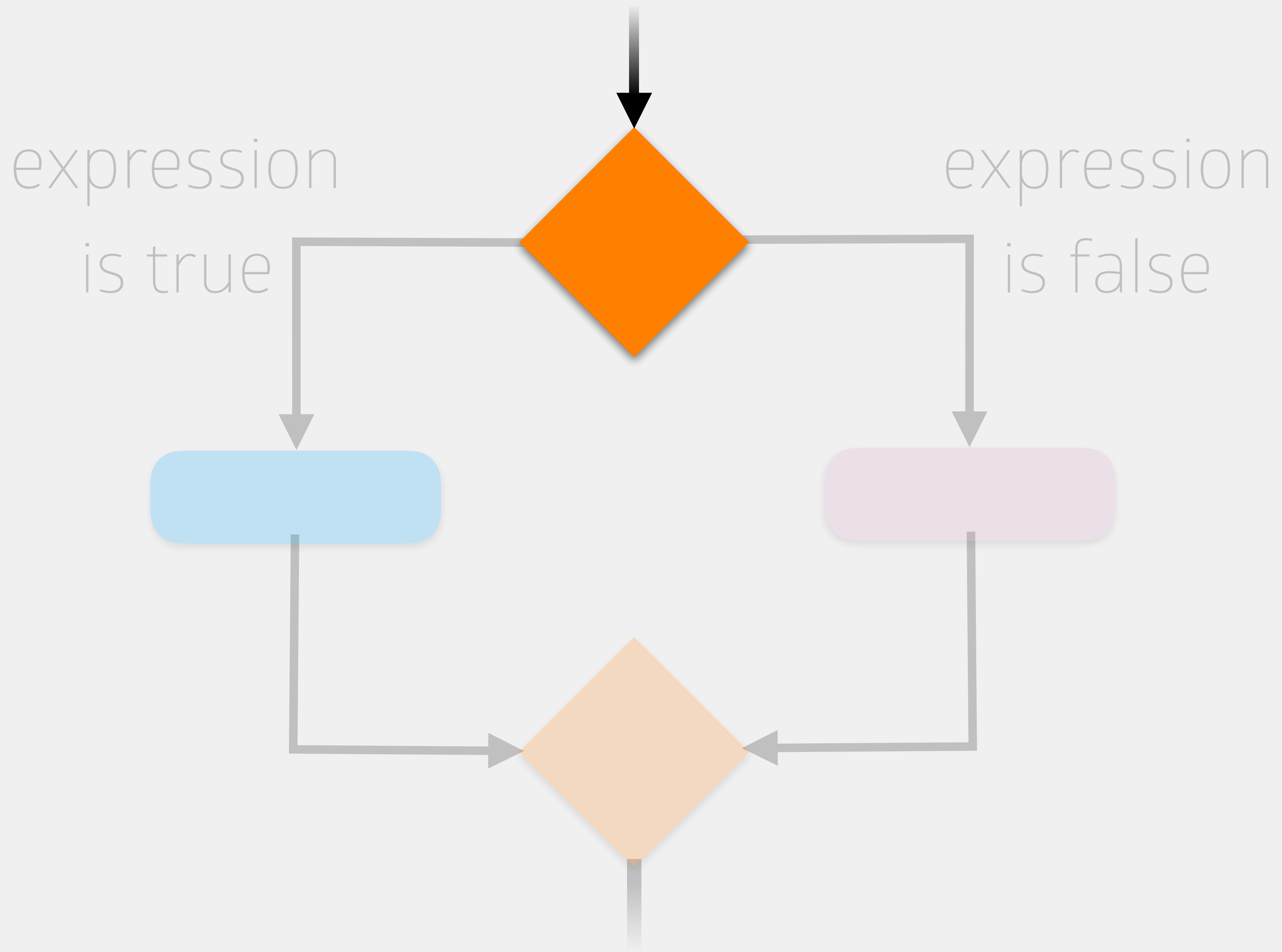

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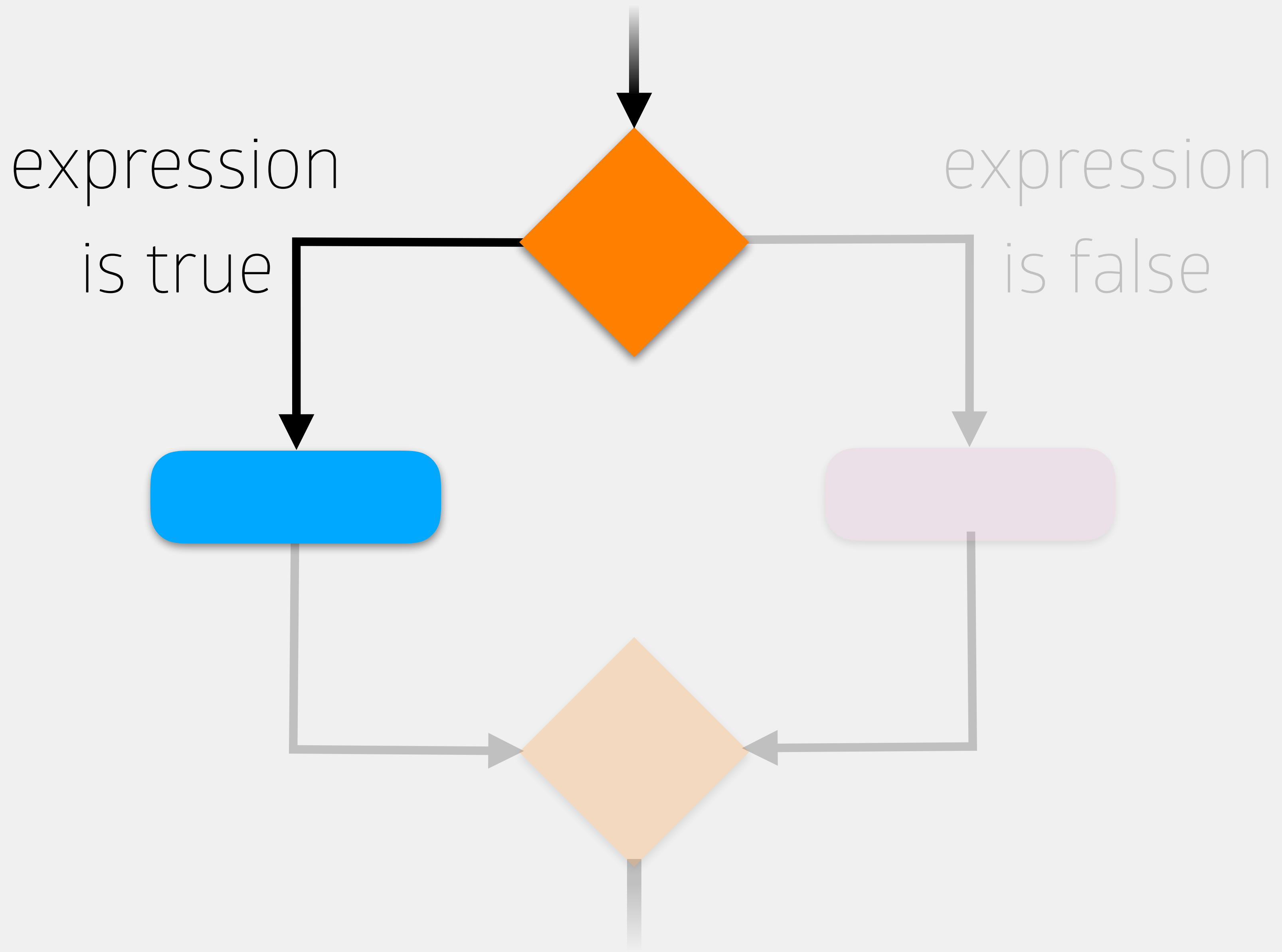

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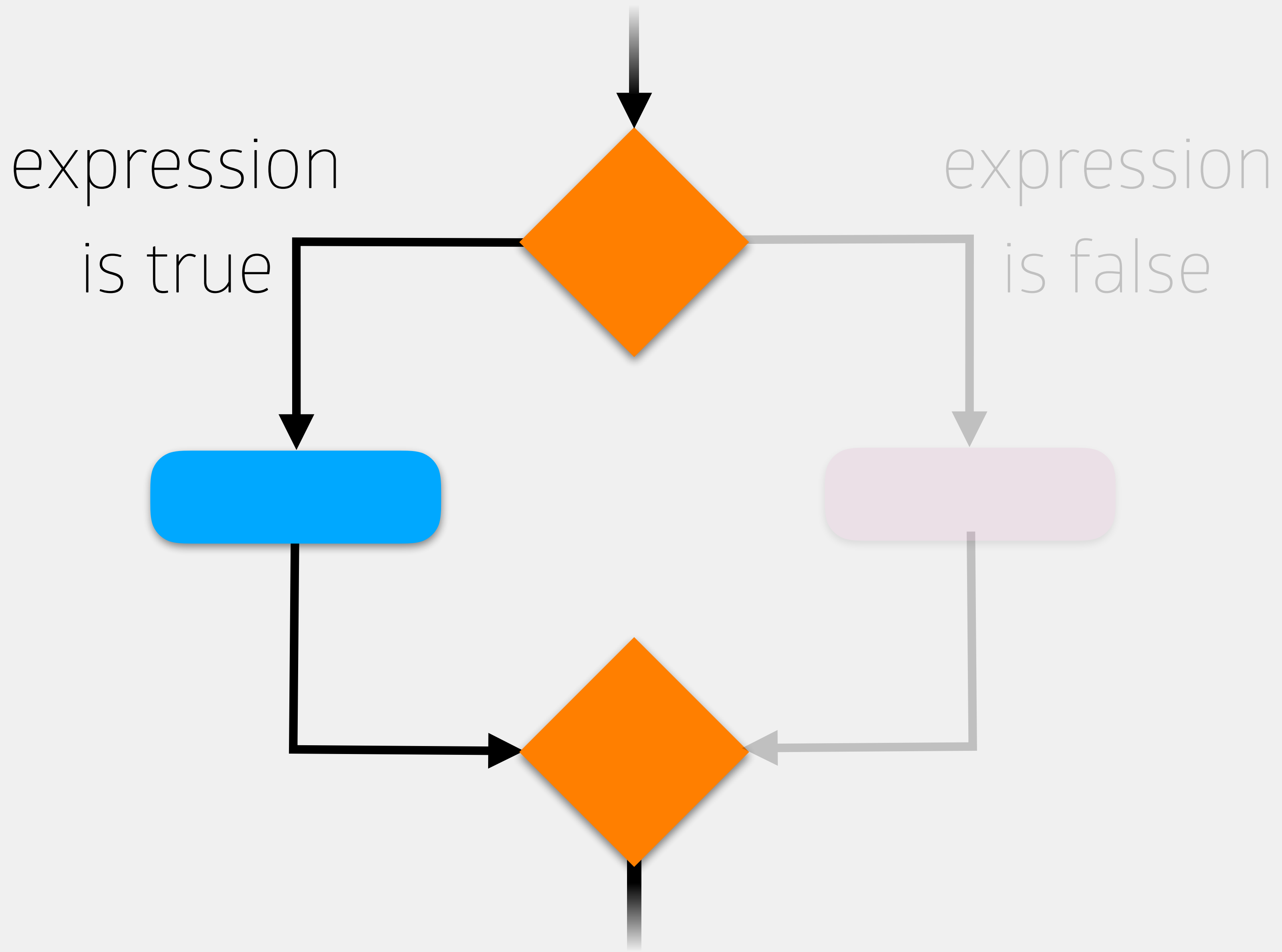

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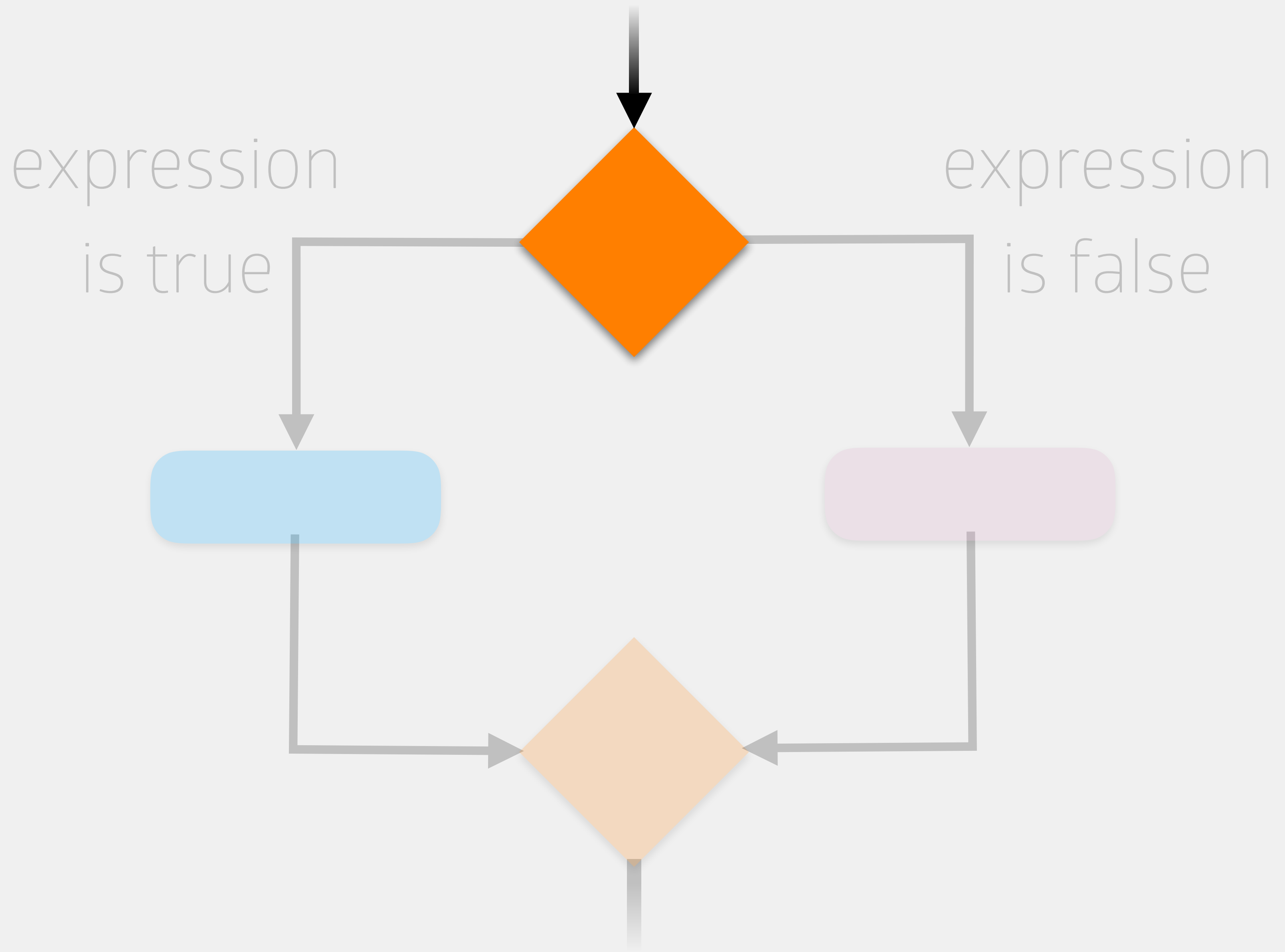

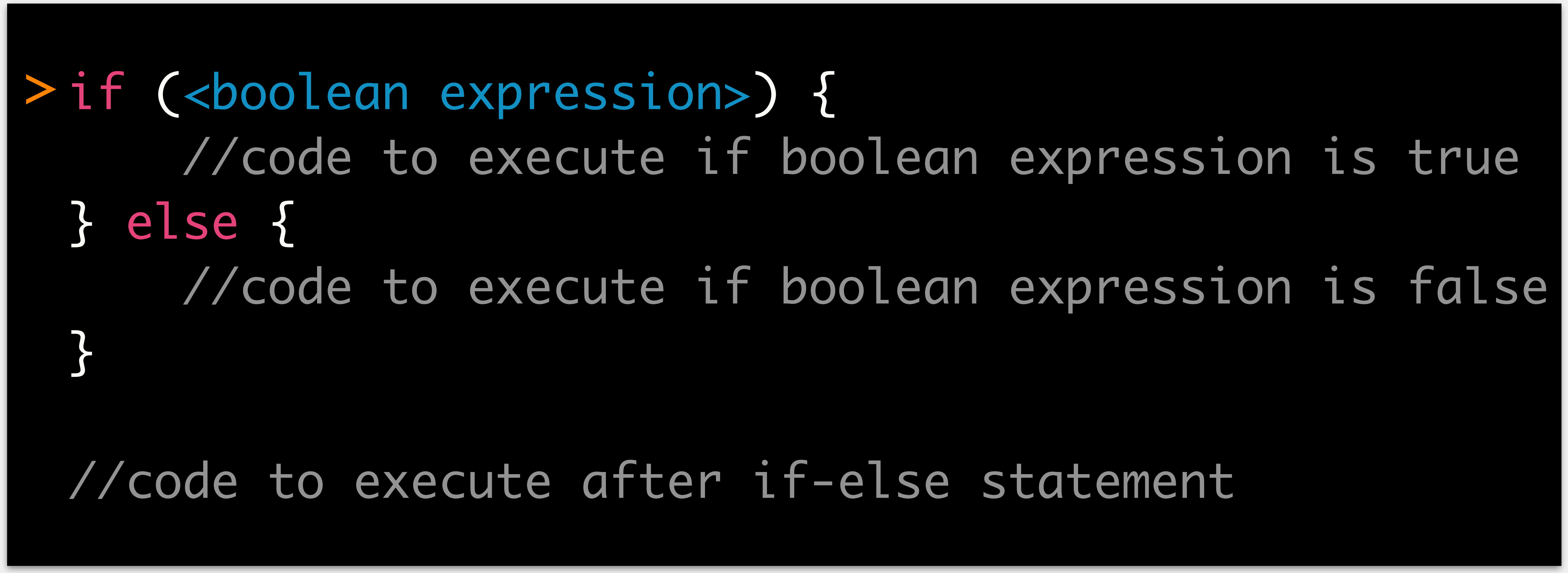

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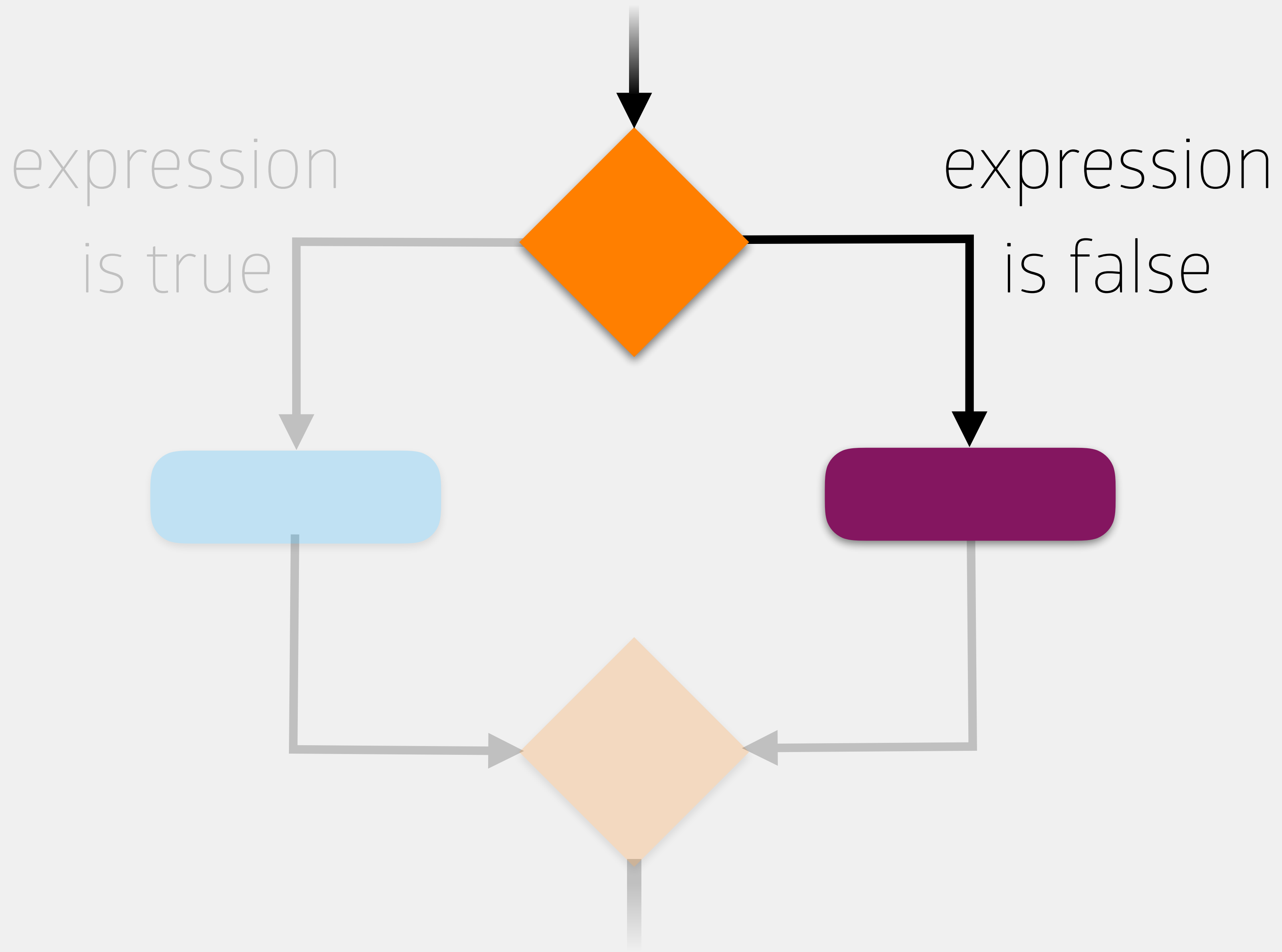

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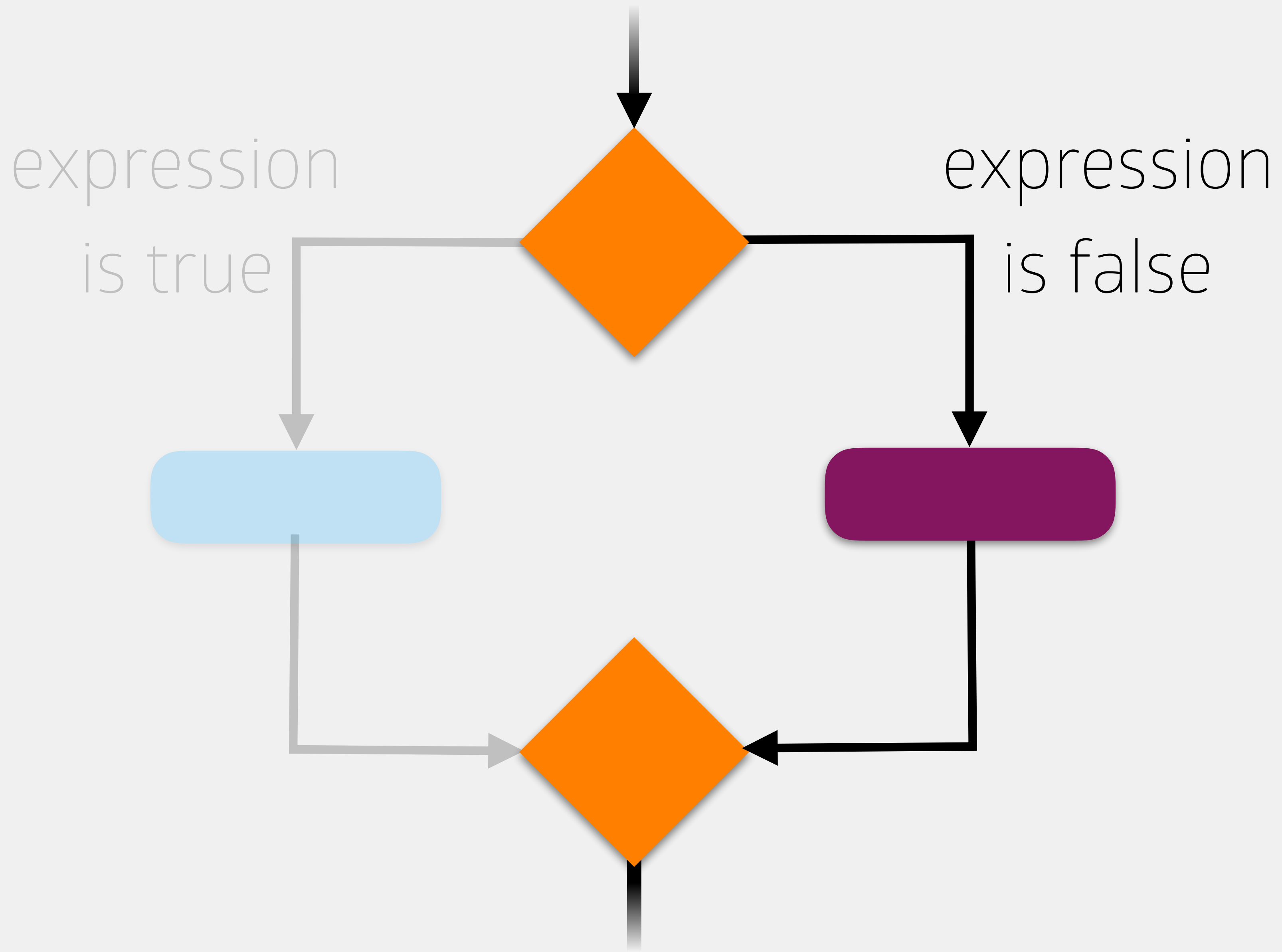

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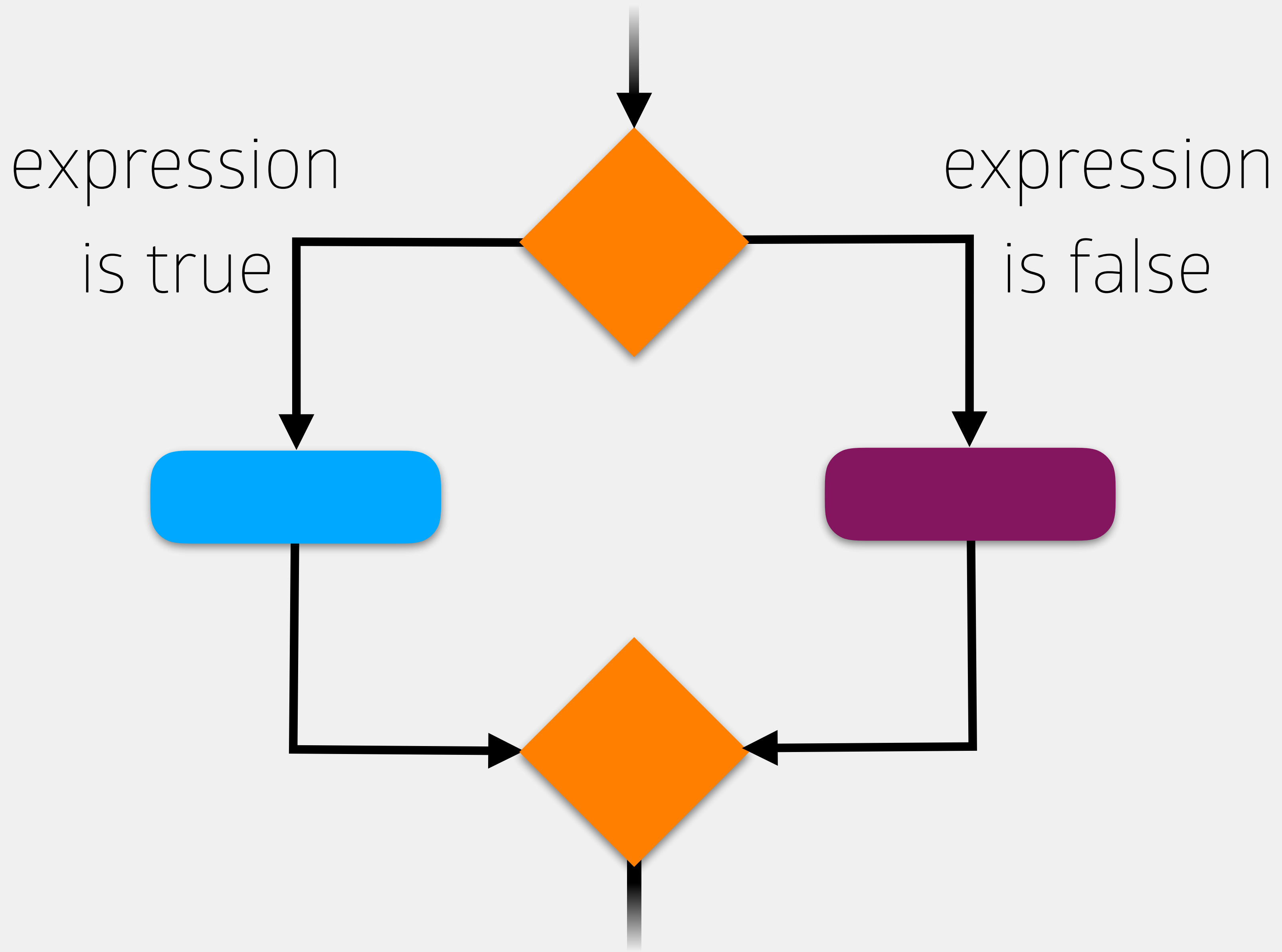
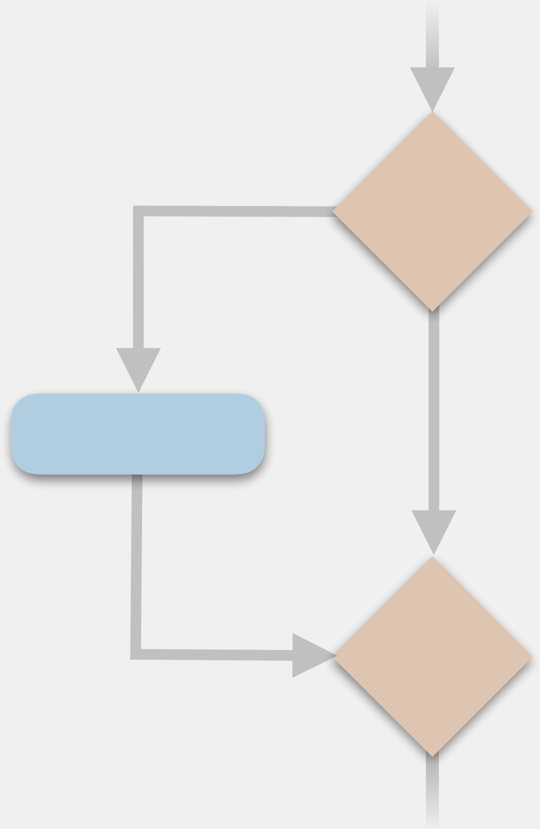


```
if (<boolean expression>) {
    //code to execute if boolean expression is true
} else {
    //code to execute if boolean expression is false
}

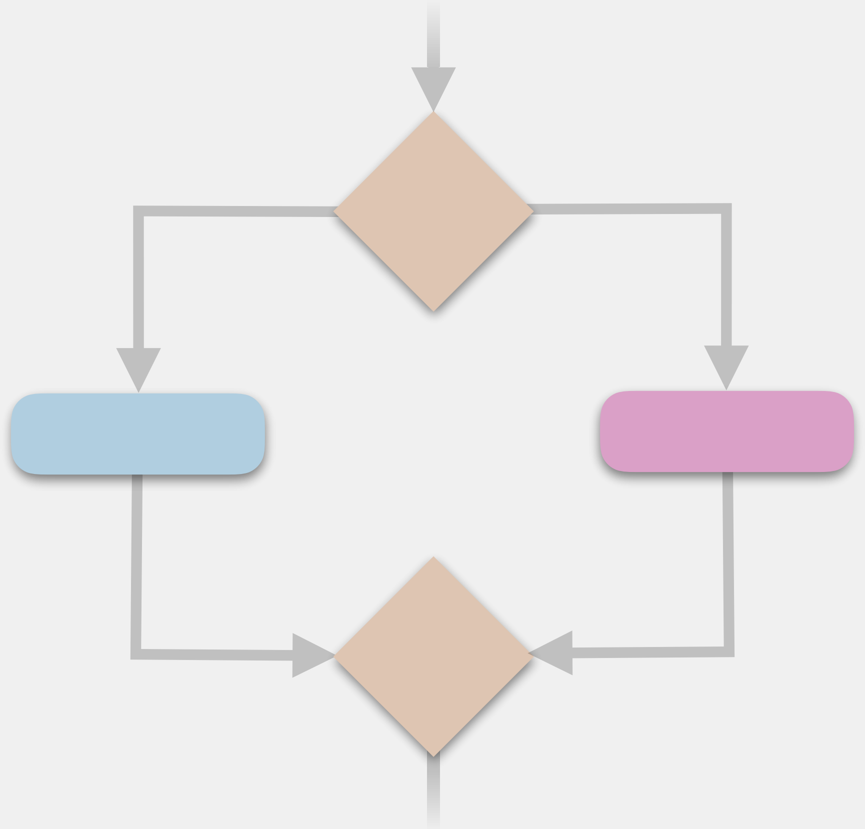
//code to execute after if-else statement
```

N.B.: exactly one of these two blocks will execute!

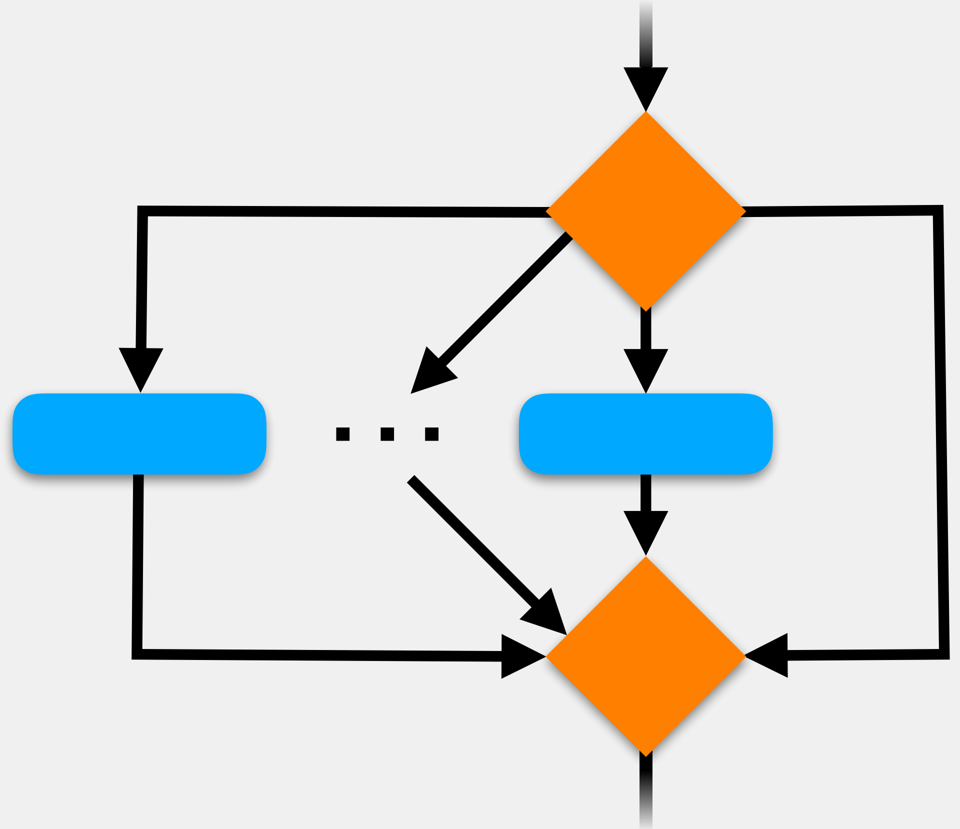
Types of Conditional Statements



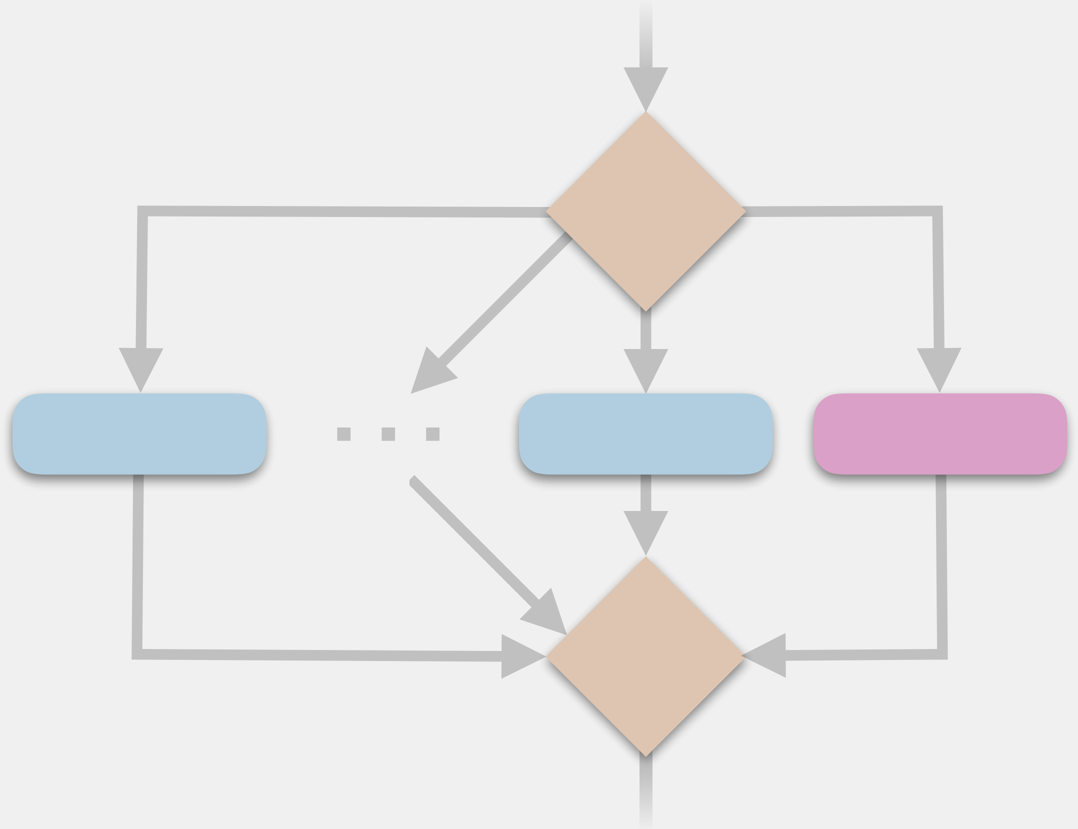
`if` statements



`if-else` statements



`if-else if` statements



`if-else if-else` statements

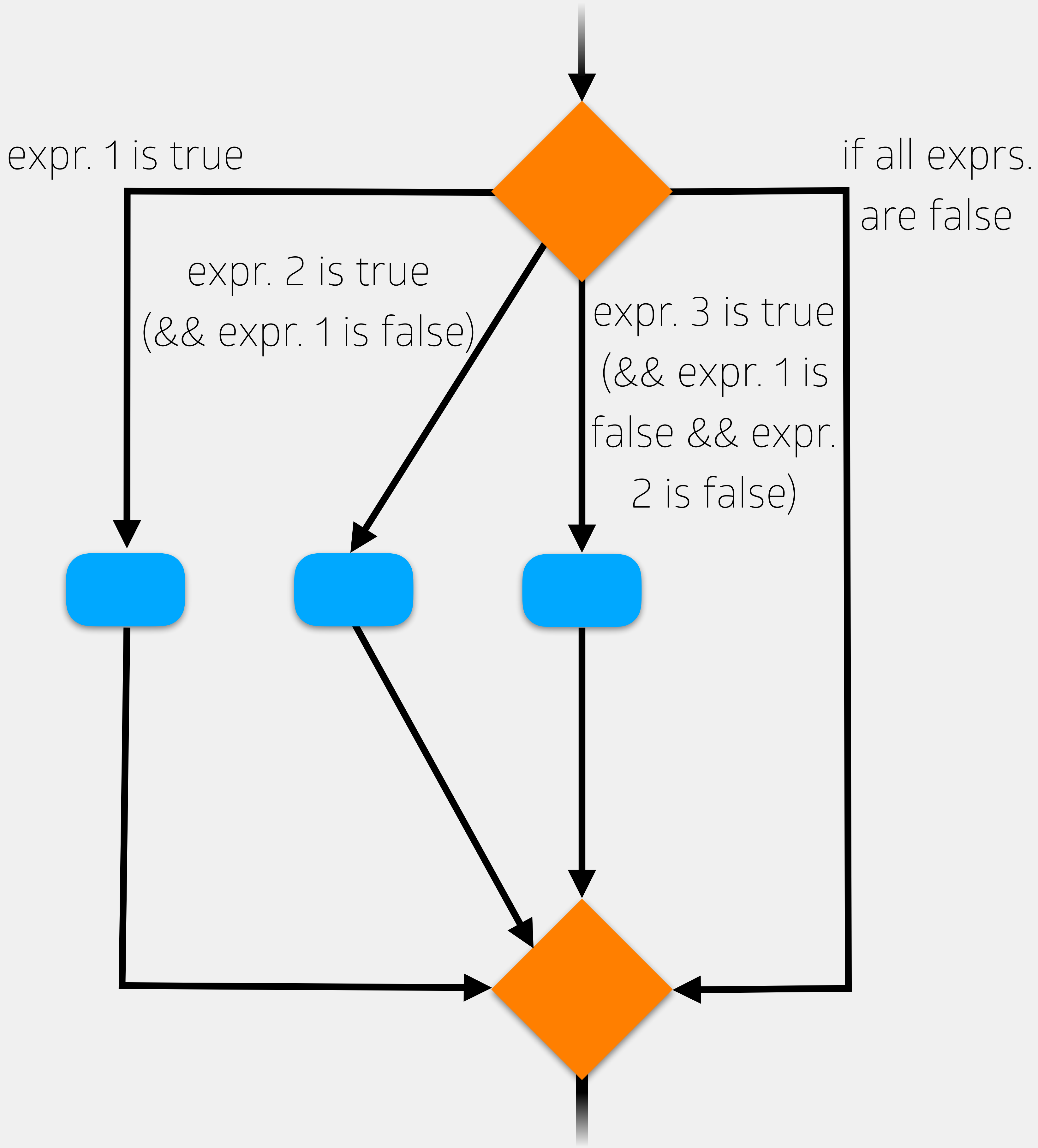
`if-else if` Statements

Makes at most one decision amongst many boolean expressions

- *if* the boolean expression is true, execute the code in the block underneath the `if`
- *else if* the previous boolean expr. is false and the boolean expr. in the `else if` is true, execute the code in the block underneath the `else if`
- otherwise (i.e., if the previous boolean exprs. are false), skip all the code in the brackets

Can have one or more `else if` statements

if-else if Statements

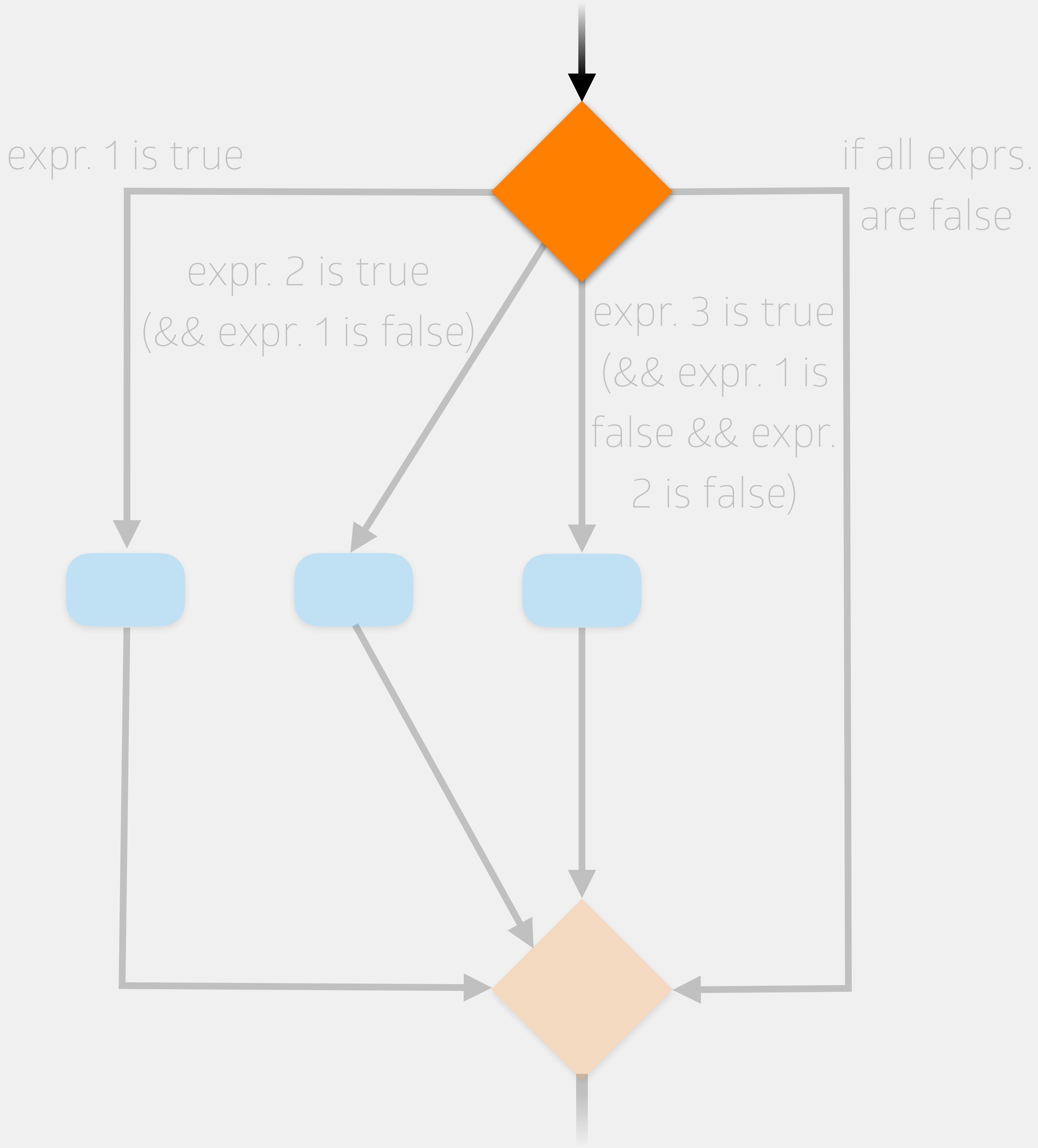


```
if (<boolean expression 1>) {
    //code to execute if boolean expression 1 is true
} else if (<boolean expression 2>) {
    //code to execute if boolean expression 2 is true
    // and the previous boolean expressions are false
} else if (<boolean expression 3>) {
    //code to execute if boolean expression 3 is true
    // and the previous boolean expressions are false
}

//code to execute after if-else if statement
```

N.B.: we could have greater or fewer else if blocks; this example happens to have two

if-else if Statements


expr. 1 is true
if all exprs. are false
expr. 2 is true (&& expr. 1 is false)
expr. 3 is true (&& expr. 1 is false && expr. 2 is false)

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  //code to execute after if-else if statement
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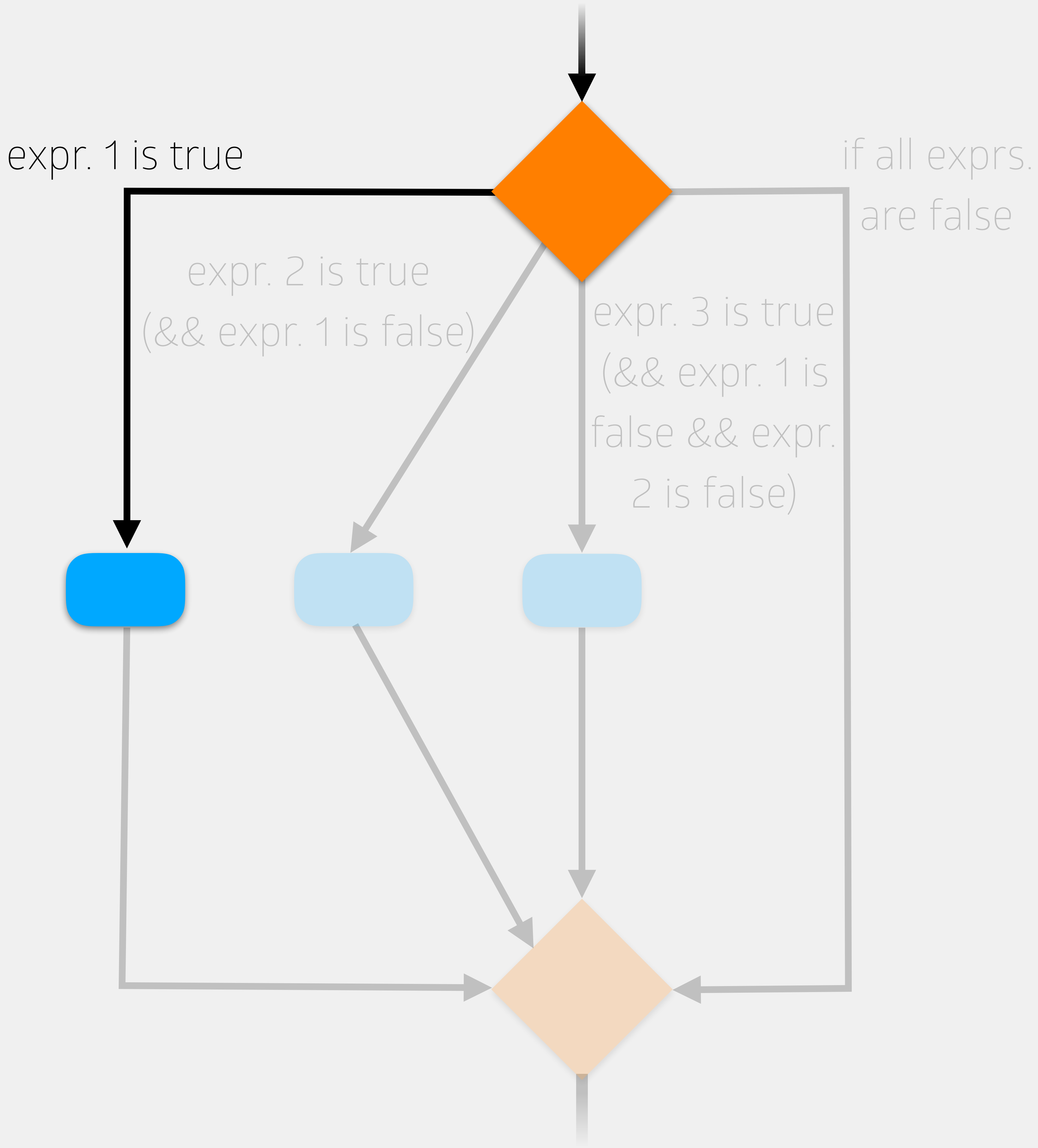
if-else if Statements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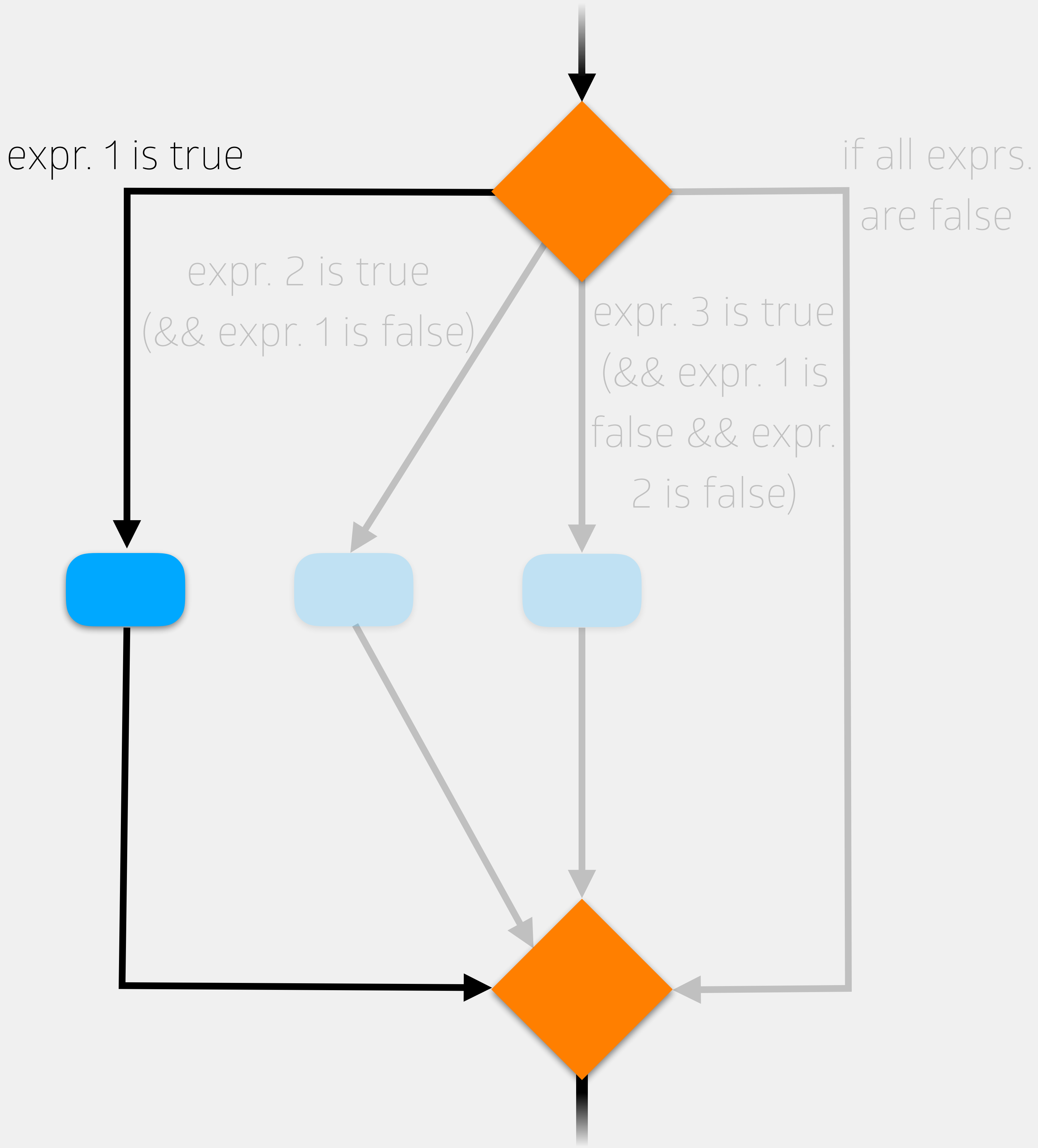
if-else if Statements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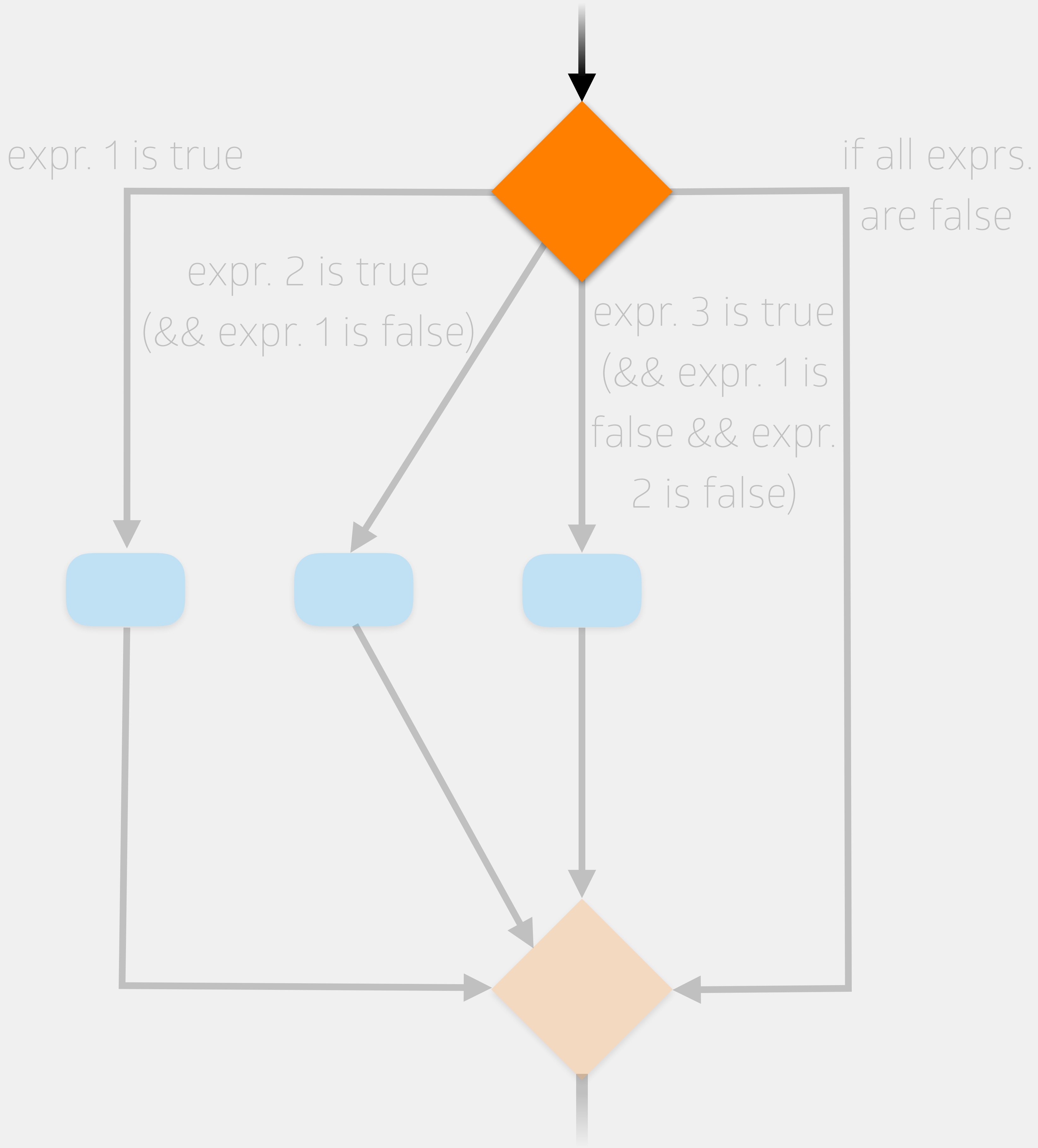
if-else if Statements



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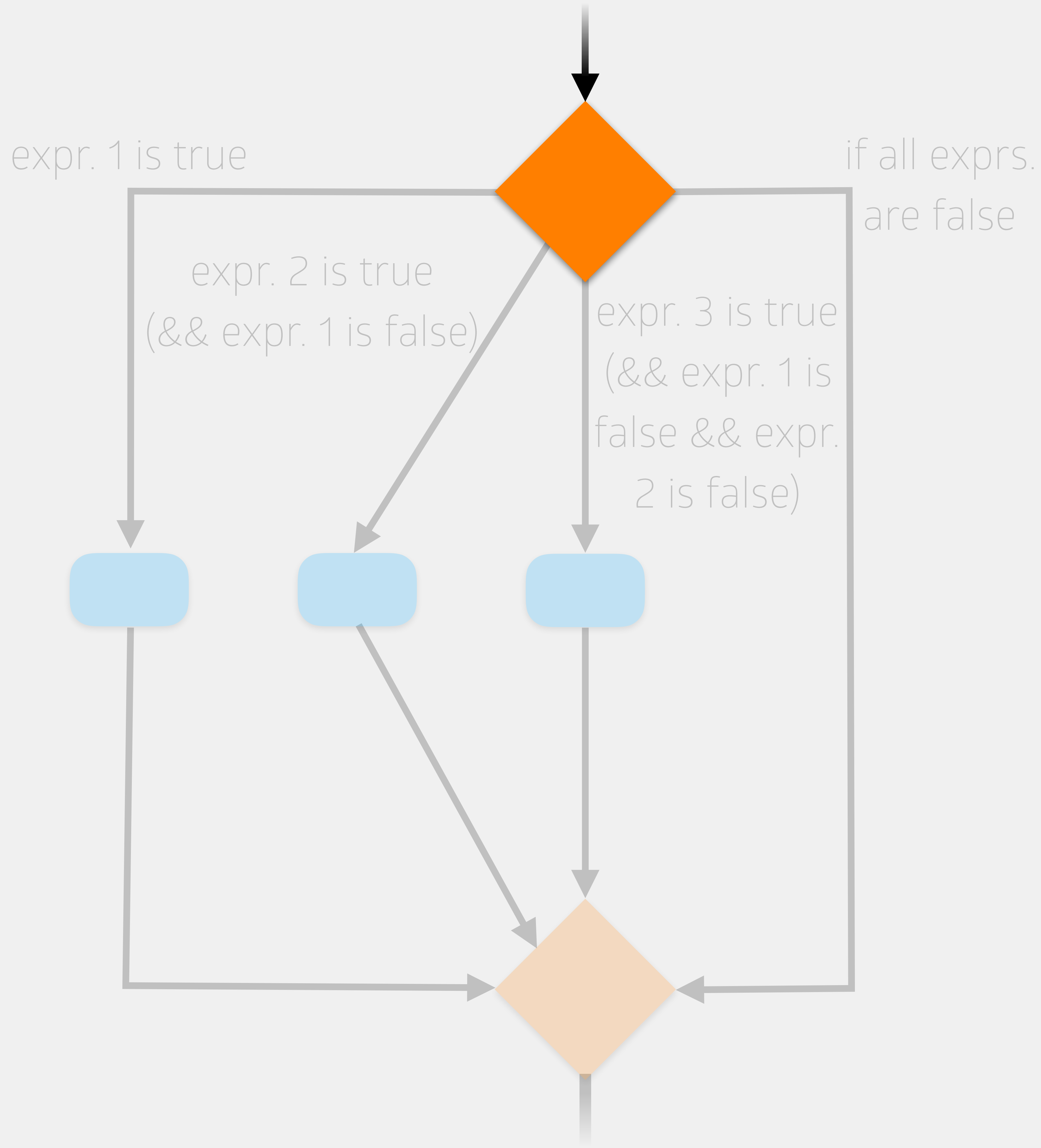
if-else if Statements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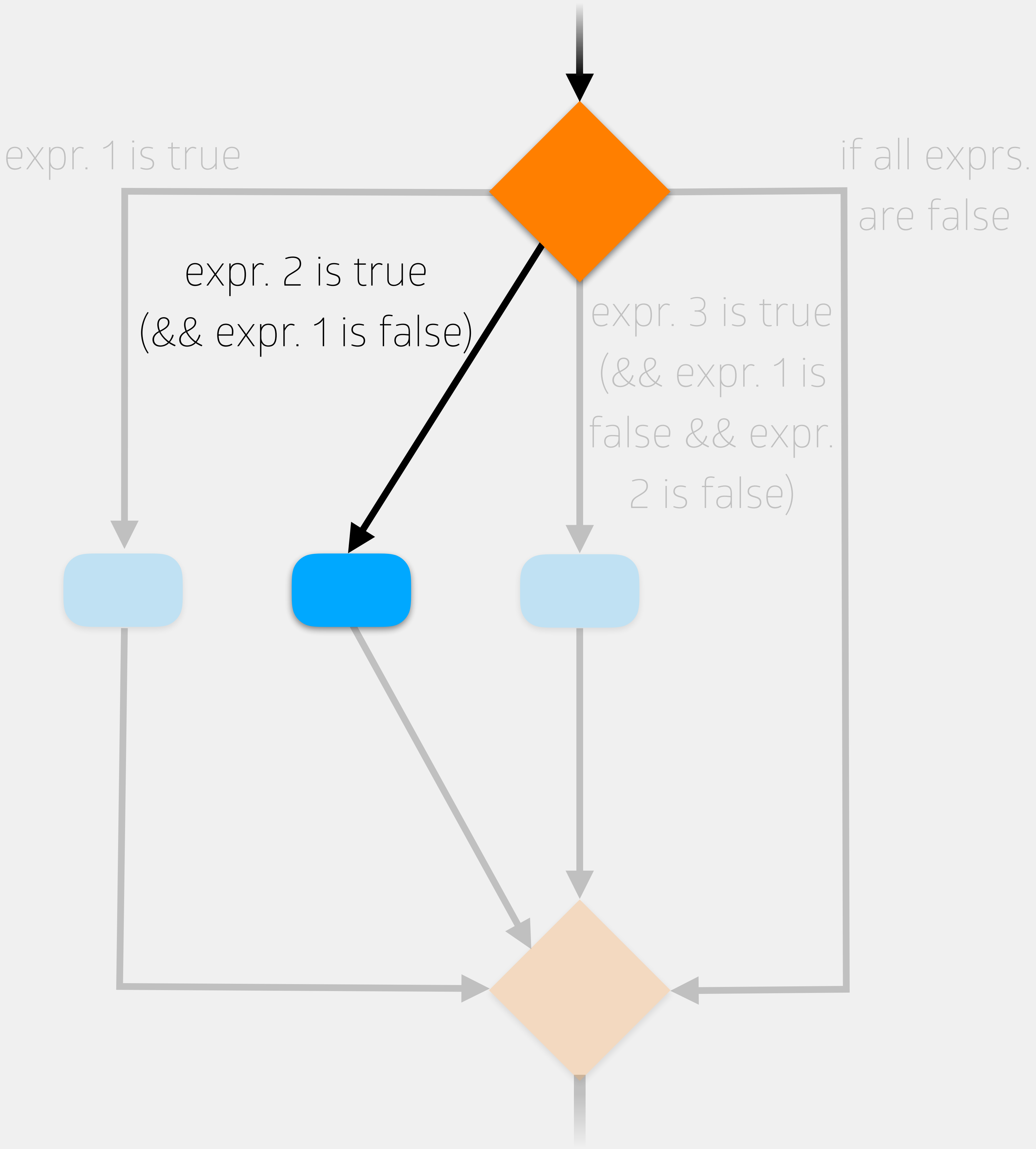
if-else if Statements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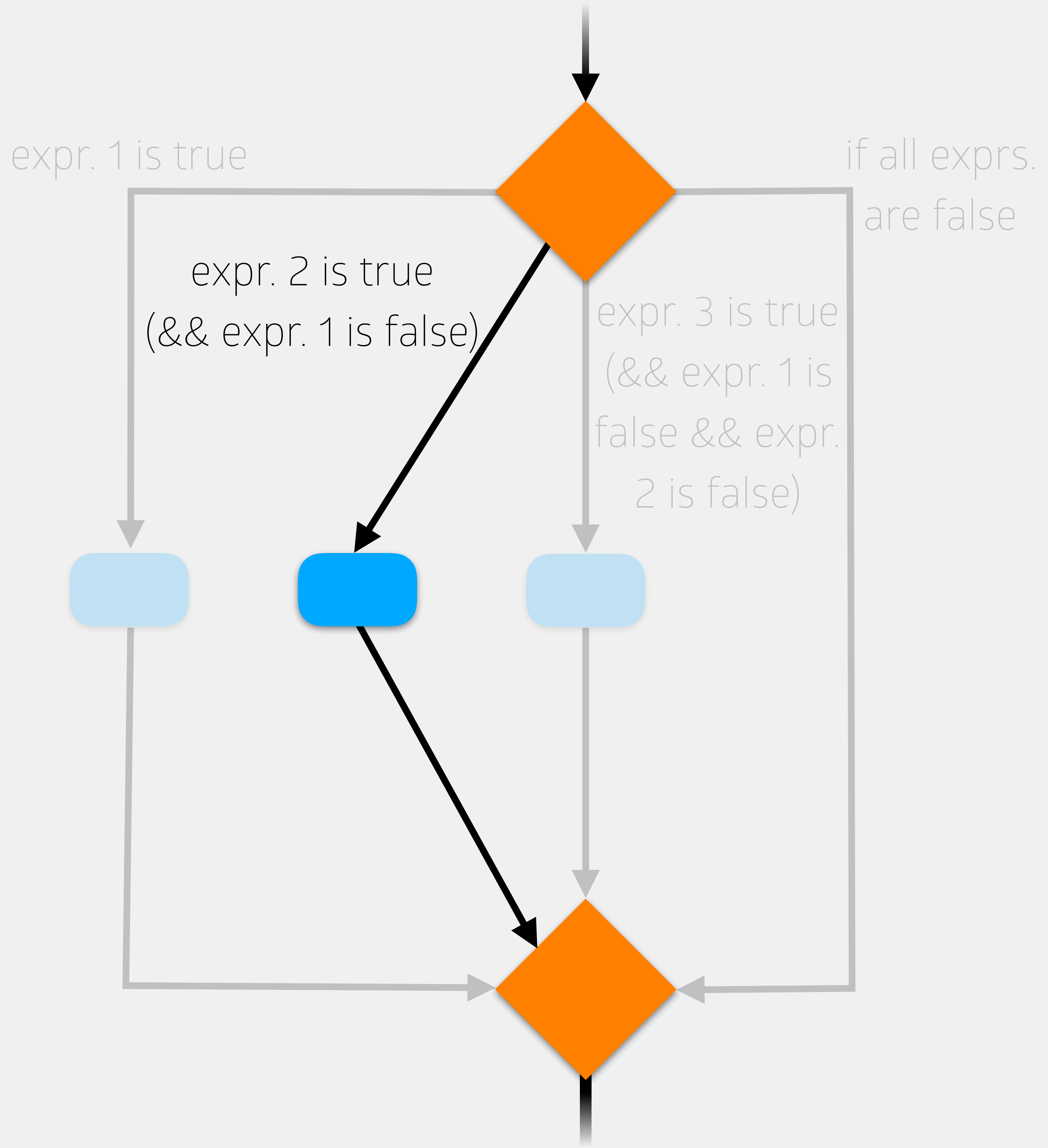
if-else if Statements



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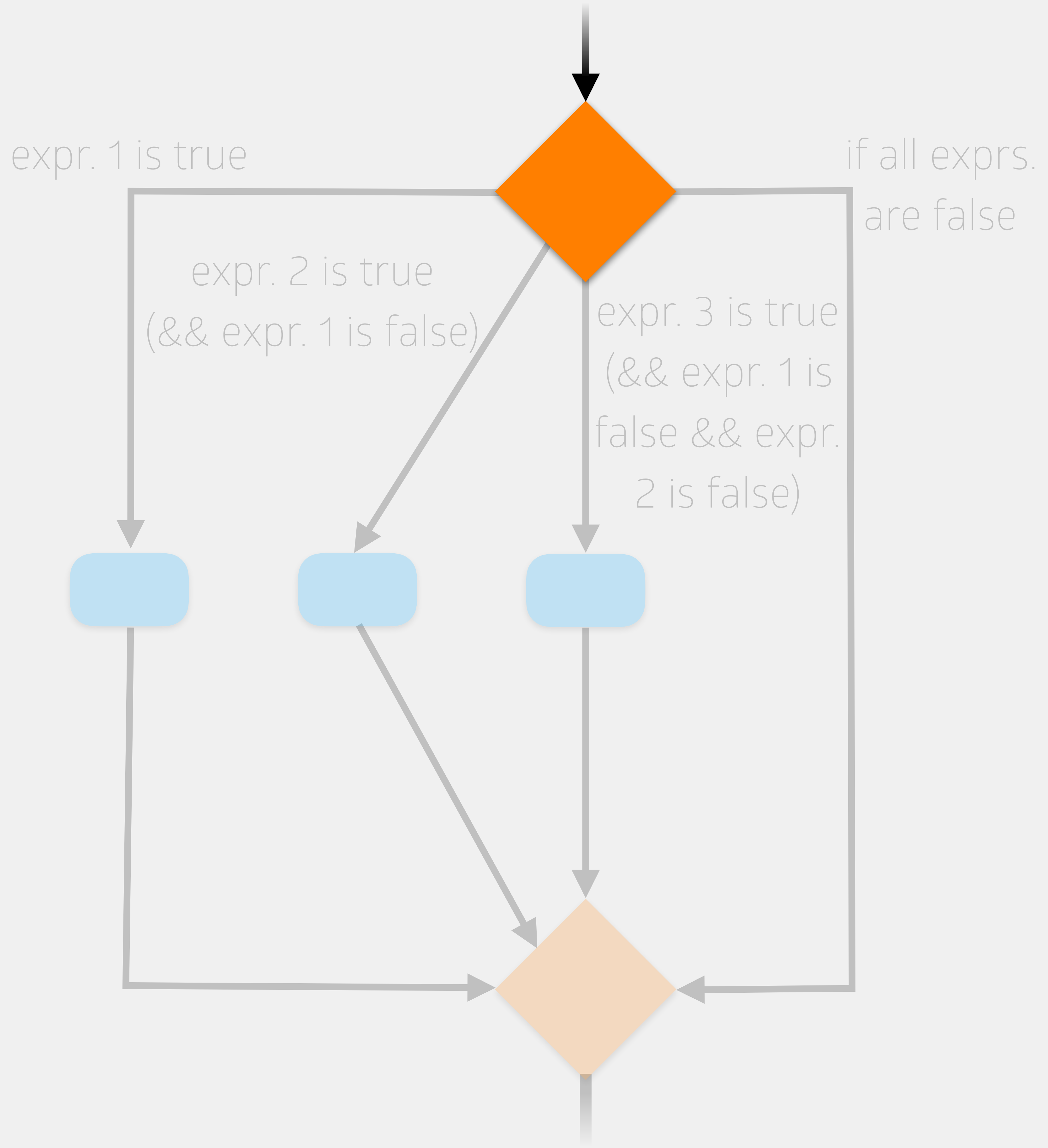
if-else if Statements



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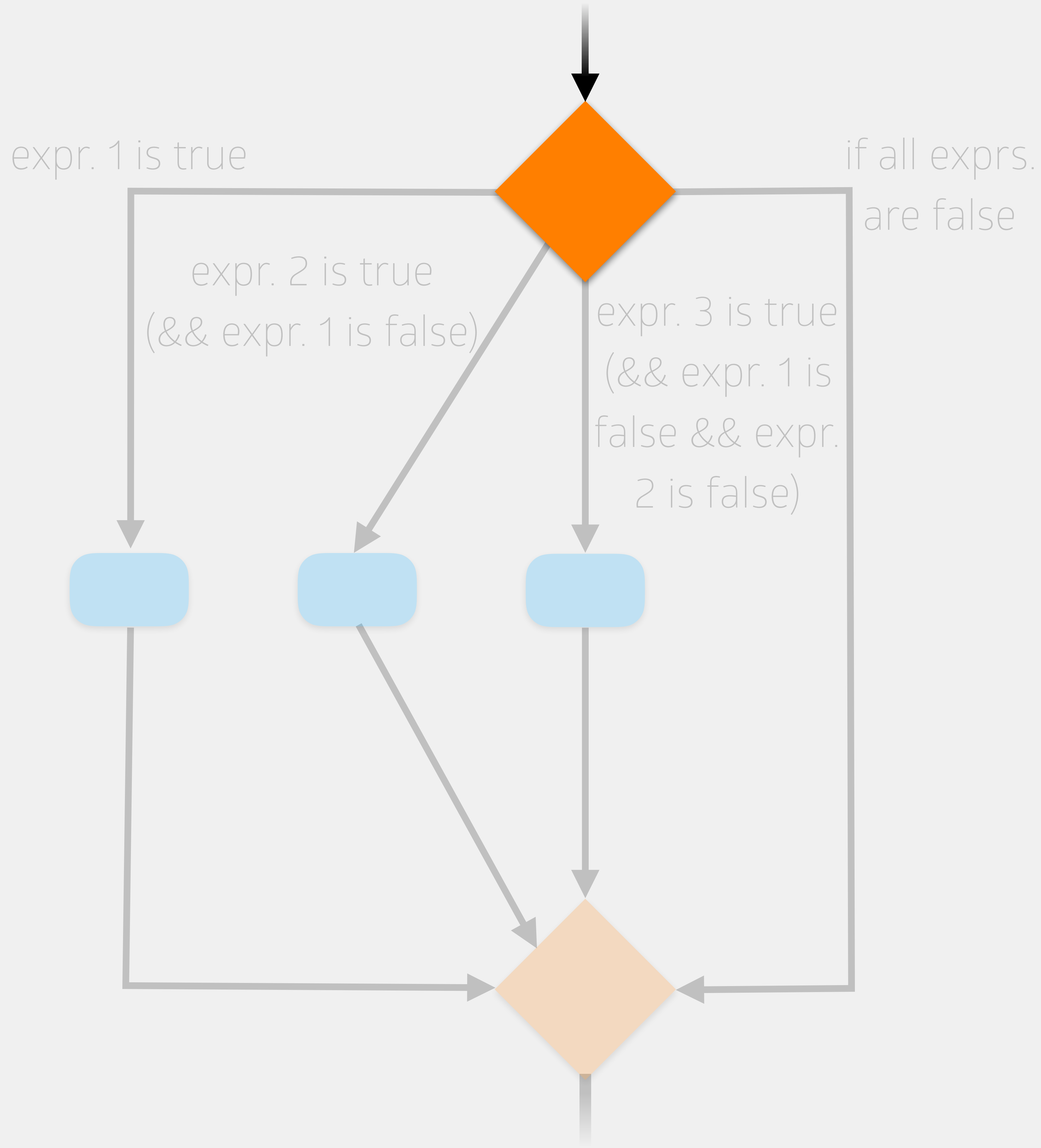
if-else if Statements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```
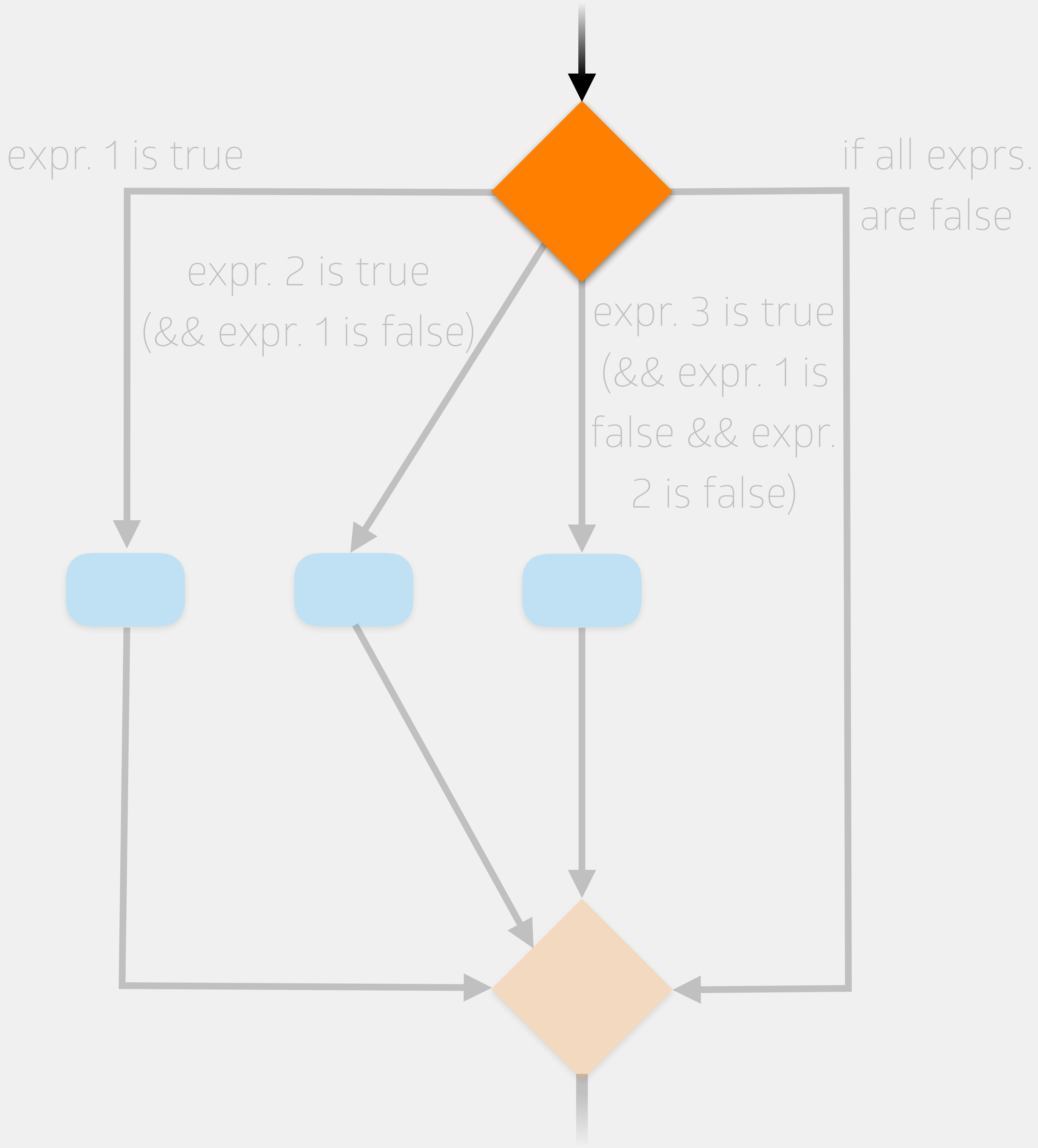

if-else if Statements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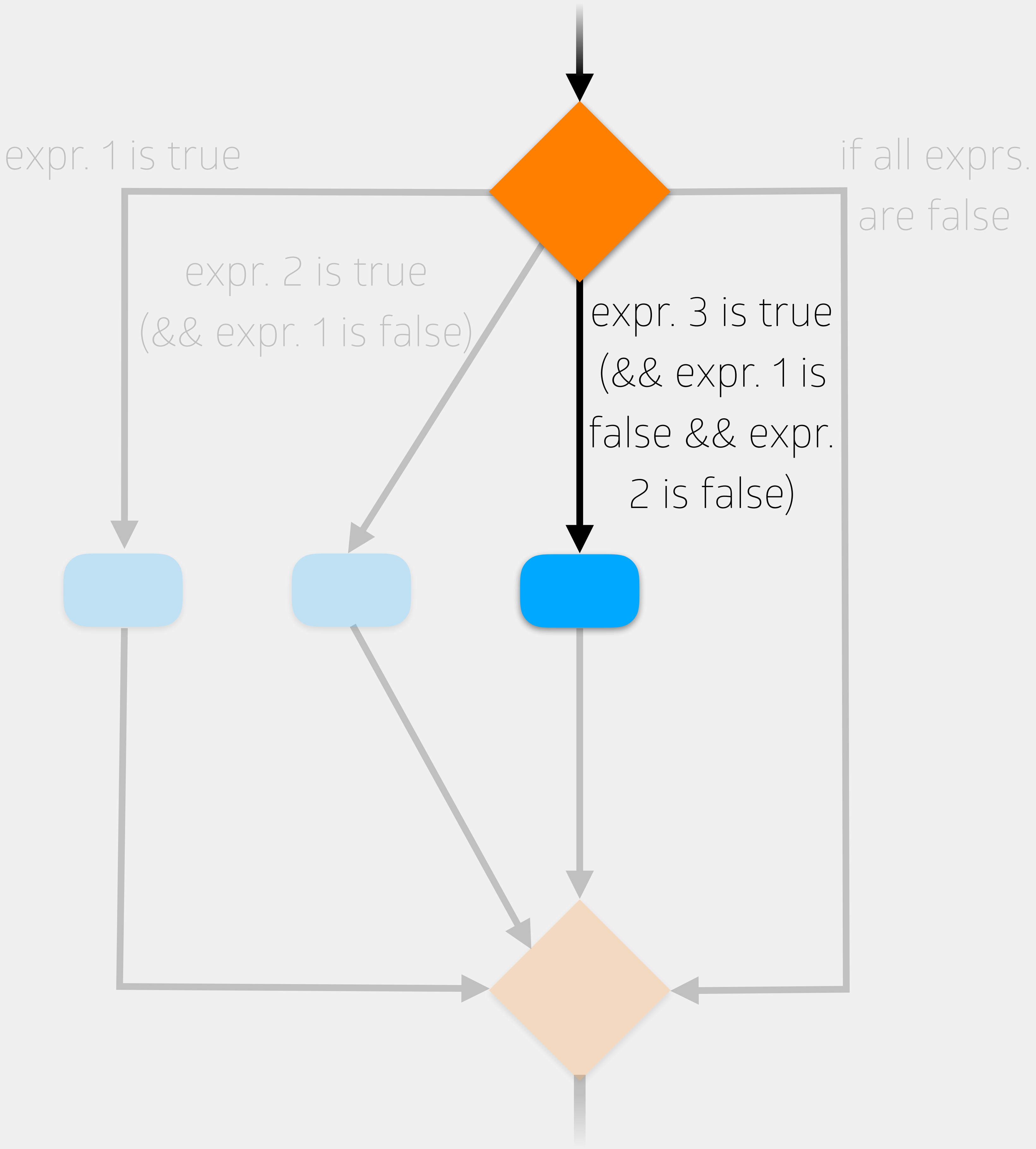
 //code to execute after if-else if statement
```

if-else if Statements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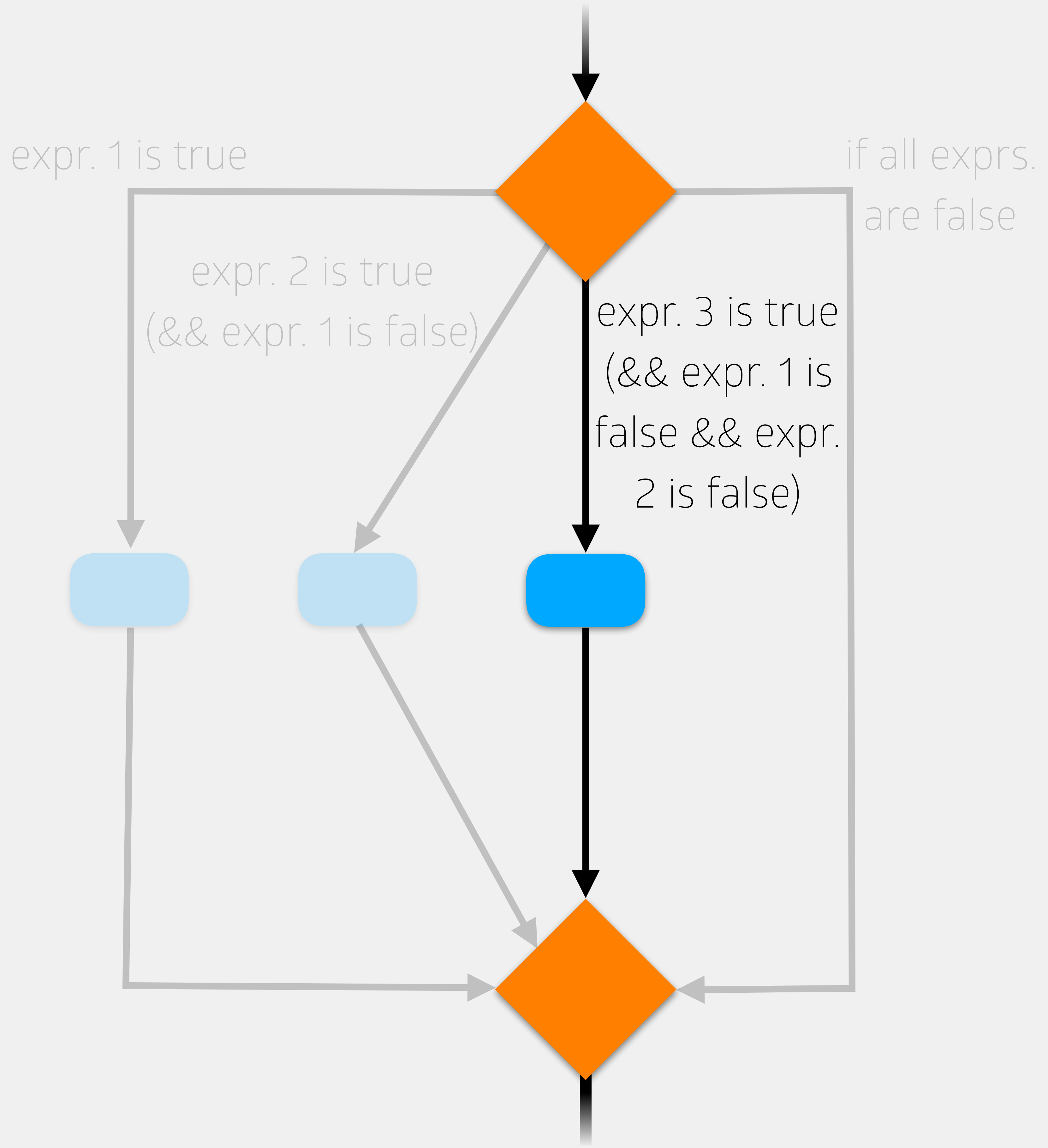
if-else if Statements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>//code to execute after if-else if statement
```
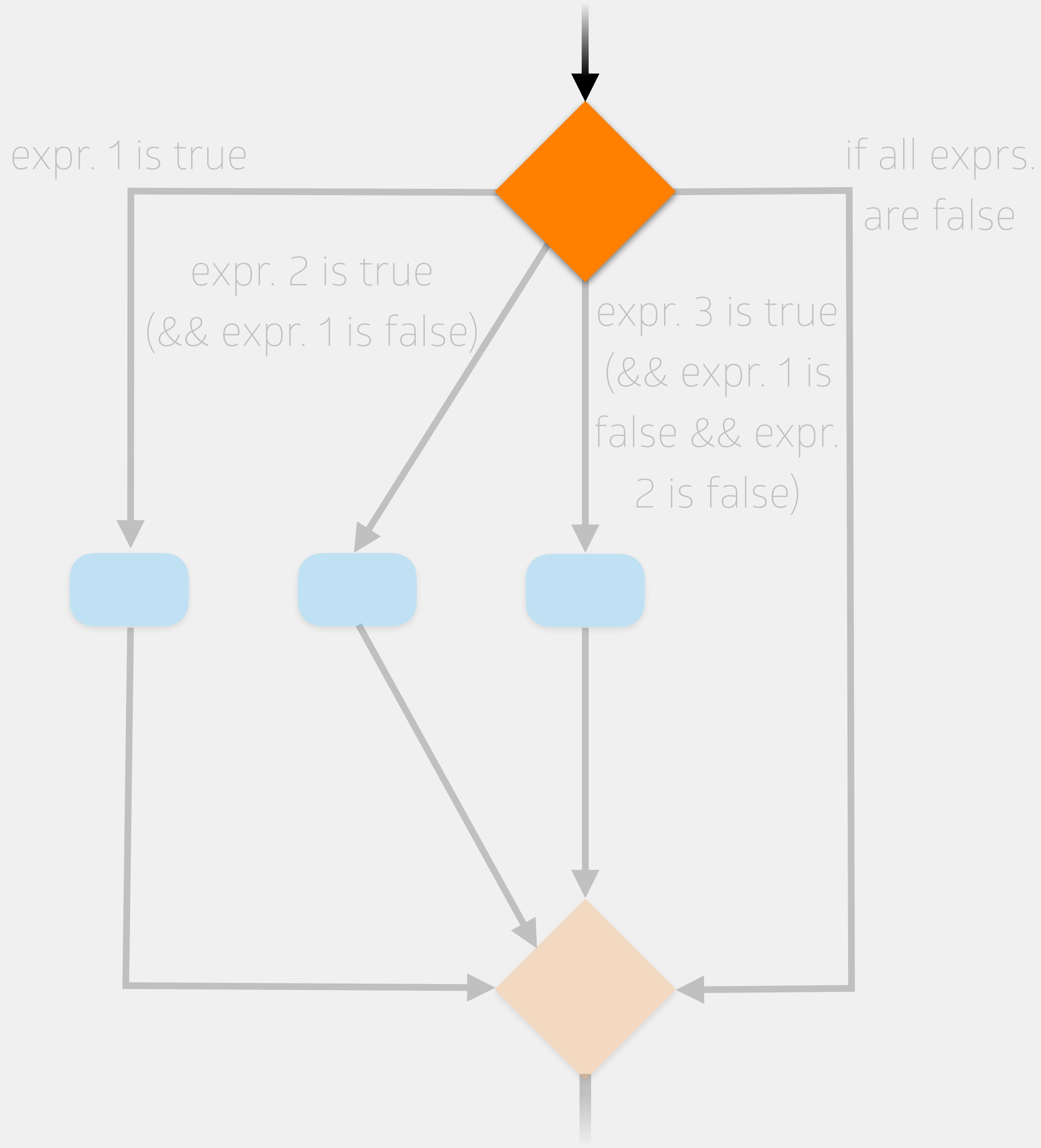

N.B.: the order of the if and else if statement(s) matters!

if-else if Statements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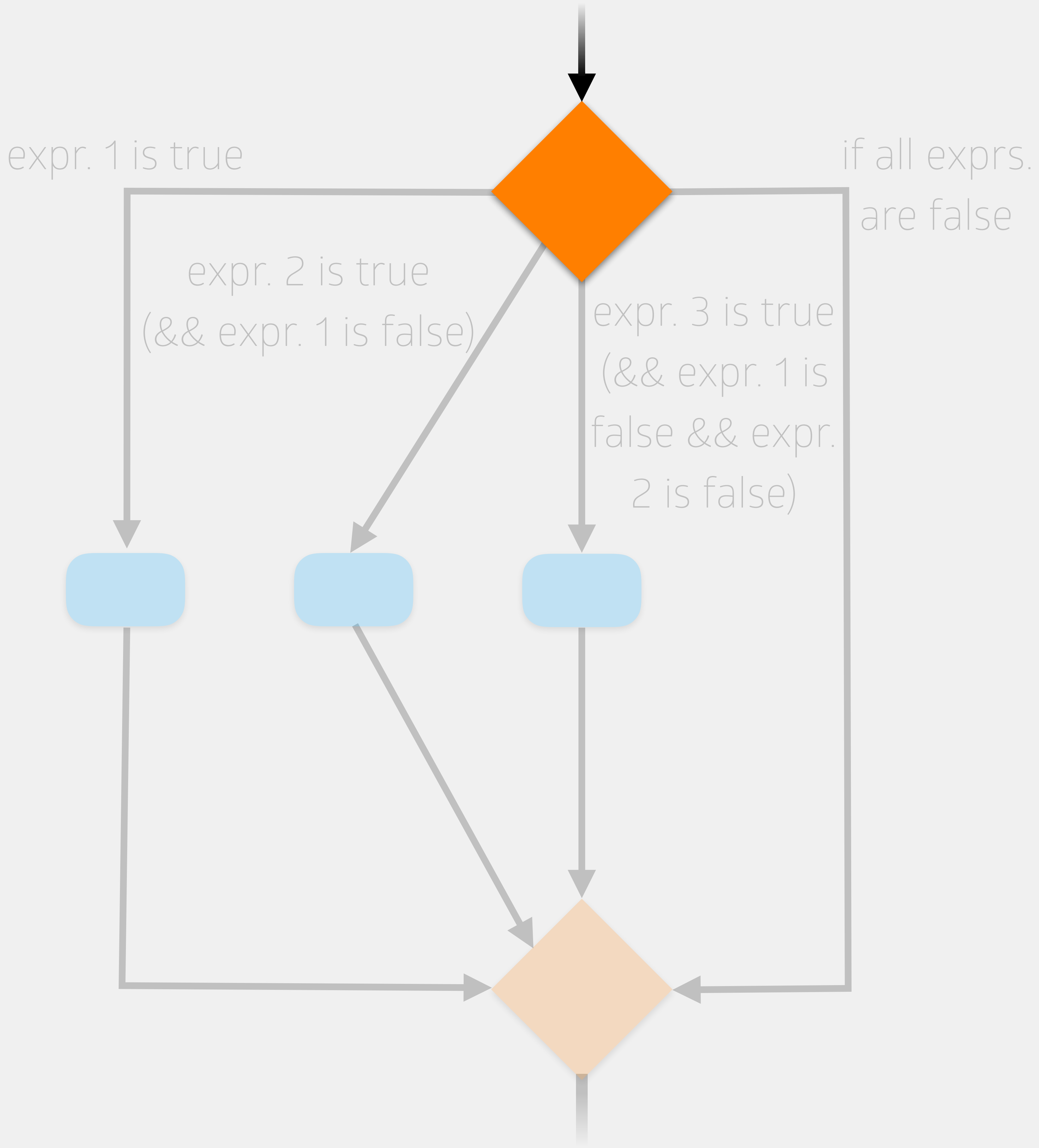
if-else if Statements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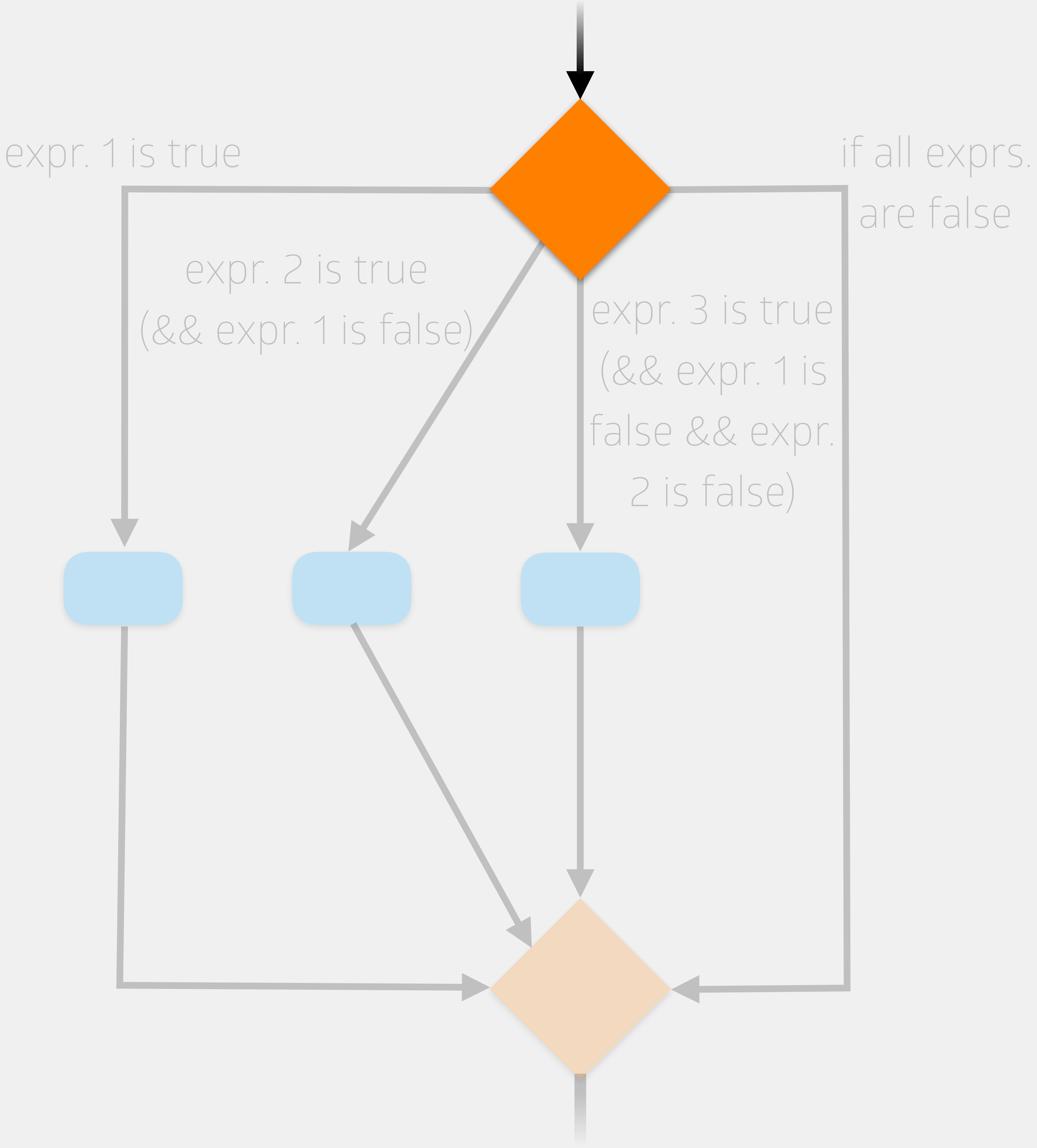
if-else if Statements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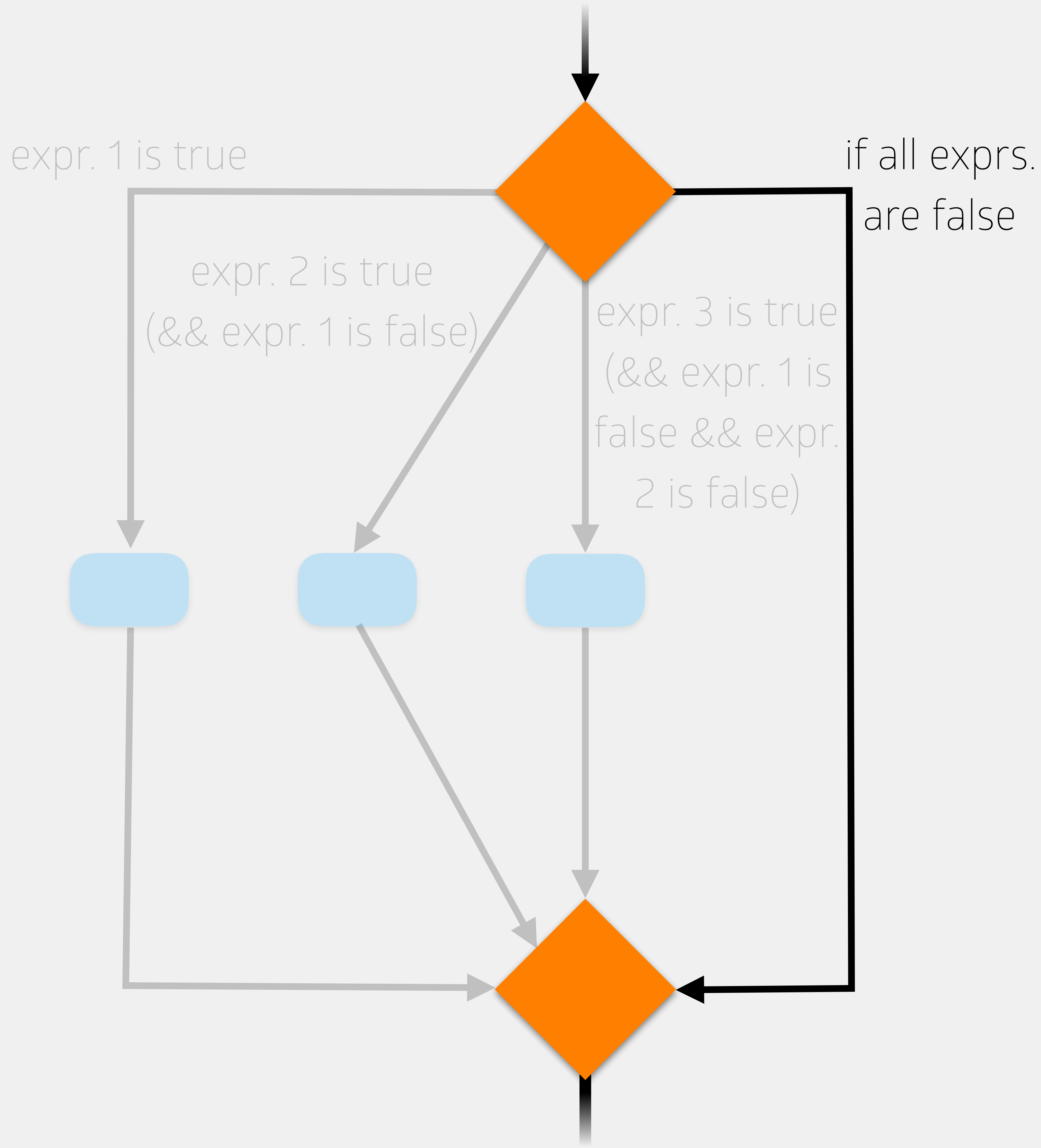
```

if-else if Statements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    // and the previous boolean expressions are false
} else if (<boolean expression 3>) {
    //code to execute if boolean expression 3 is true
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}

>//code to execute after if-else if statement
```
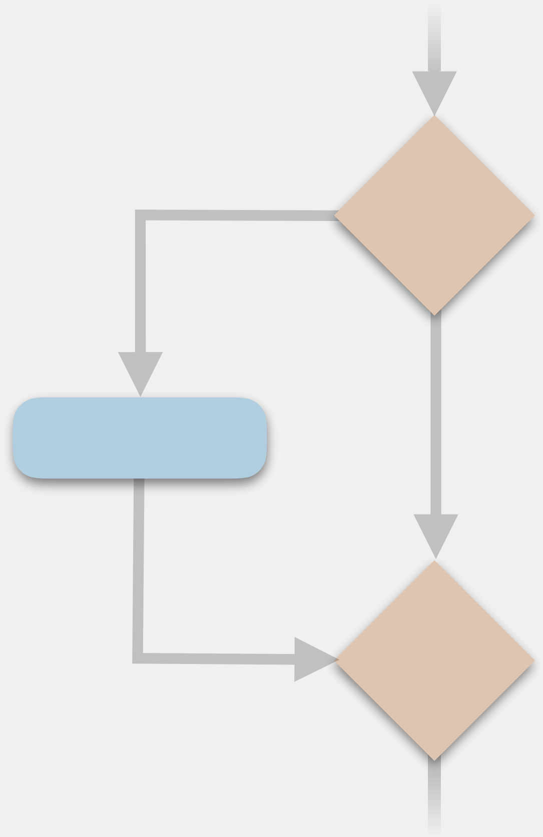
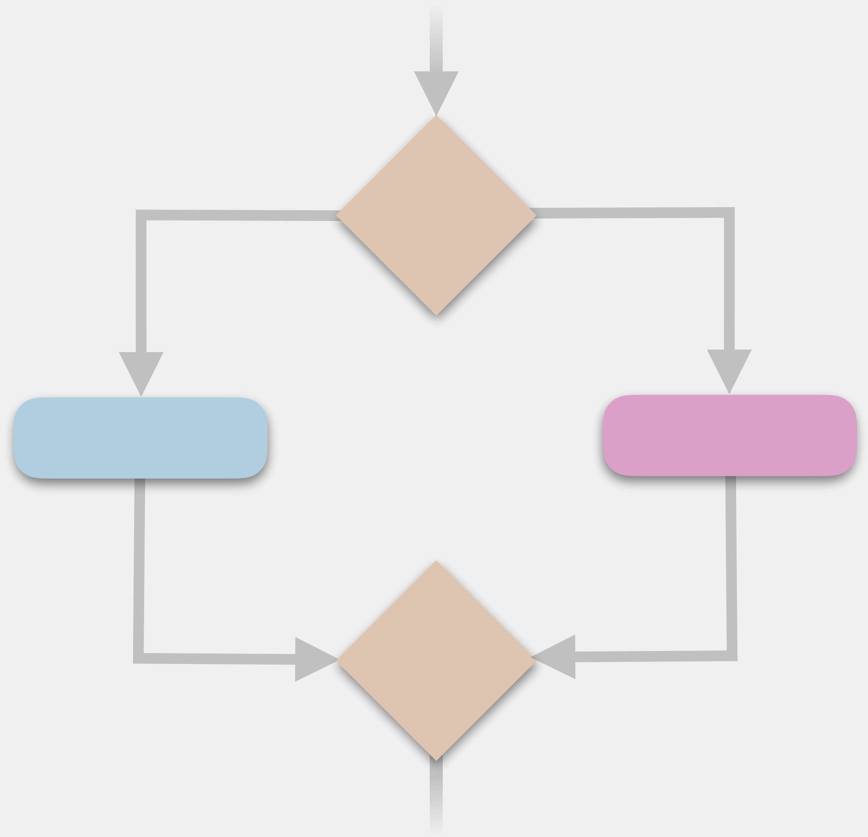

N.B.: in this case, we execute **none** of the if or else if statements

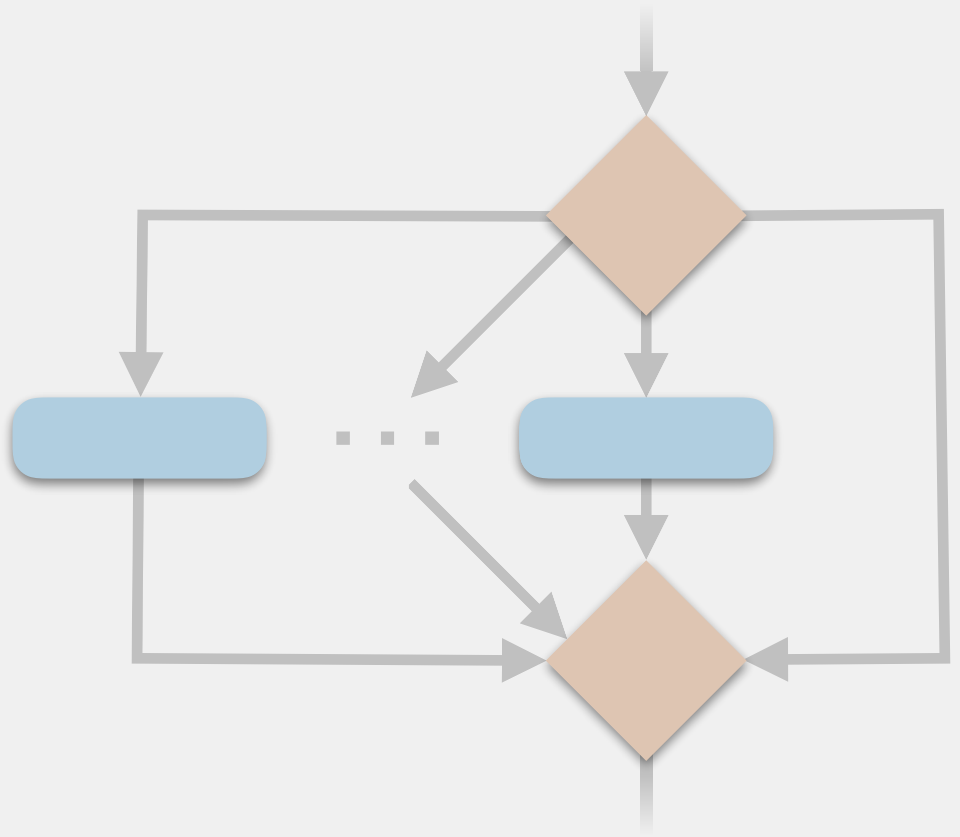
Types of Conditional Statements



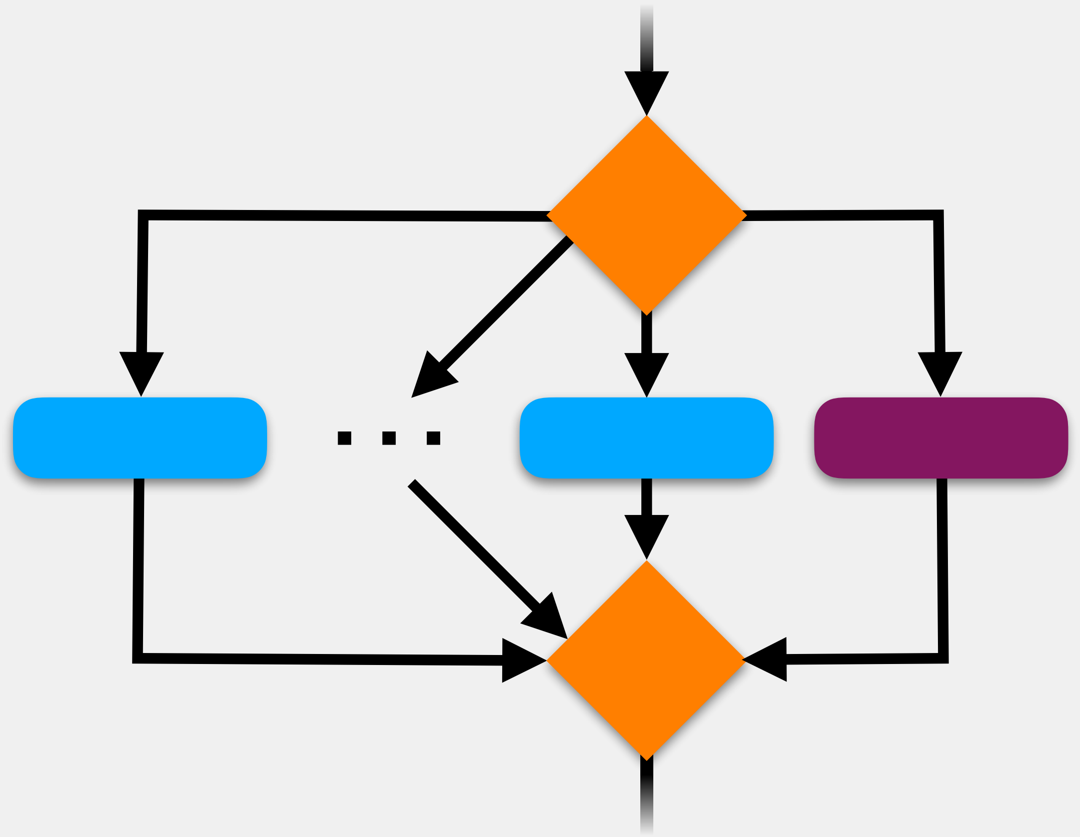
`if` statements



`if-else` statements



`if-else if` statements



`if-else if-else` statements

`if-else if-else` Statements

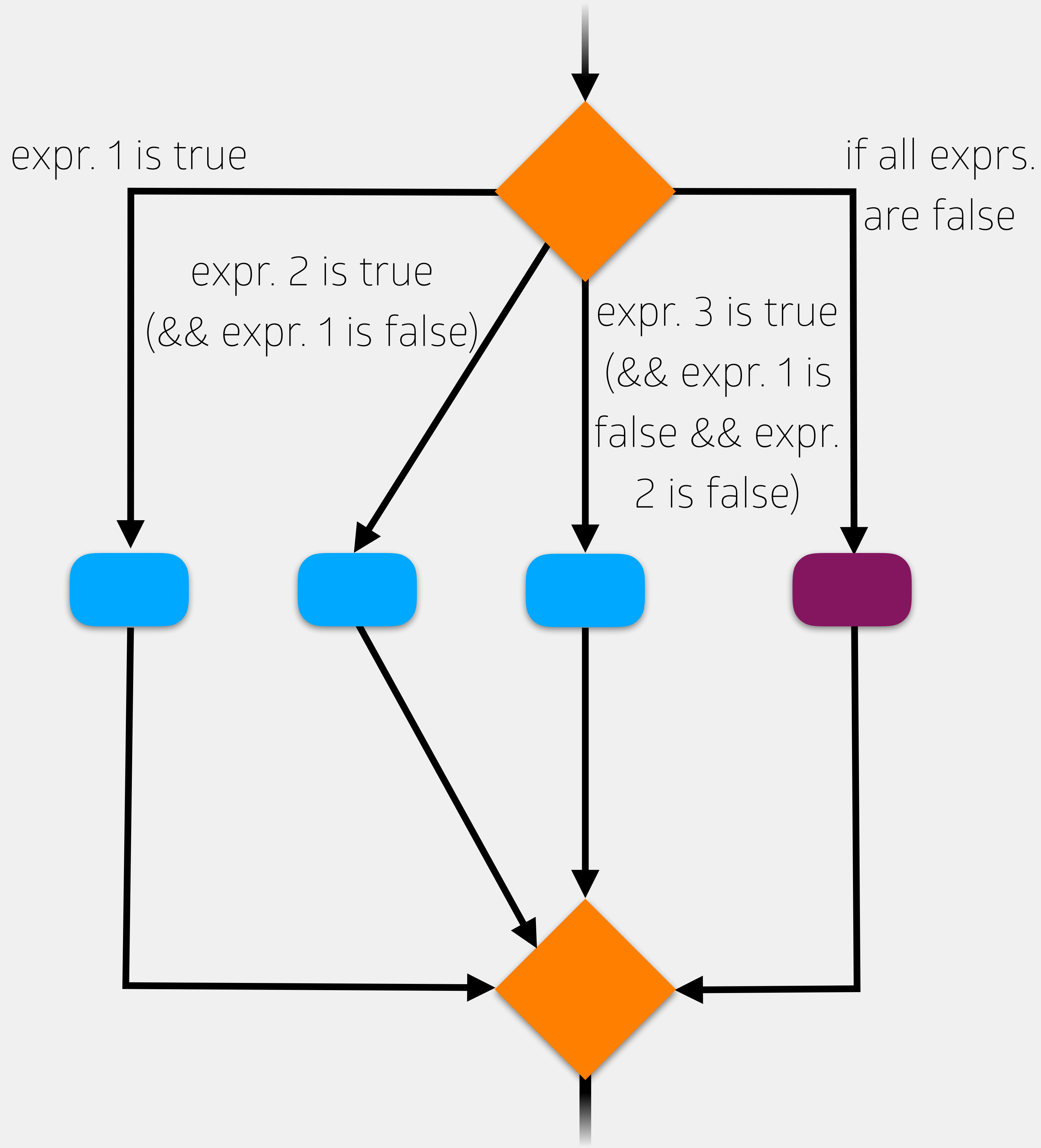
Makes exactly one decision amongst many boolean expressions

- *if* the boolean expression is true, execute the code in the block underneath the `if`
- *else if* the previous boolean expr. is false and the boolean expr. in the `else if` is true, execute the code in the block underneath the `else if`
- *else* (i.e., if all previous boolean exprs. are false), execute the code in the block underneath the `else`

Can have one or more `else if` statements

Must have exactly one `else` statement

if-else if-else Statements


expr. 1 is true
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expr. 3 is true (&& expr. 1 is false && expr. 2 is false)
if all exprs. are false

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if (<boolean expression 1>) {
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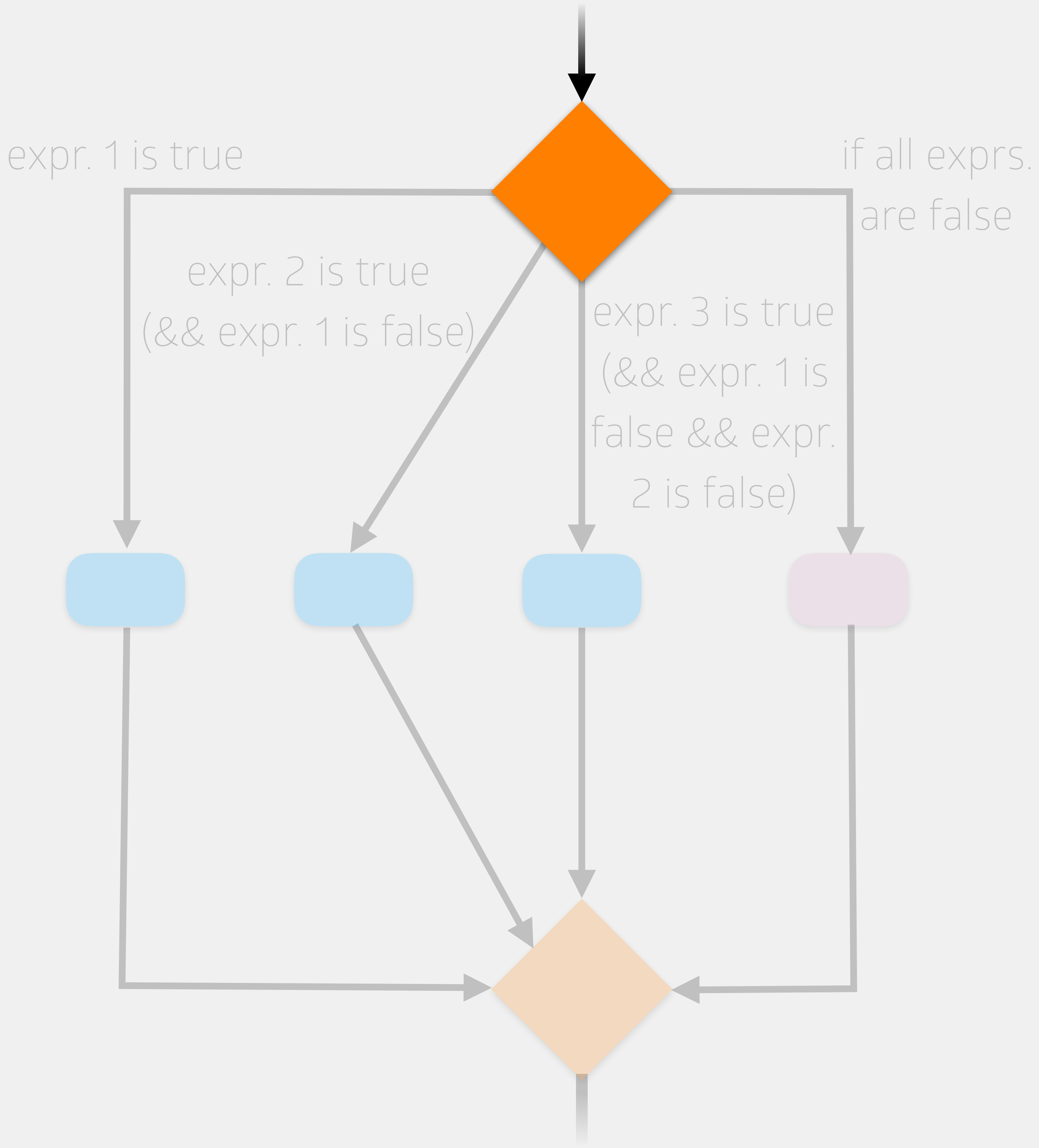
} else if (<boolean expression 3>) {
    //code to execute if boolean expression 3 is true
    // and the previous boolean expressions are false
} else {
    //code to execute if the previous boolean
    // expressions are false
}

//code to execute after if-else if-else statement
```

N.B.: we could have greater or fewer else if blocks; this example happens to have two

if-else if-else Statements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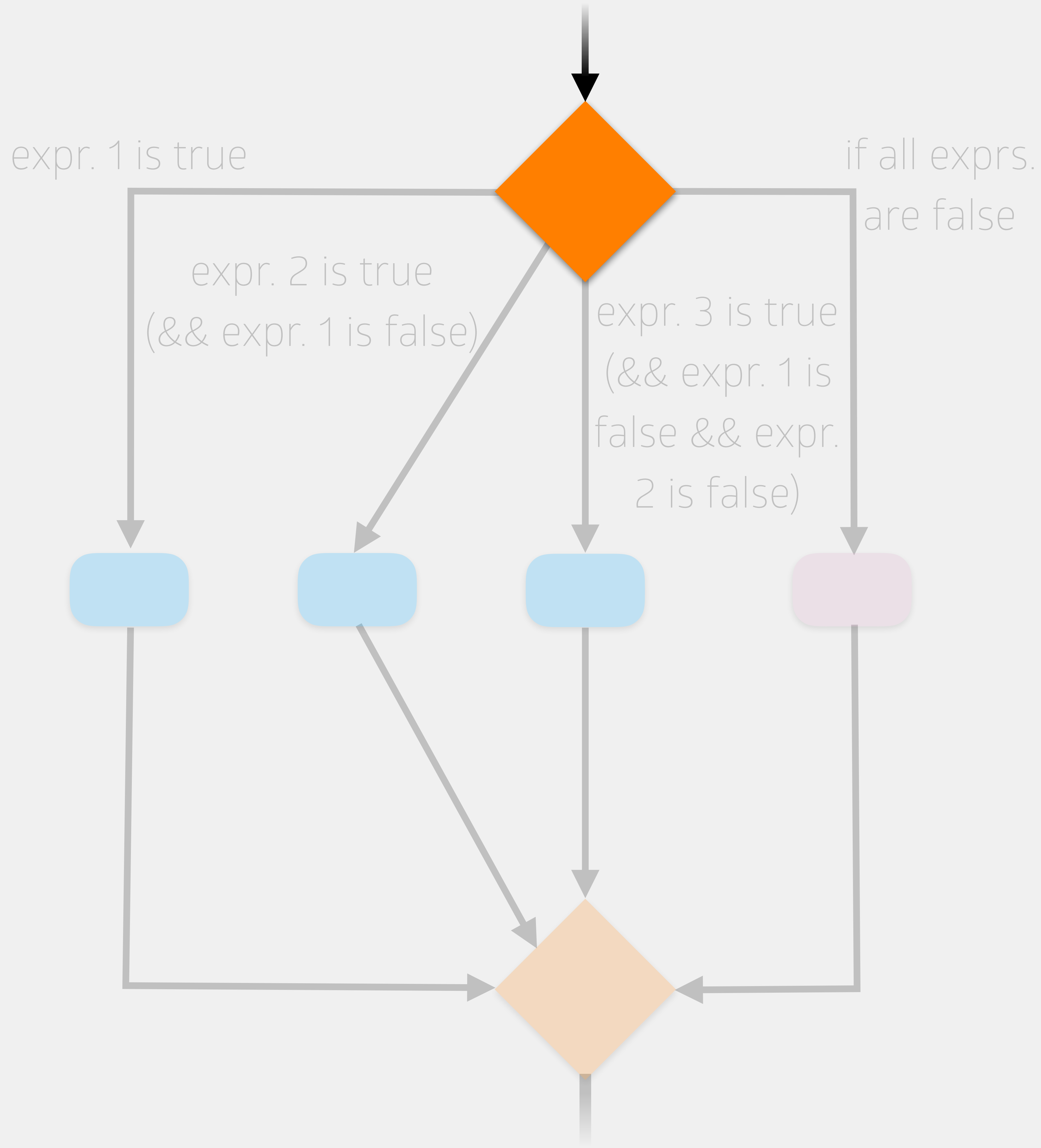
if-else if-else Statements



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if all exprs. are false

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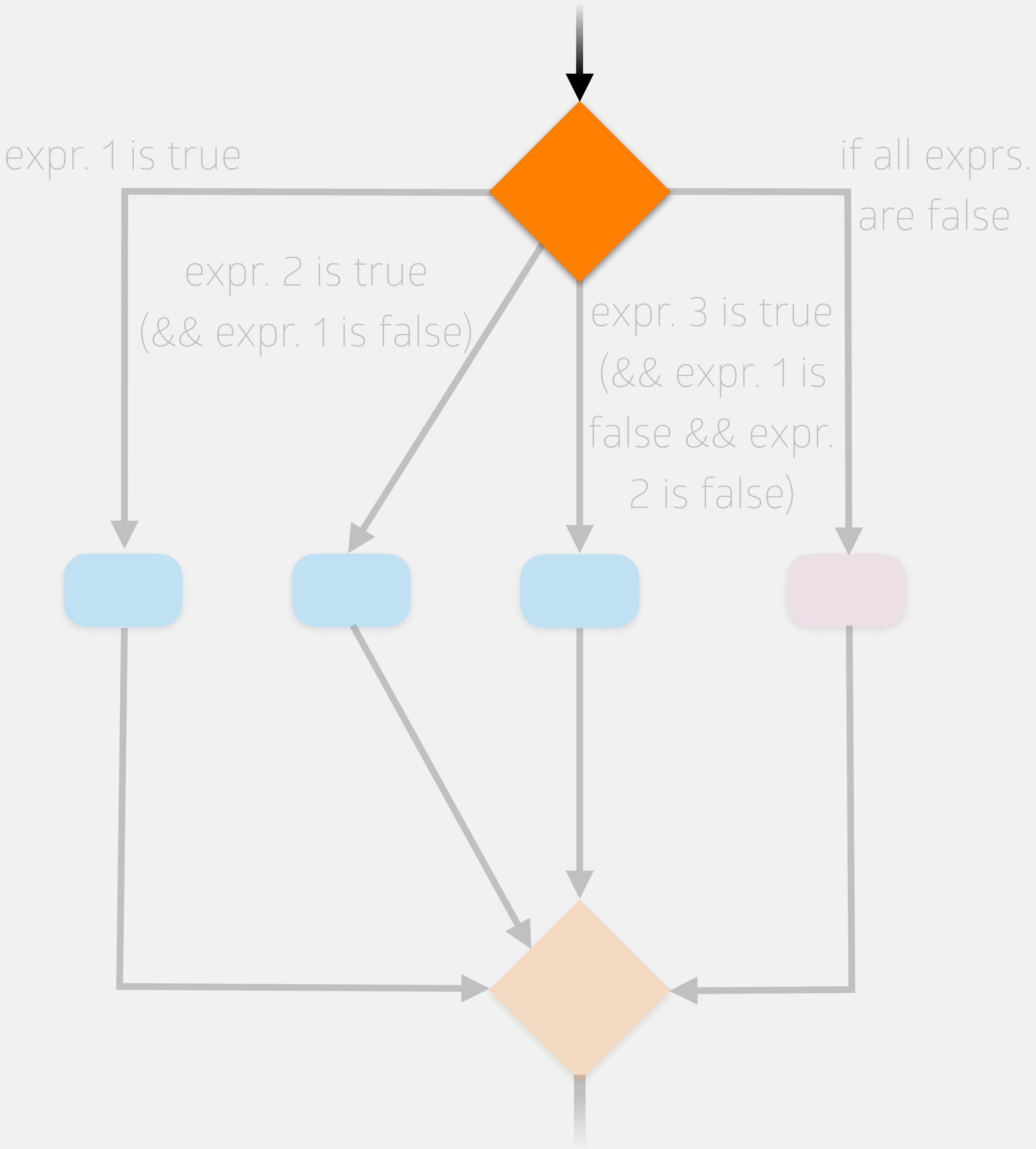
if-else if-else Statements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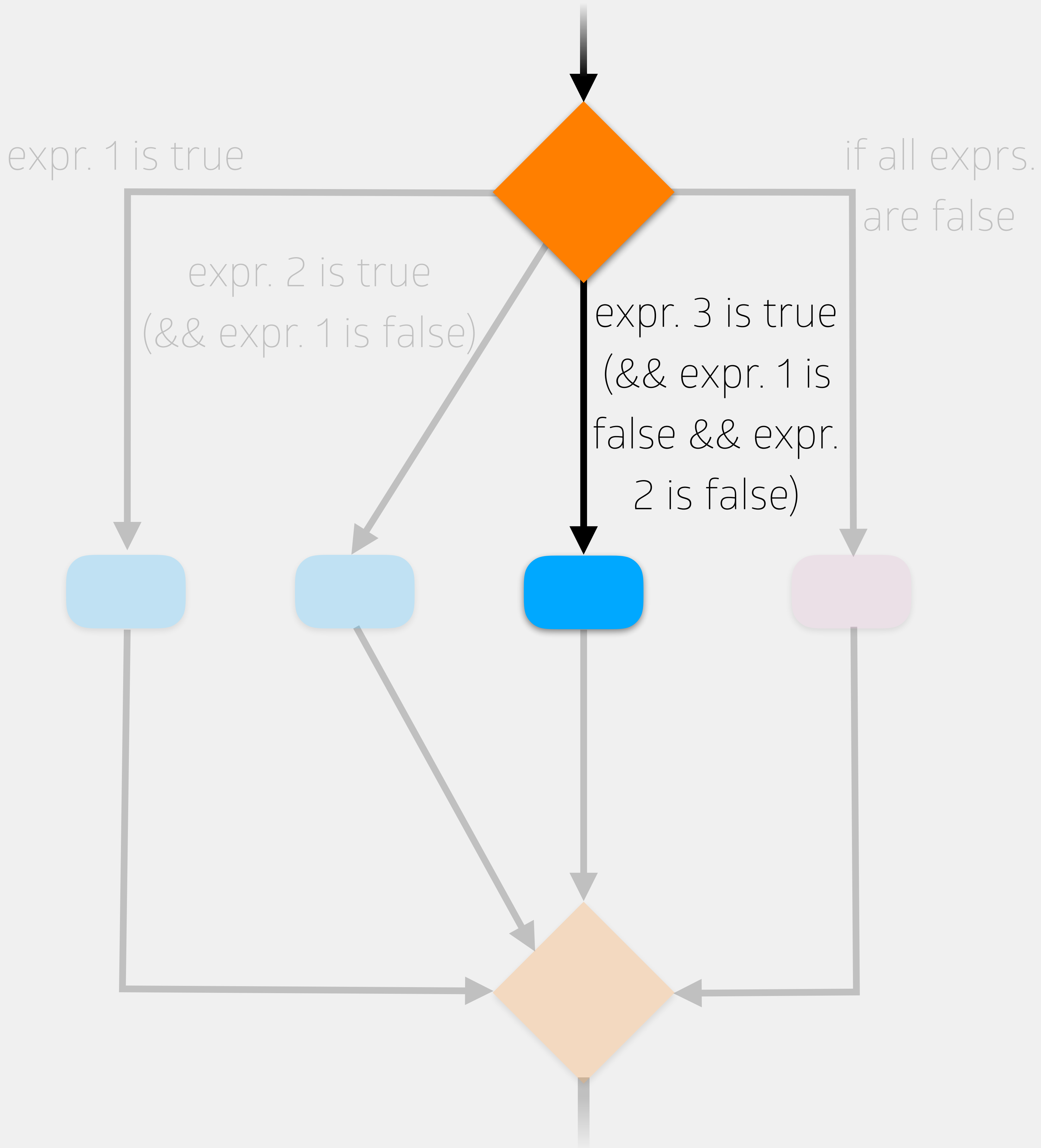
if-else if-else Statements



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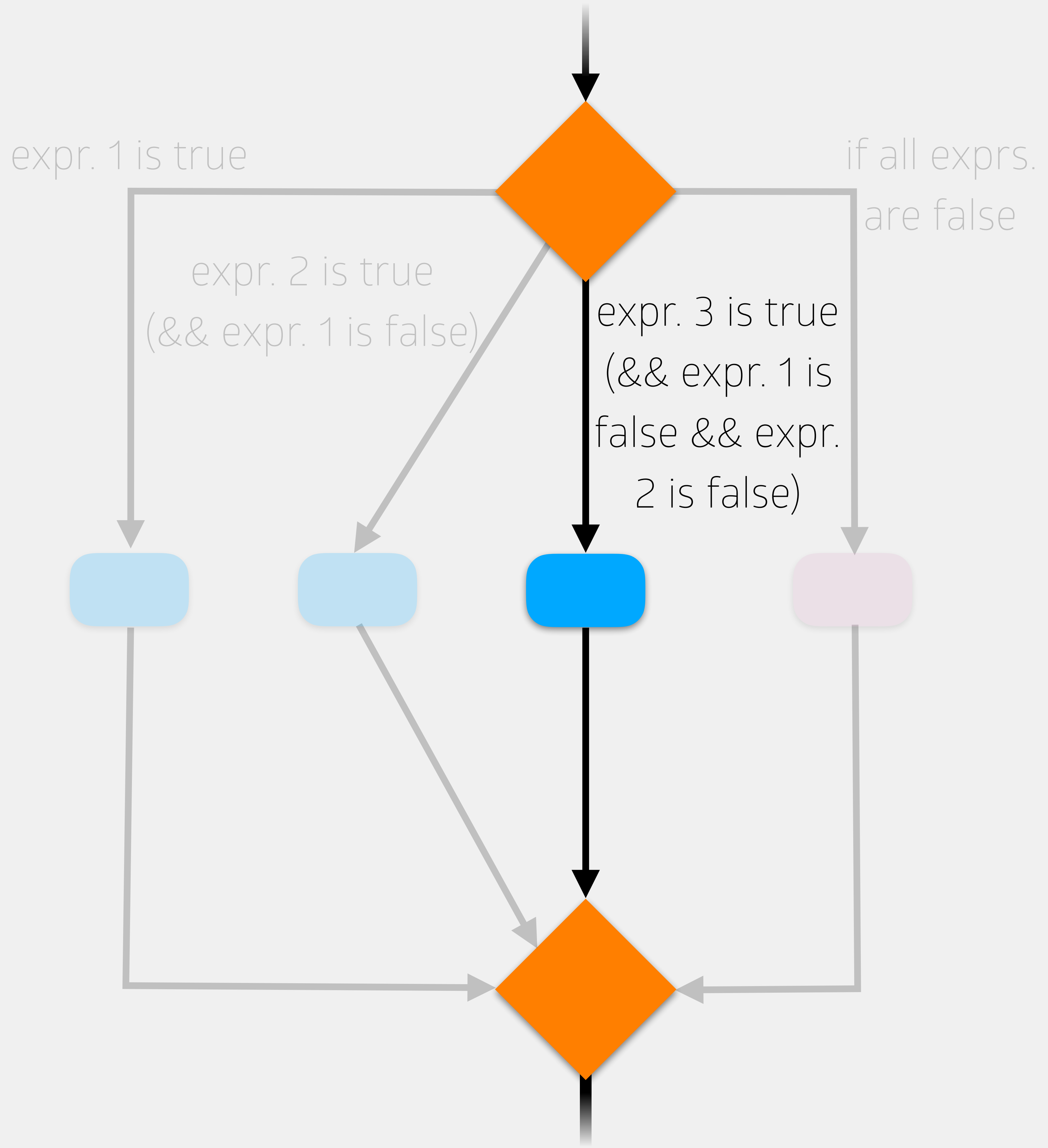
if-else if-else Statements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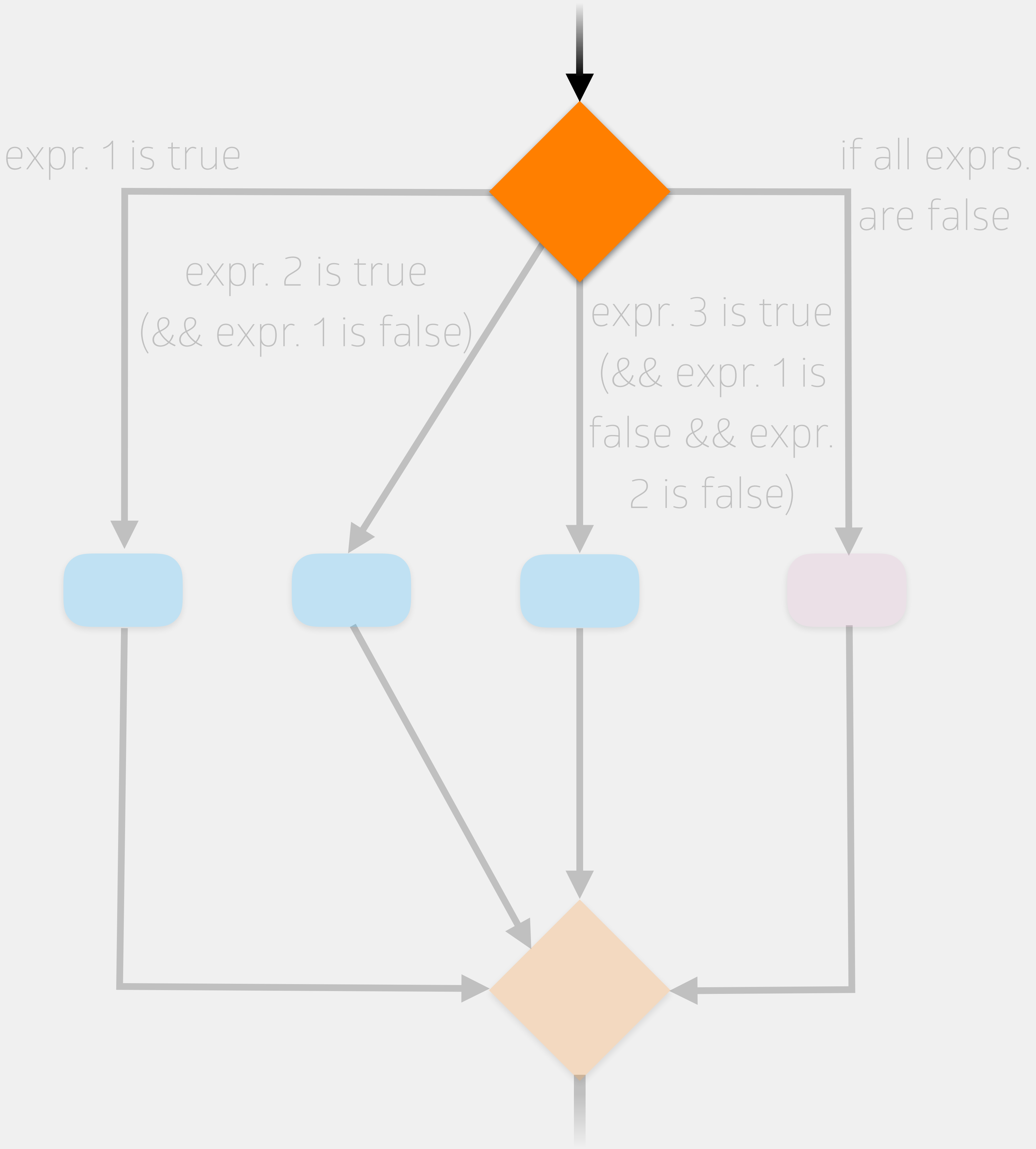
if-else if-else Statements



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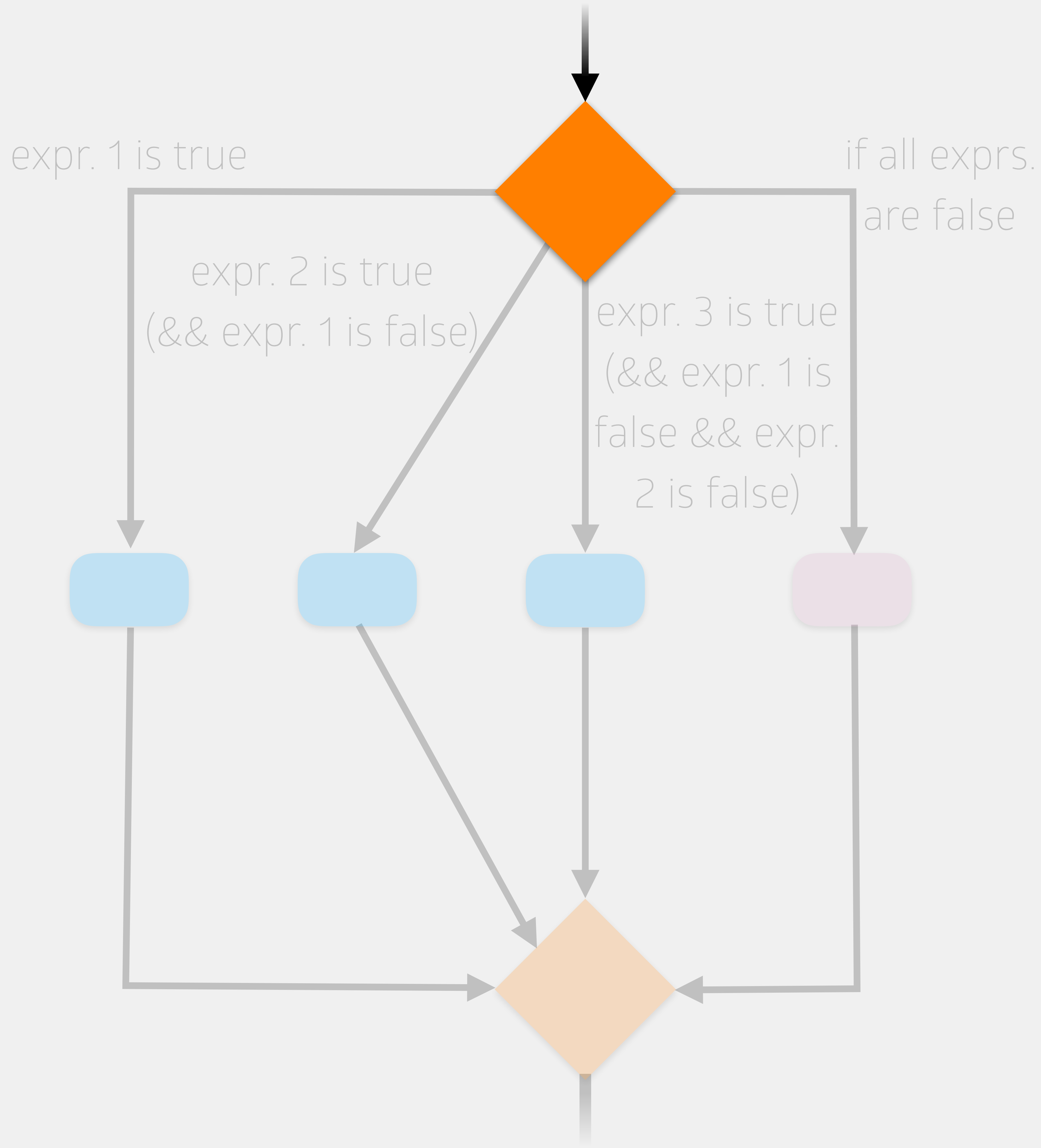
if-else if-else Statements



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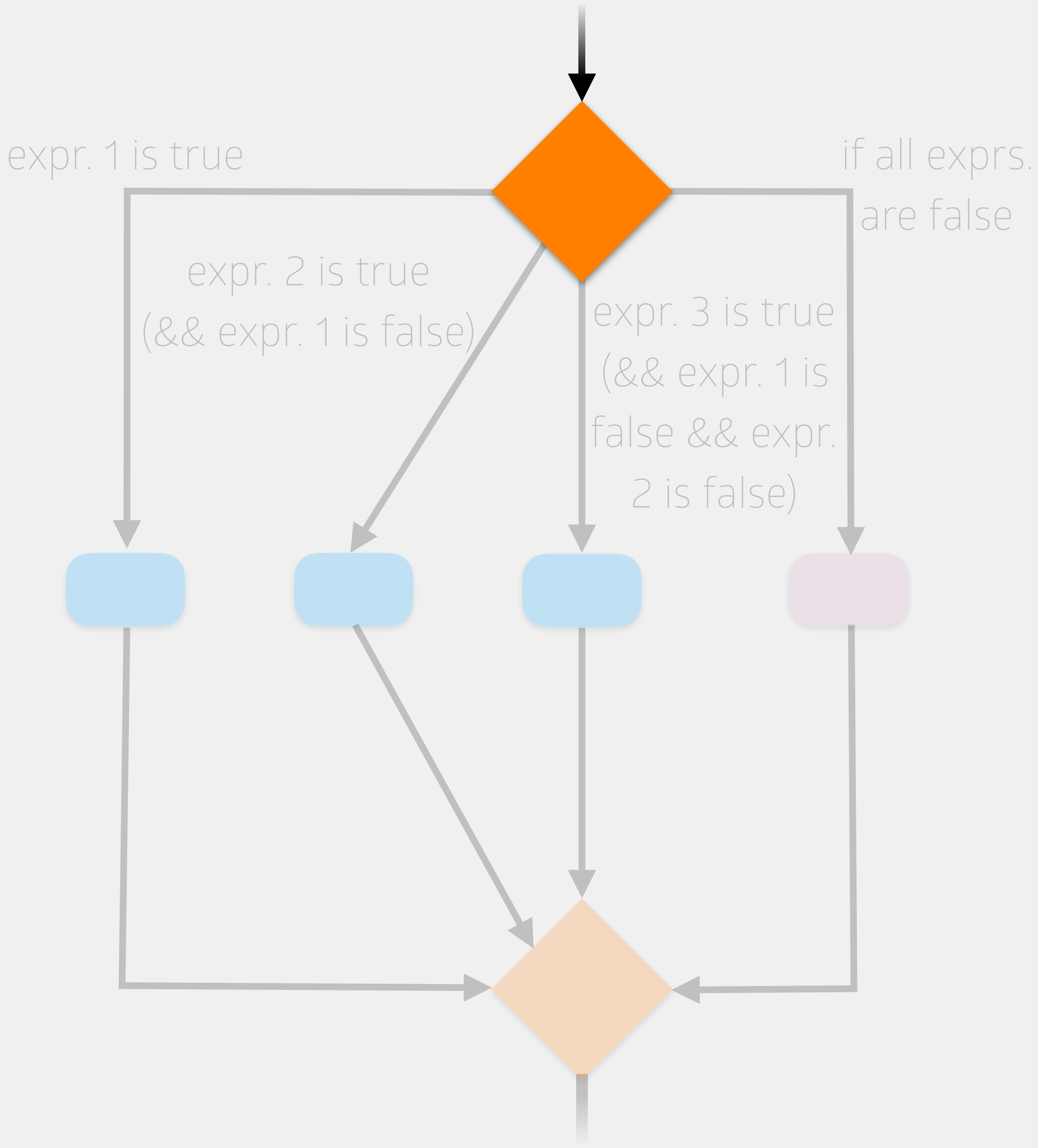
if-else if-else Statements



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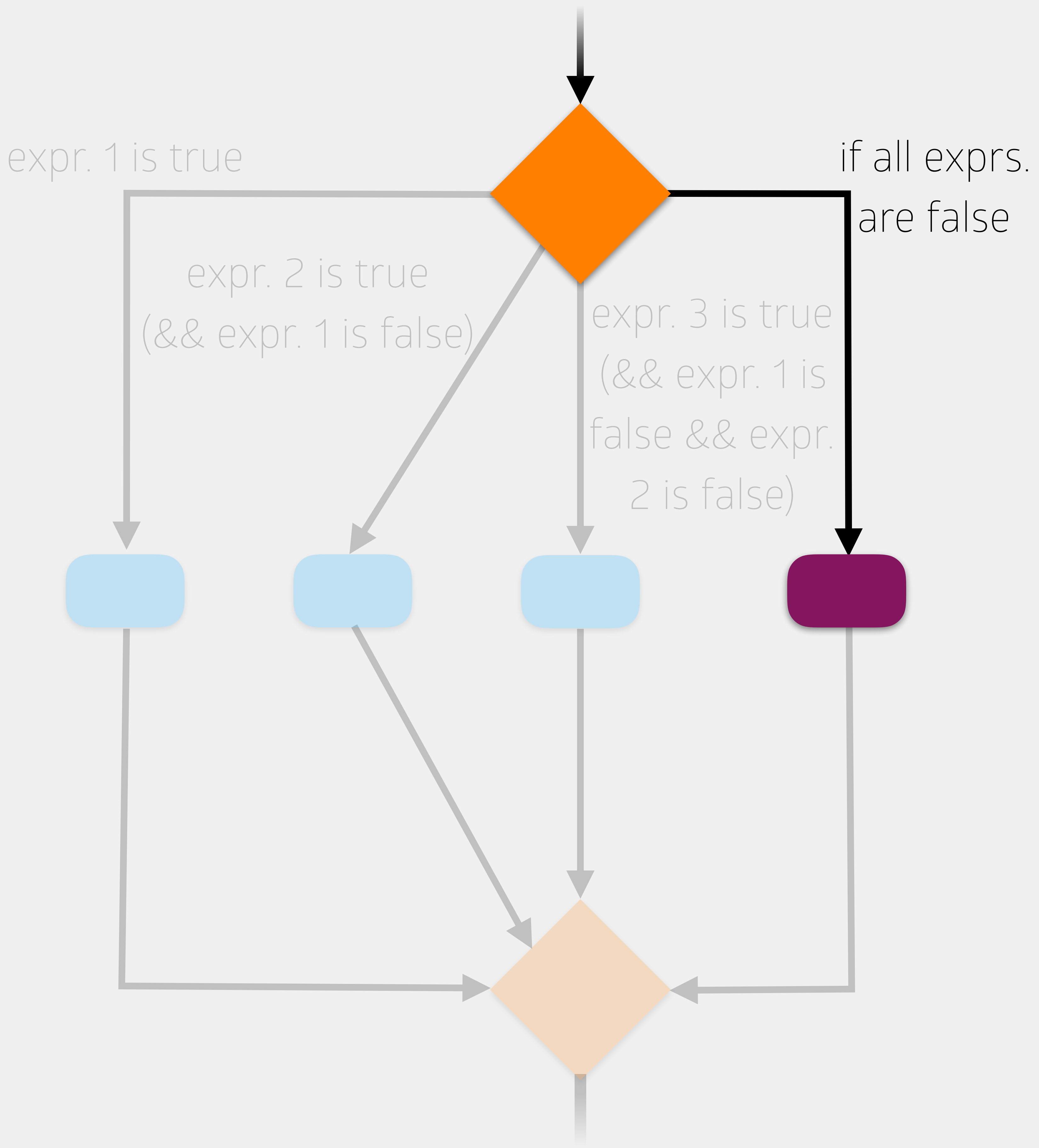
if-else if-else Statements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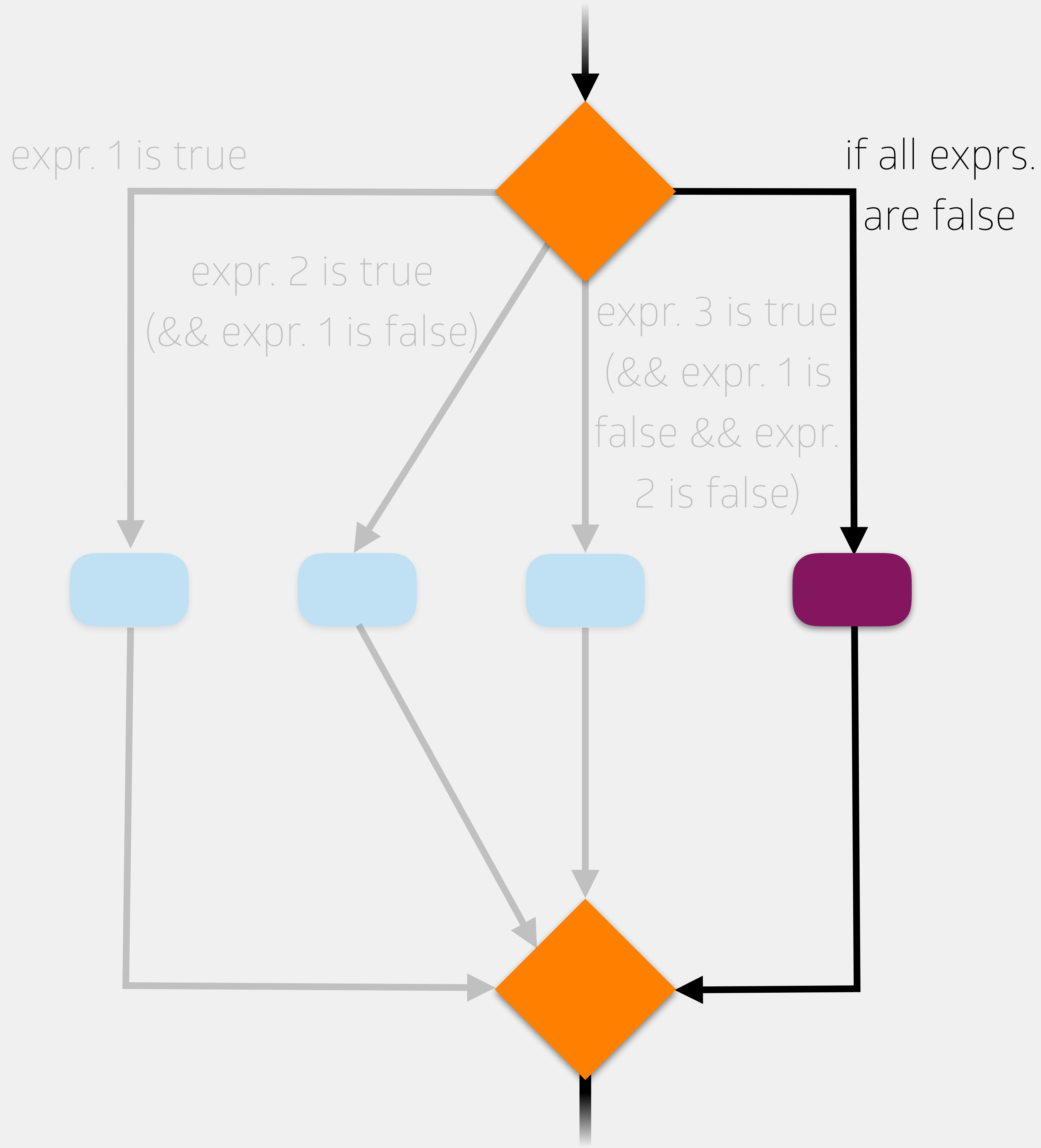
if-else if-else Statements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>//code to execute after if-else if-else statement
```

N.B.: we will always execute exactly one of these blocks

In A Nutshell

We have three types of conditional blocks: `if`, `else if`, and `else`

Every conditional statement...

- must start with exactly one `if` block
  - `if` blocks are always the first statement
- can be followed by zero or more `else if` blocks
- can have exactly zero or one `else` blocks
  - `else` blocks are always the last statement (if included)

If there is an `else` block, exactly 1 block will execute

If there is no `else` block (i.e., just `if`, or `if` + `else if`), then either 0 or 1 blocks will execute

A Note on Naming Variables…

Sensibly naming variables becomes more important with control flow statements

What is the following code used for?

```
if (x == 'A' && y == 'S') {
  System.out.println("Match found");
}
```

A Note on Naming Variables…

Sensibly naming variables becomes more important with control flow statements

What is the following code used for?

```
if (firstInitial == 'A' && lastInitial == 'S') {
  System.out.println("Match found");
}
```

Activity Diagrams: Symbols

▭	Activity
→	Control flow
◇	Merge/split
●	Start
◉	End

Activity Diagrams: Symbols

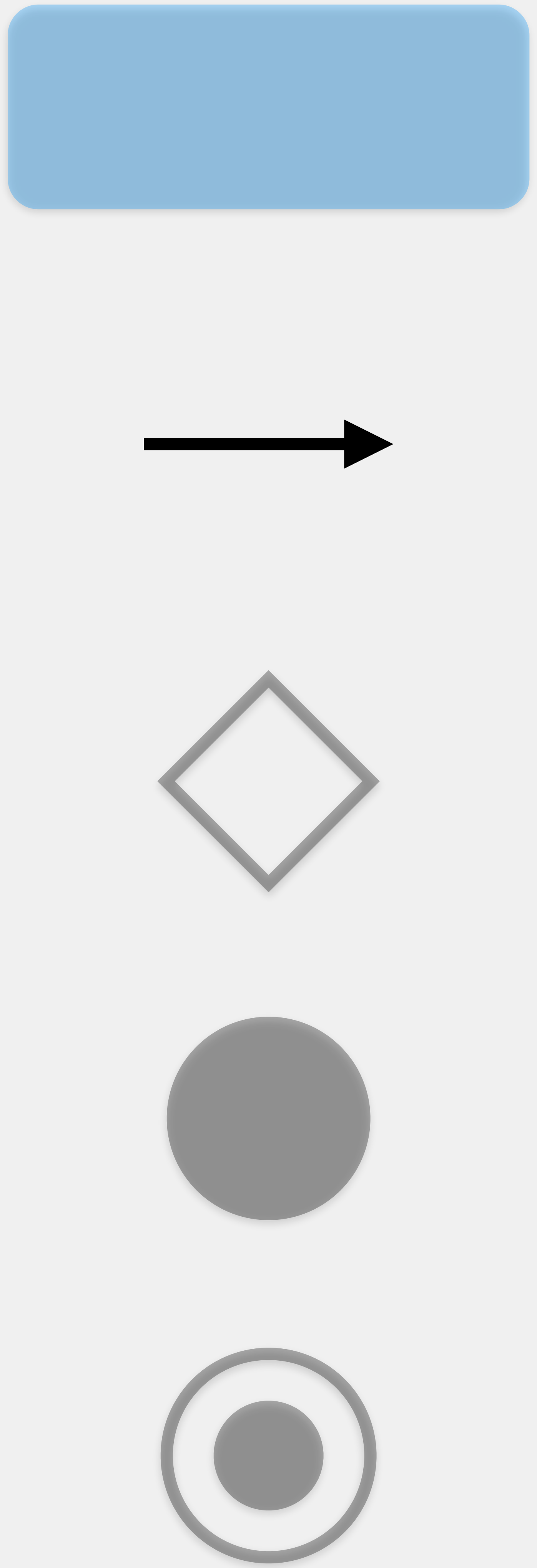
▭	**Activity**
→	Control flow
◇	Merge/split
●	Start
◉	End

Represents a single activity, a set of instructions

In software…

- one or more statements
- “read in user input”

Activity Diagrams: Symbols



Activity

Control flow

Merge/split

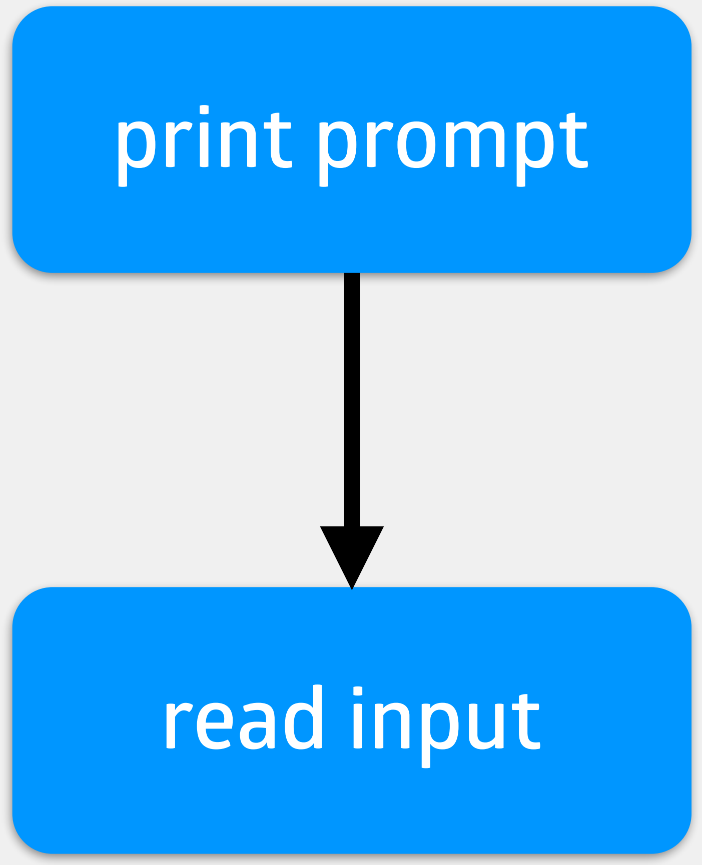
Start

End

control flow: the order of execution

Communicates the order of activities

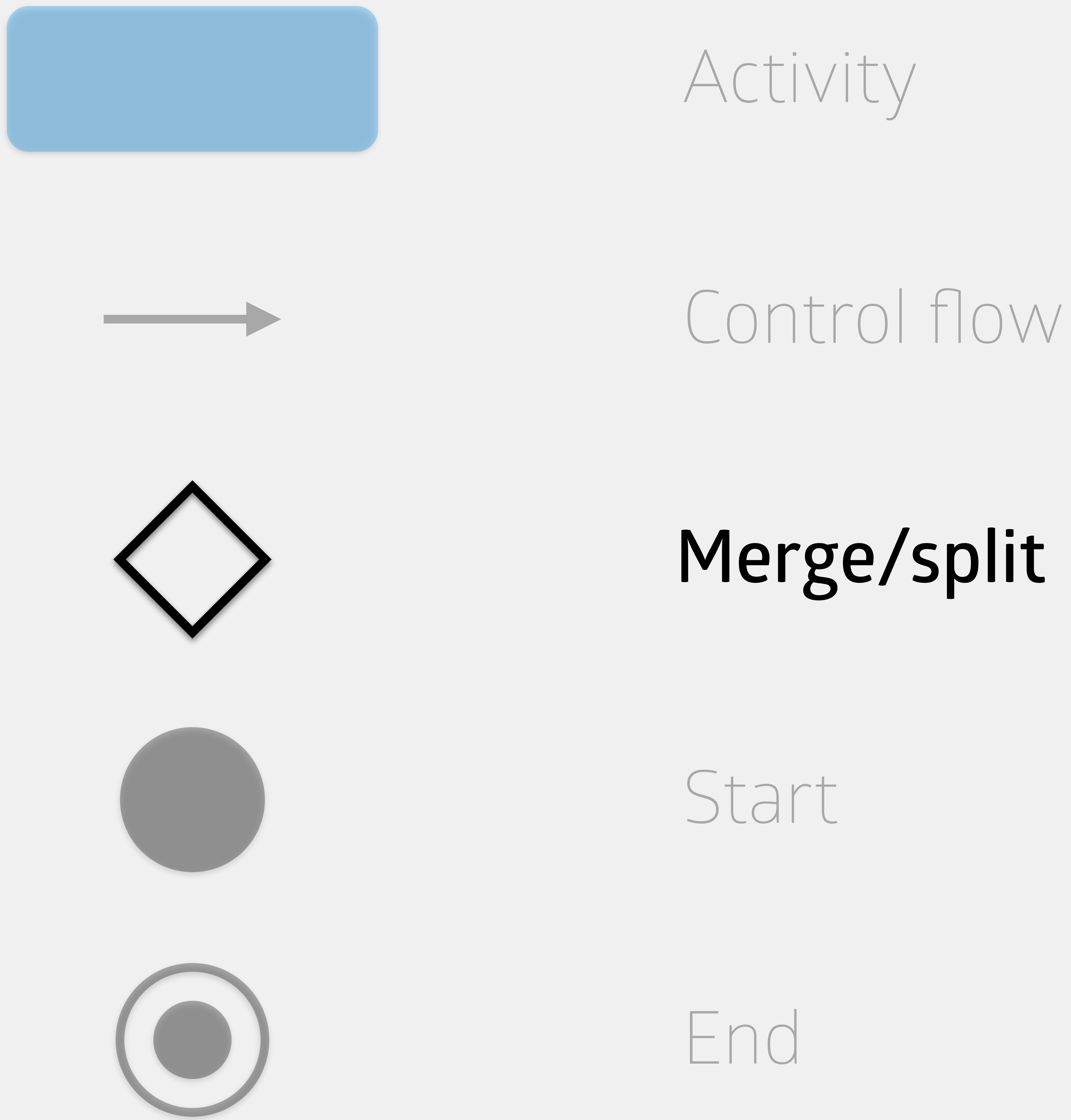
e.g., you print a prompt before reading input



print prompt

read input

Activity Diagrams: Symbols



Activity

Control flow

Merge/split

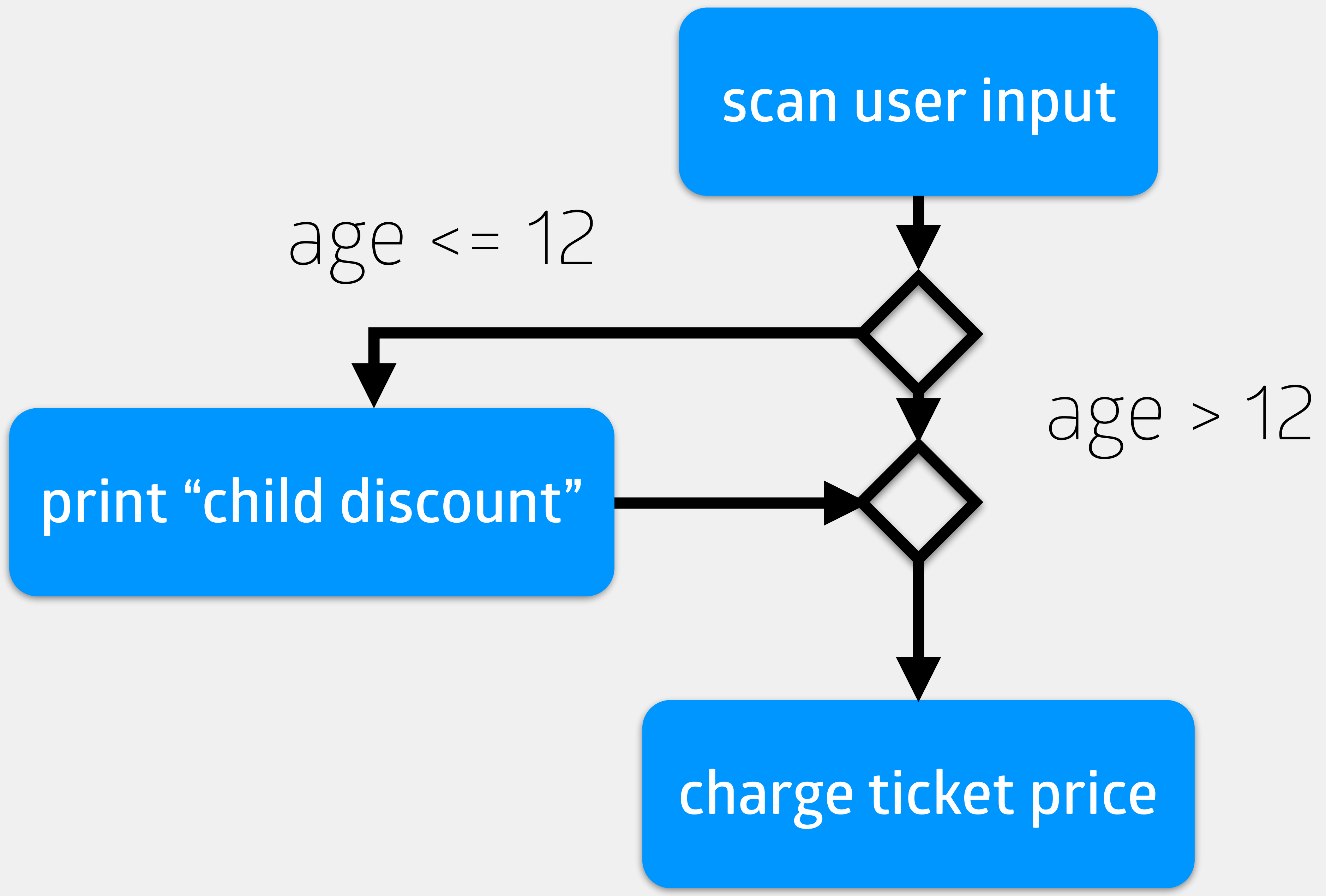
Start

End

Used to merge or split control flow

Handle different sequences of activities

e.g., asking user for age



scan user input

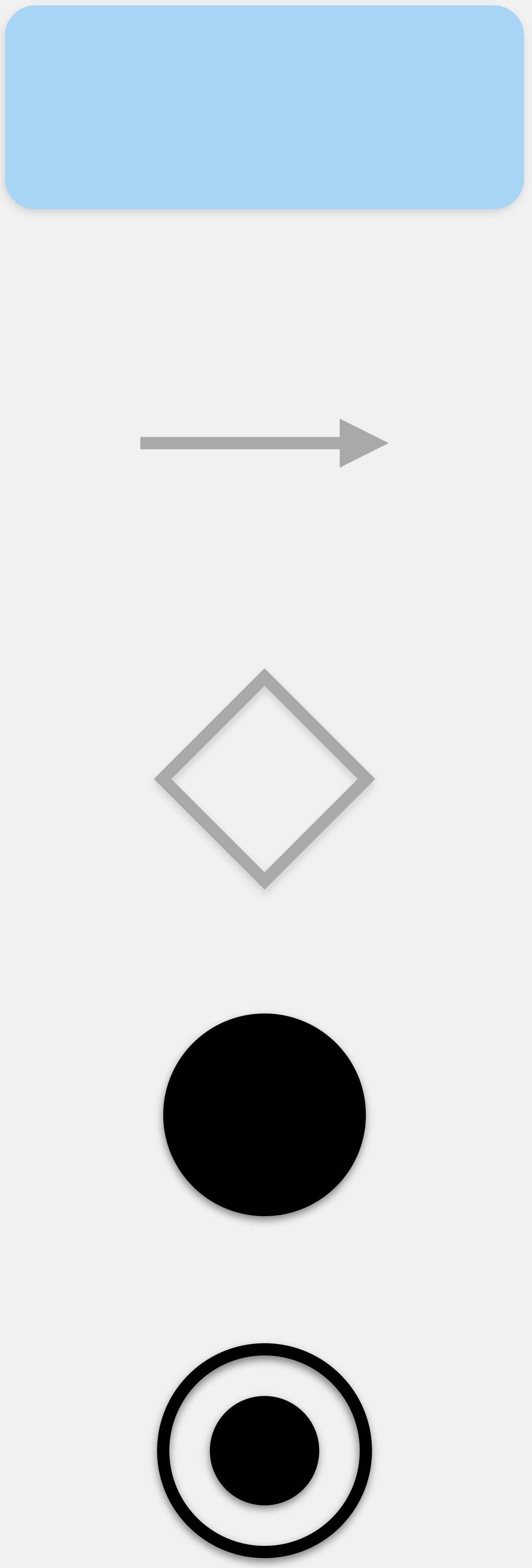
age <= 12

age > 12

print “child discount”

charge ticket price

Activity Diagrams: Symbols



Activity

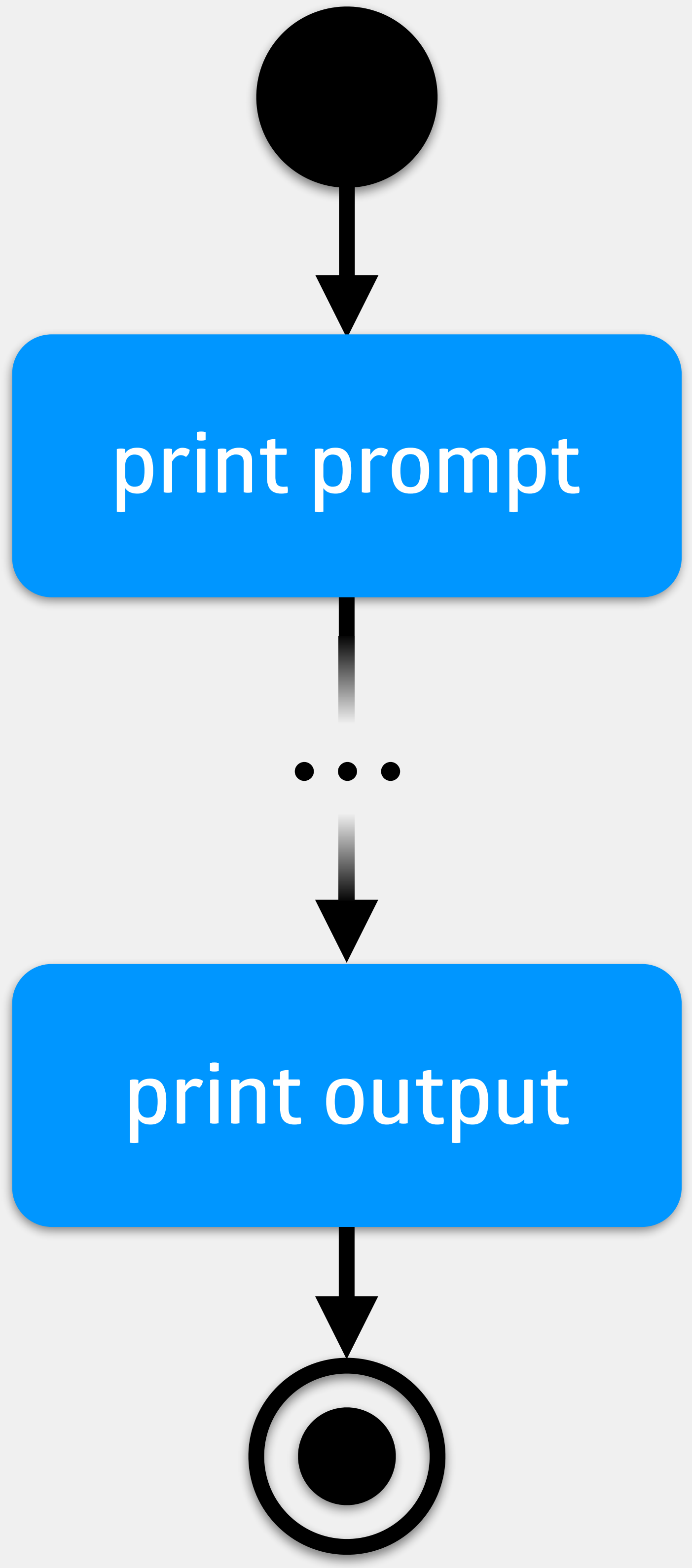
Control flow

Merge/split

Start

End

Denotes where the algorithm begins and ends



Combining Conditional Statements

Power of programming comes from combining control flow statements

- placing one conditional statement after another
- nesting one conditional statement inside another

Can do this in as many possible combinations as you can imagine!

- but, you typically don’t need to get too complex
- greater complexity often indicates a lack of clear problem solving strategy

To Consider

You know you need to use a conditional statement, but how to pick?

Ask yourself…

- if none of my conditions work out, do I have a default outcome? **have an else**
- are my outcomes mutually exclusive of one another? **have an if + else if(s)**
- do I want to be able to execute two or more of my outcomes? **use a sequence of conditionals**