Memoization with Pure Functions

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CEO AT CODING HELMET

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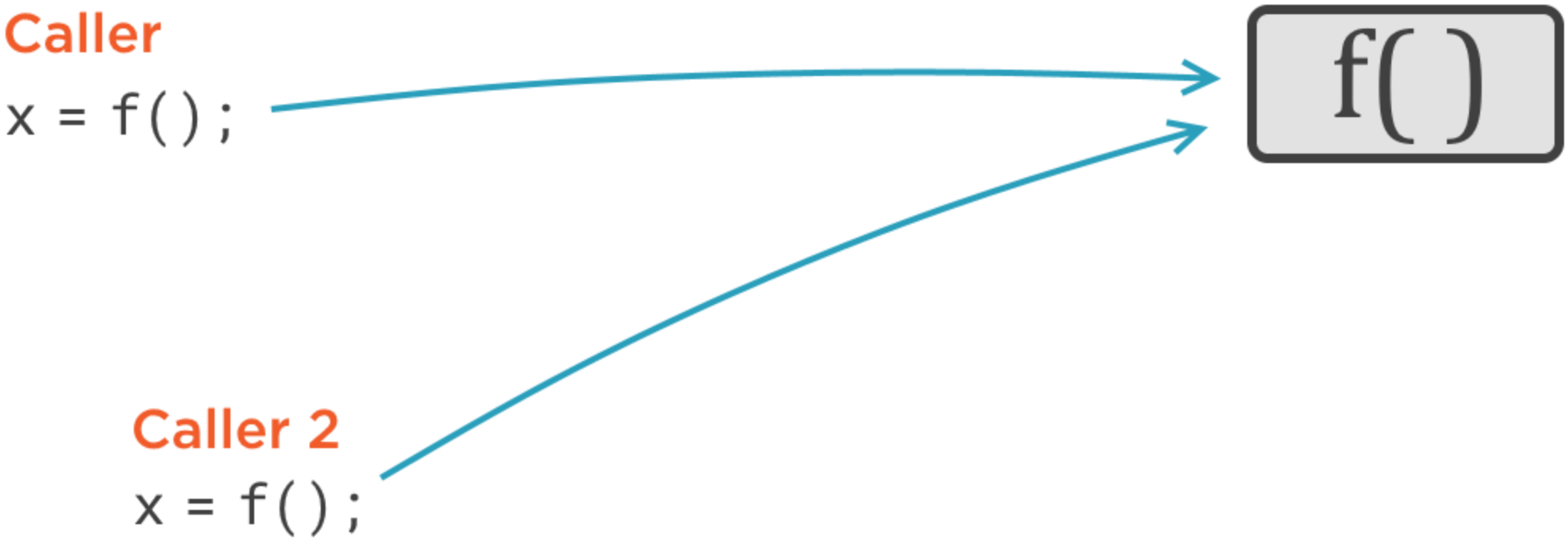
Memoization as a Trade-off



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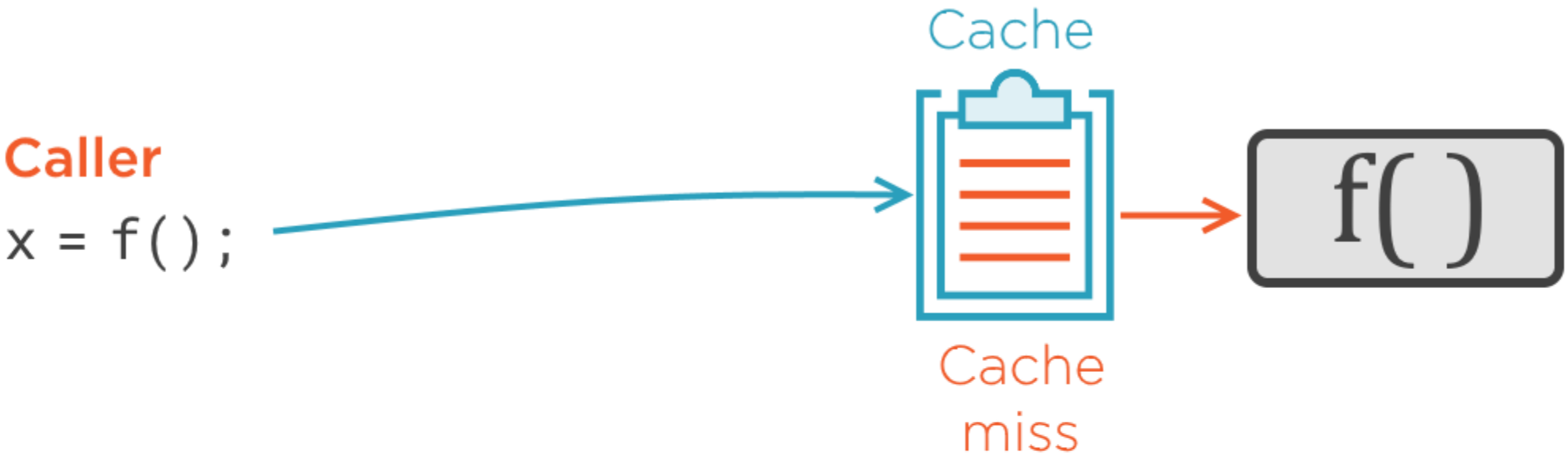
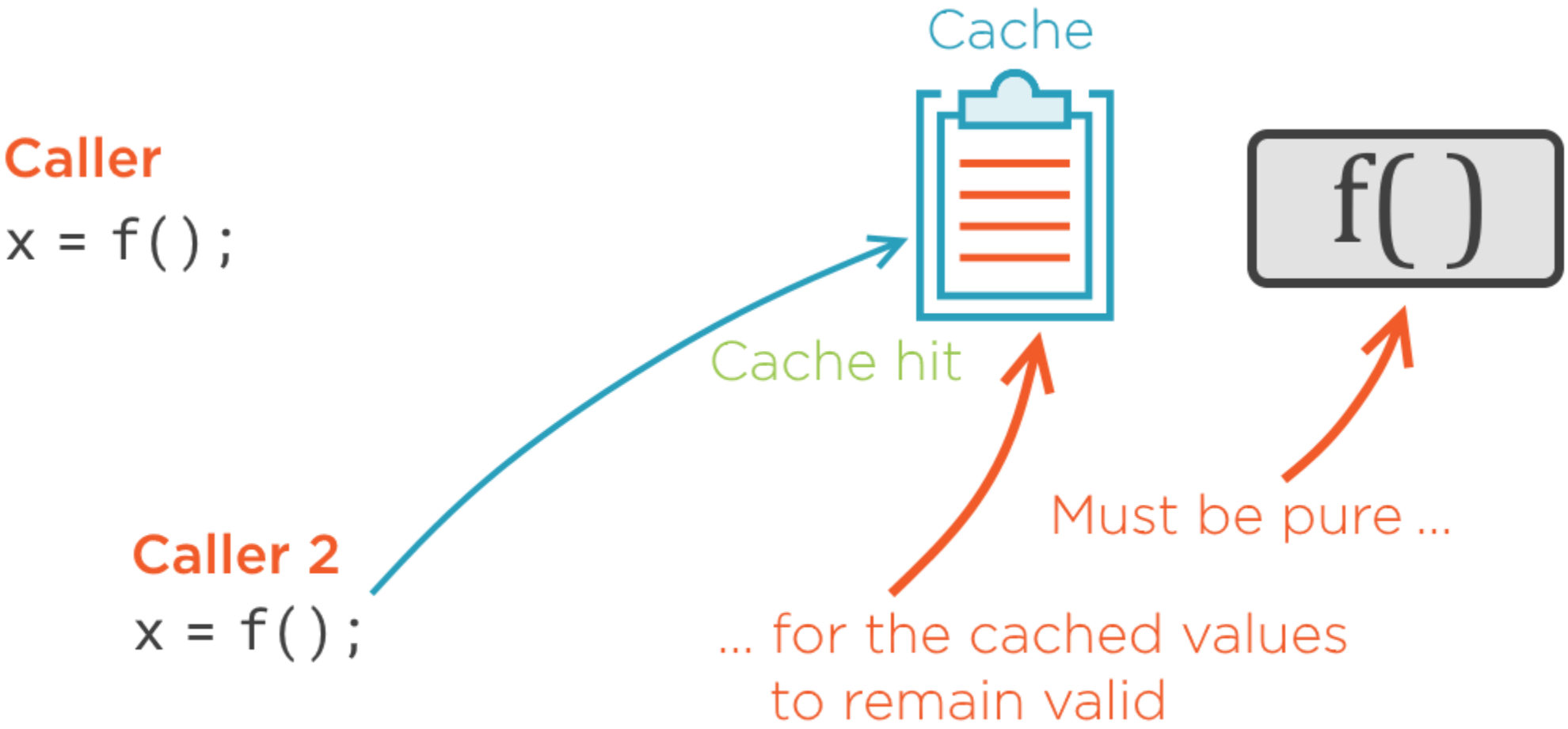


Caller 2

```
x = f();
```

Memoization as a Trade-off



Memoization as a Trade-off

Caller

```
x = f();
```

Cache

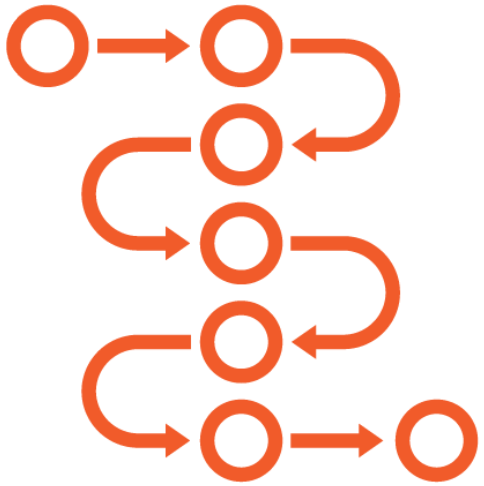
Larger memory footprint
Possible defects

Caller 2

```
x = f();
```

You have a problem.
You choose to solve it by caching results.
Now you have two problems.

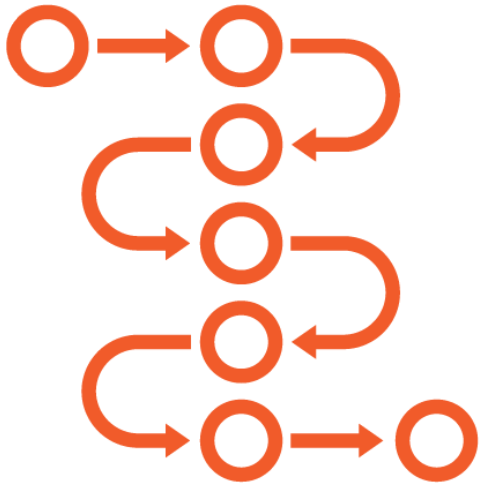
Dynamic Programming Defined



Dynamic programming (a.k.a. dynamic optimization) is a method for solving a complex problem by breaking it down into a collection of simpler subproblems, solving each of those subproblems just once, and storing their solutions.

https://en.wikipedia.org/wiki/Dynamic_programming

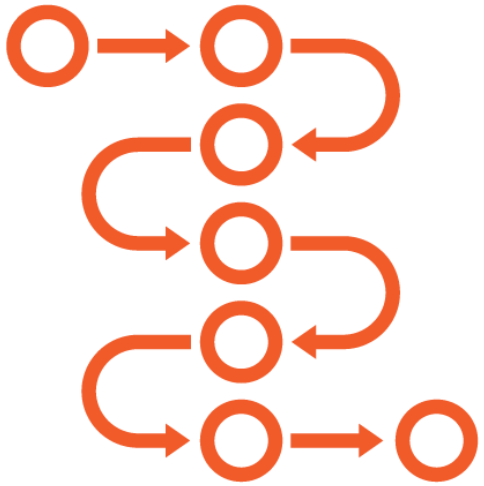
Dynamic Programming Defined

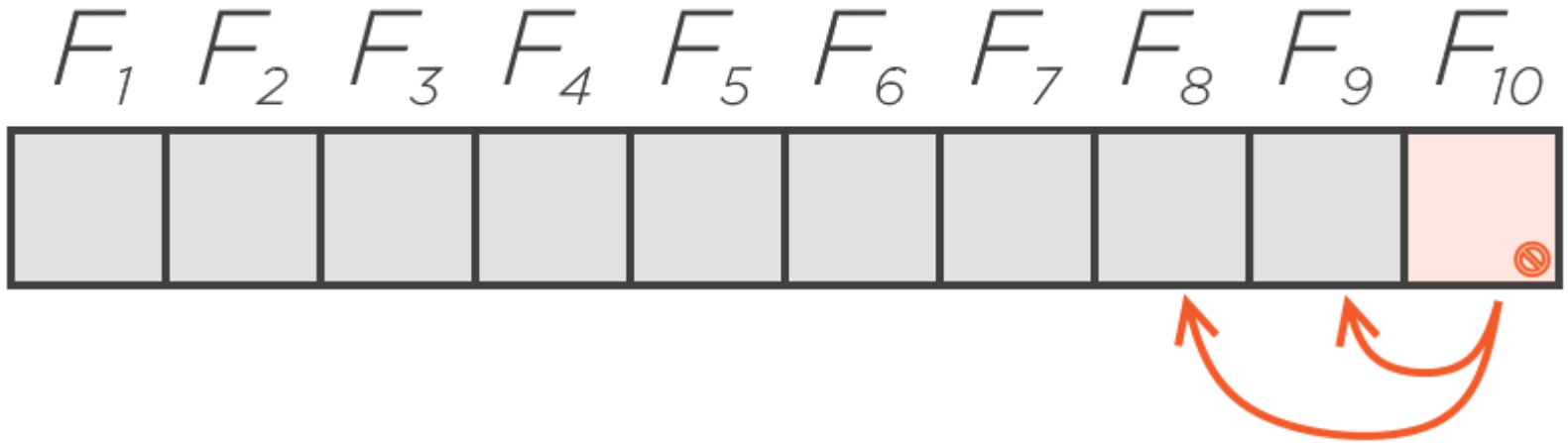


Dynamic programming (a.k.a. dynamic optimization) is a method for solving a **complex problem** by breaking it down into a collection of simpler **subproblems**, solving each of those subproblems just **once**, and **storing** their solutions.

https://en.wikipedia.org/wiki/Dynamic_programming

Dynamic Programming Defined





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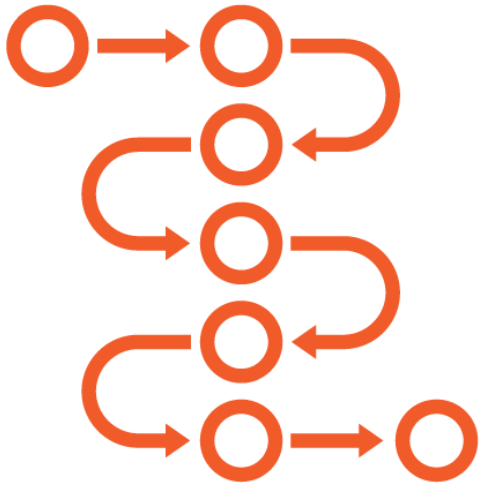

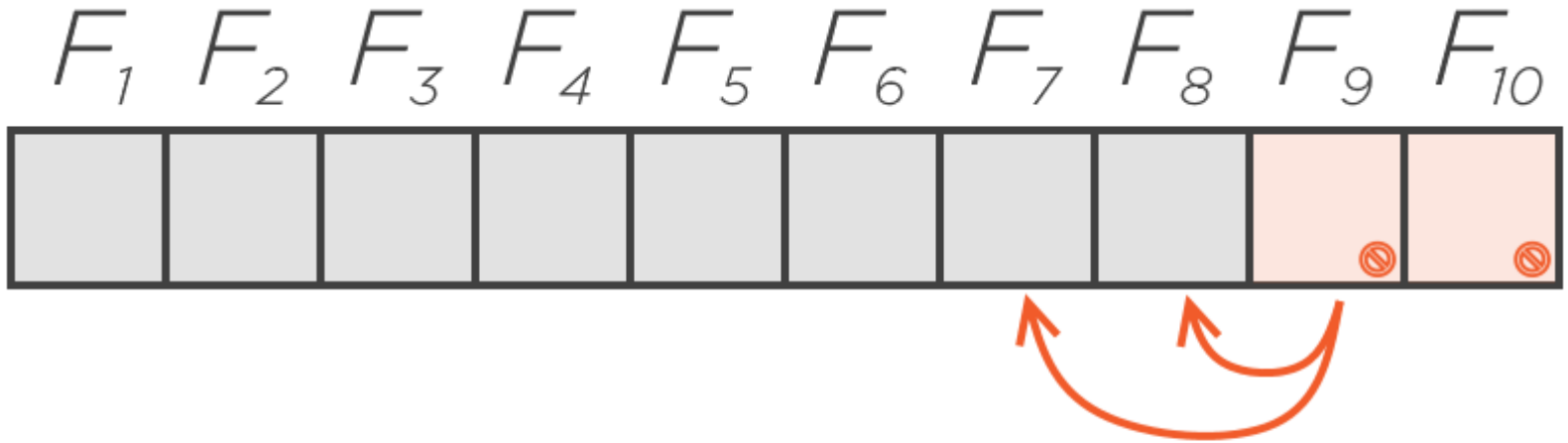

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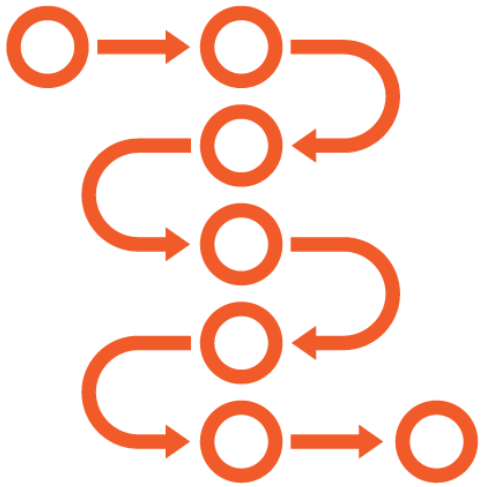

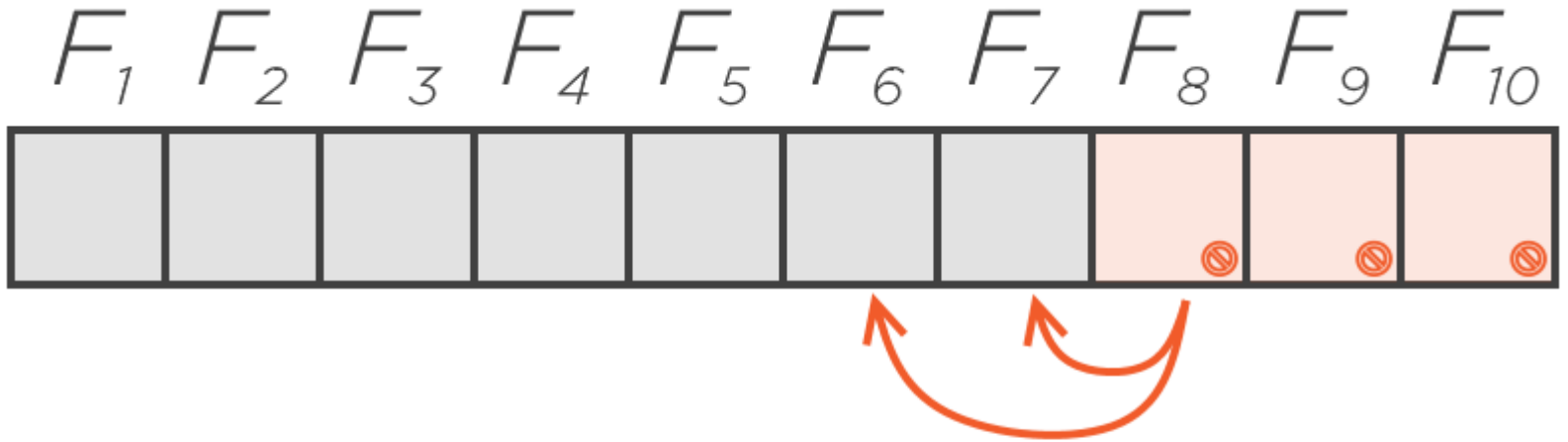

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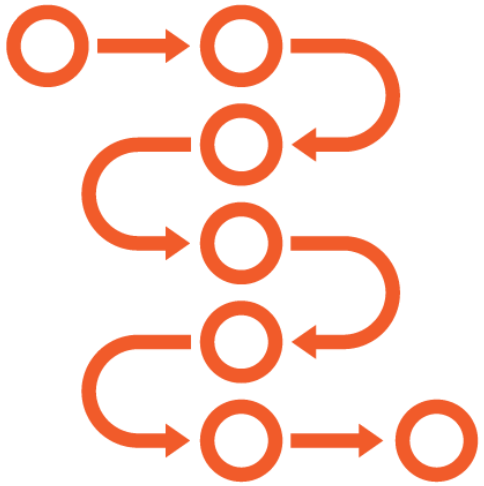

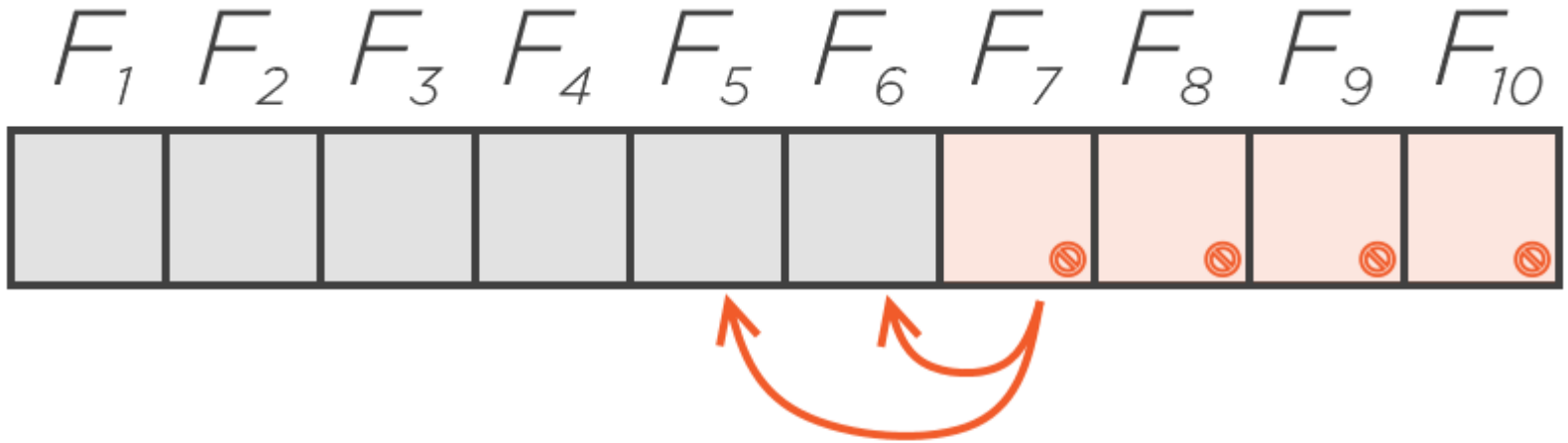

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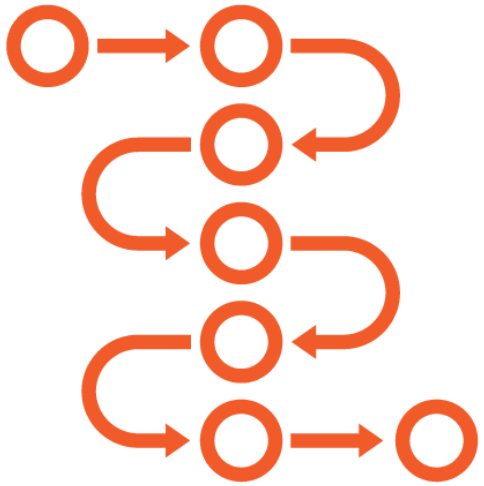

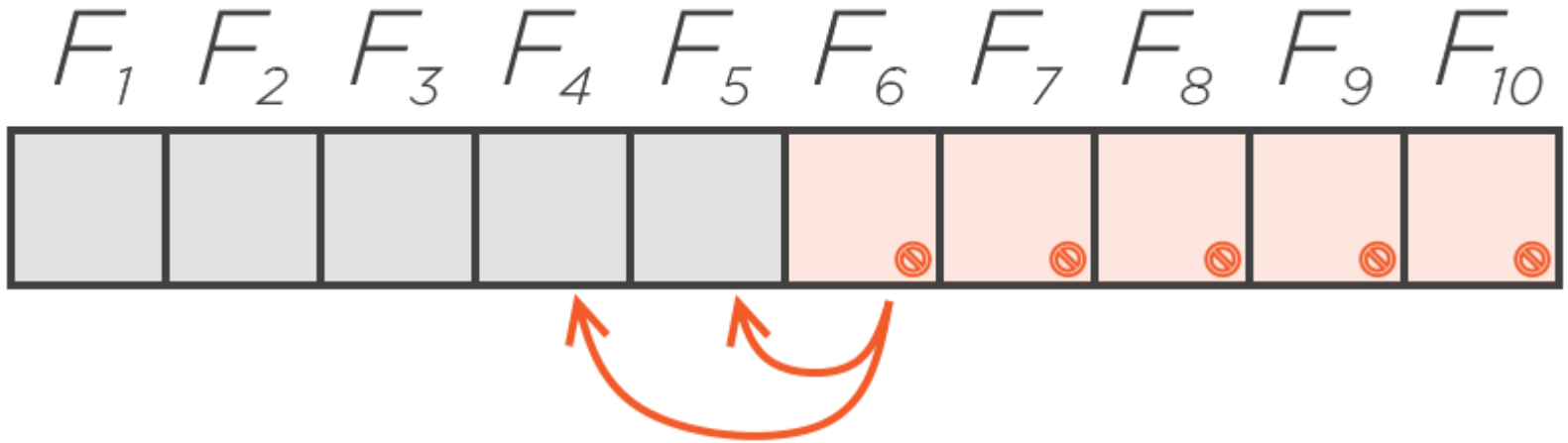

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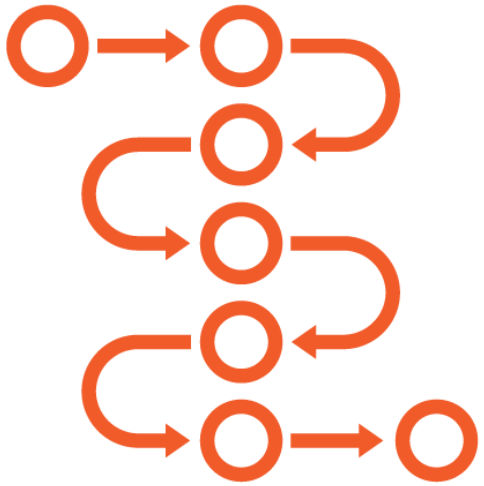

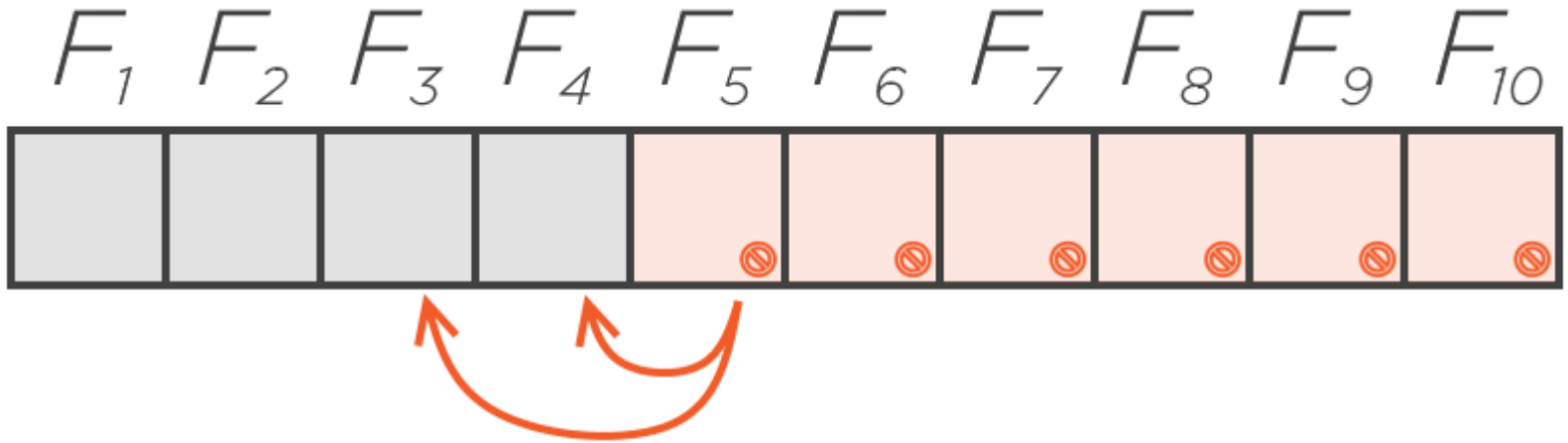

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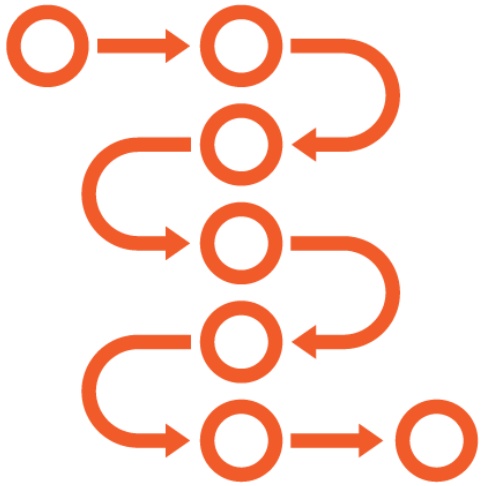

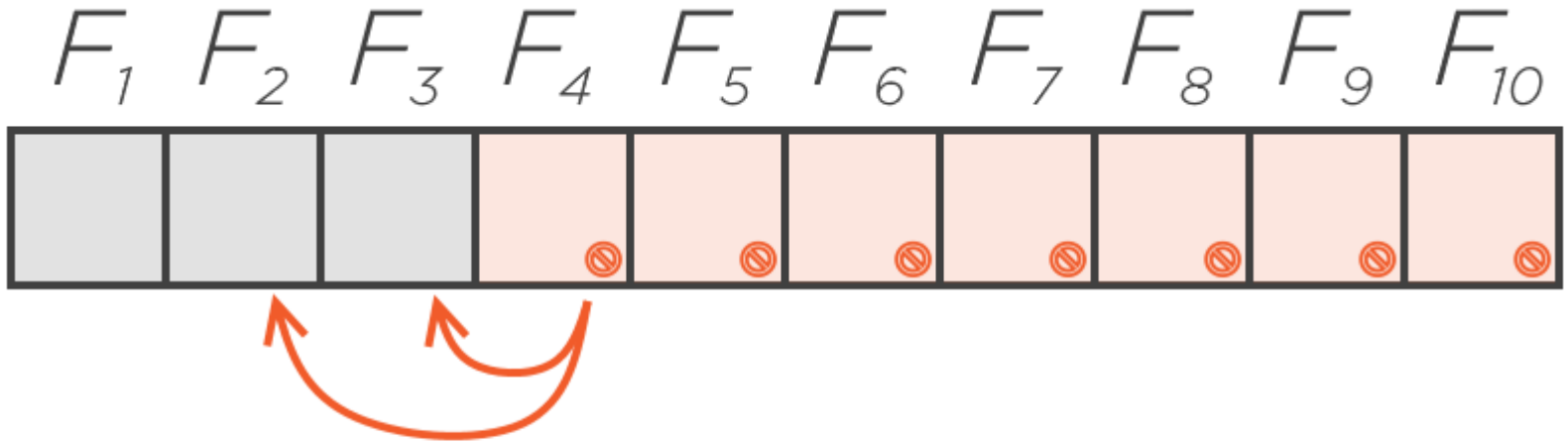

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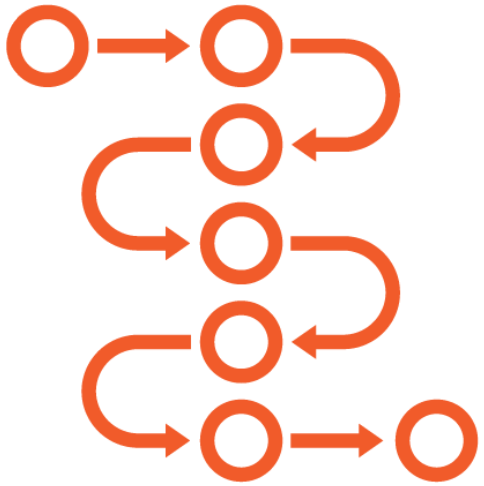

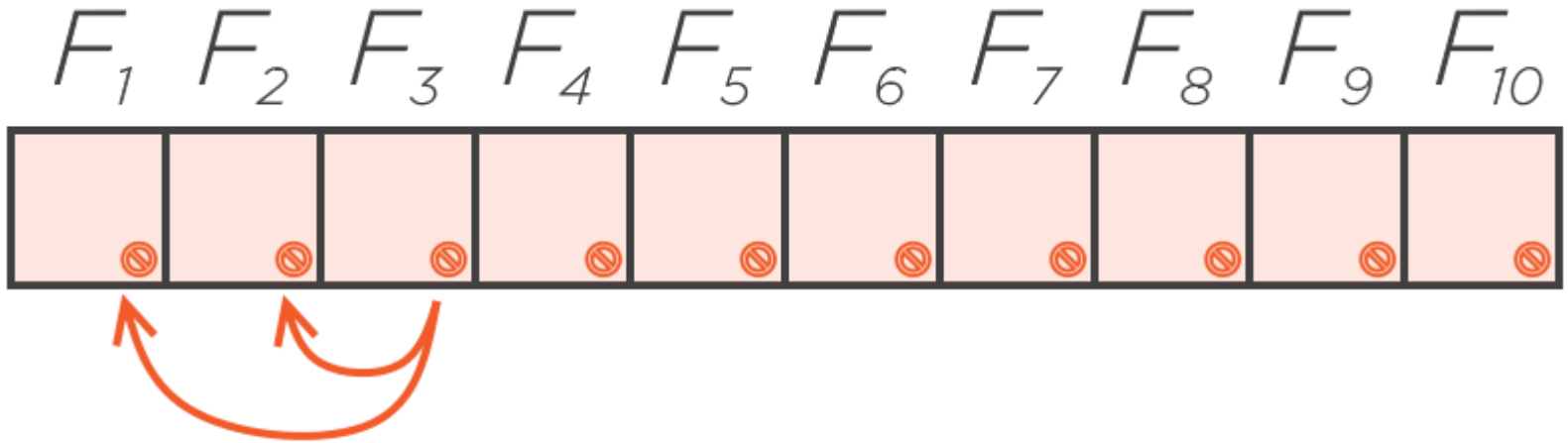

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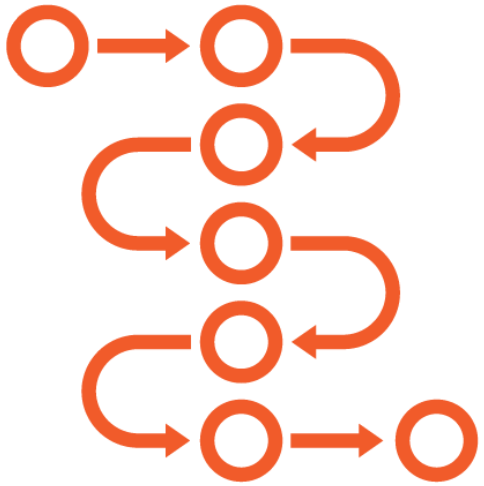

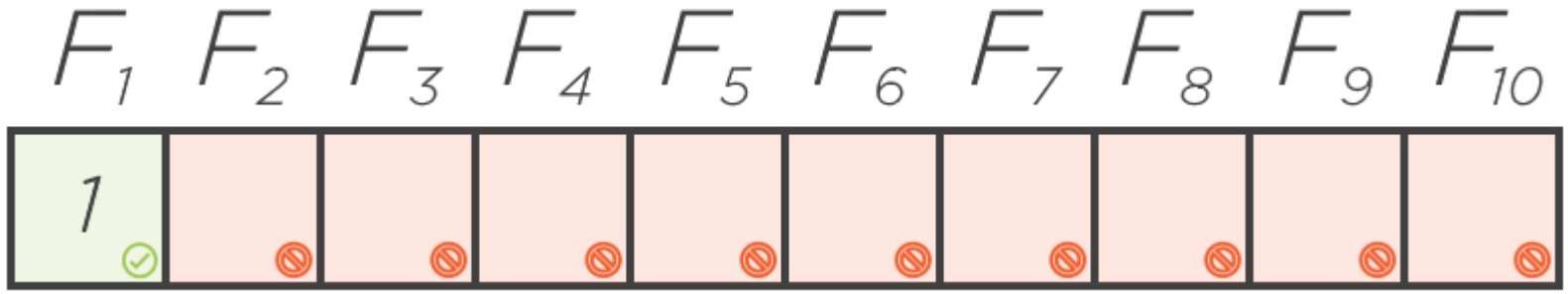

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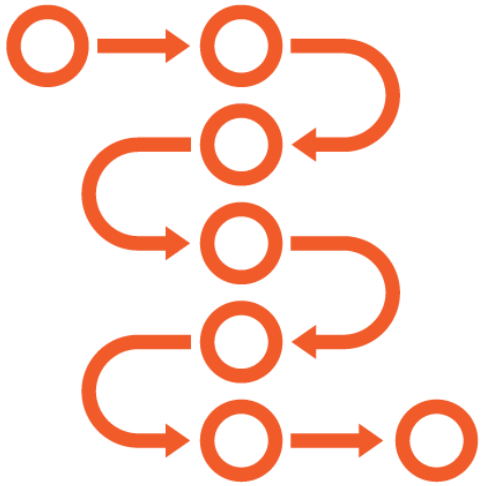

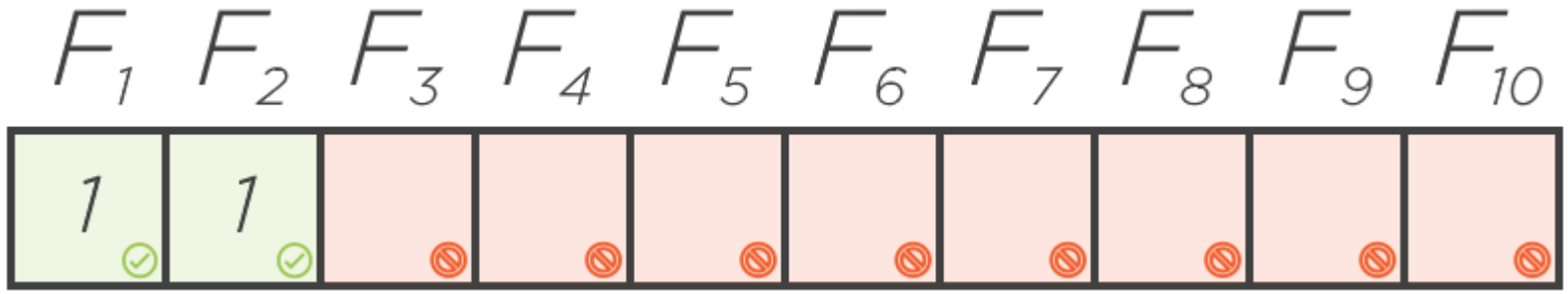

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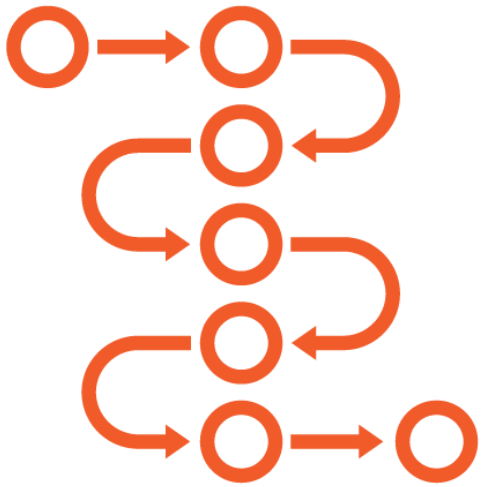

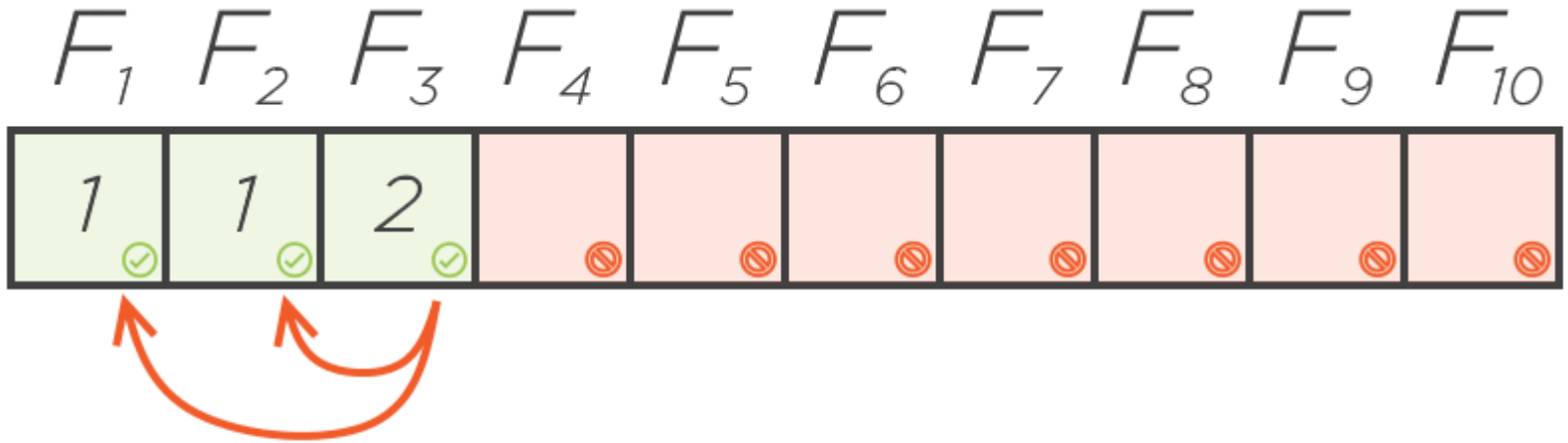

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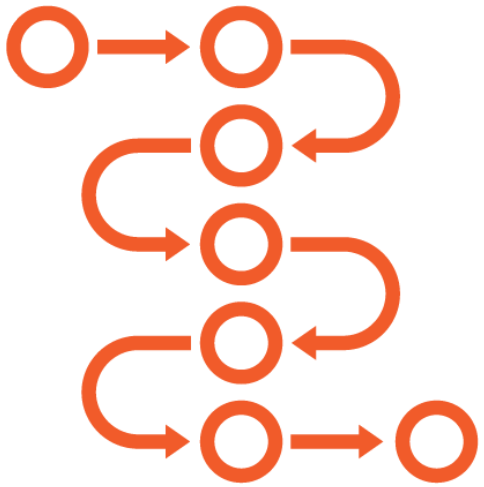

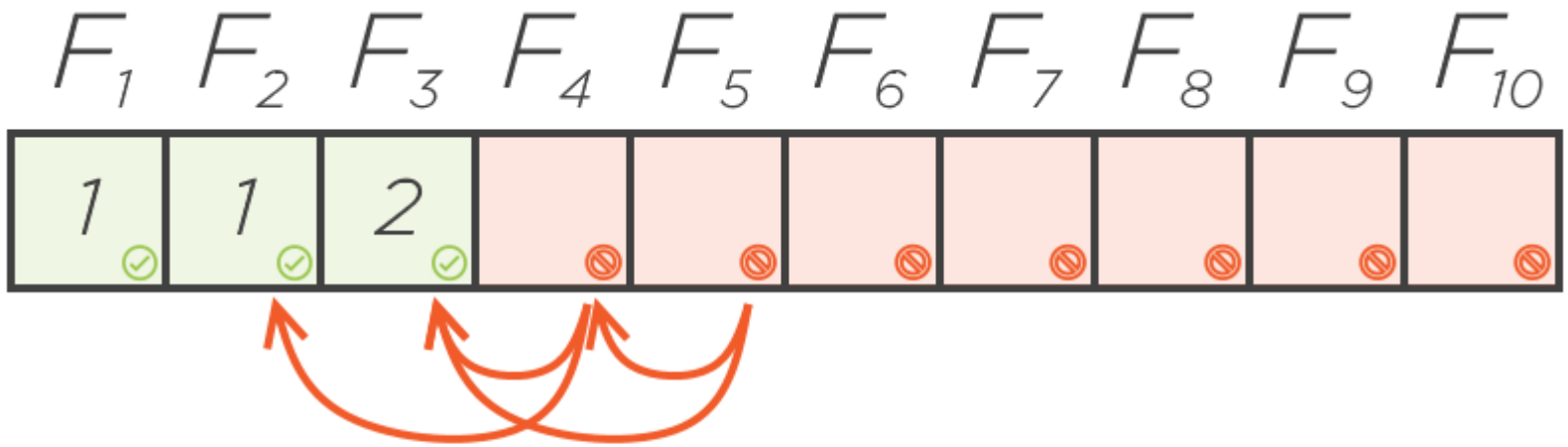

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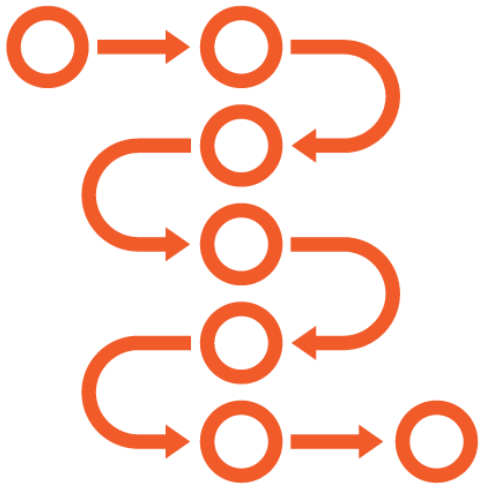

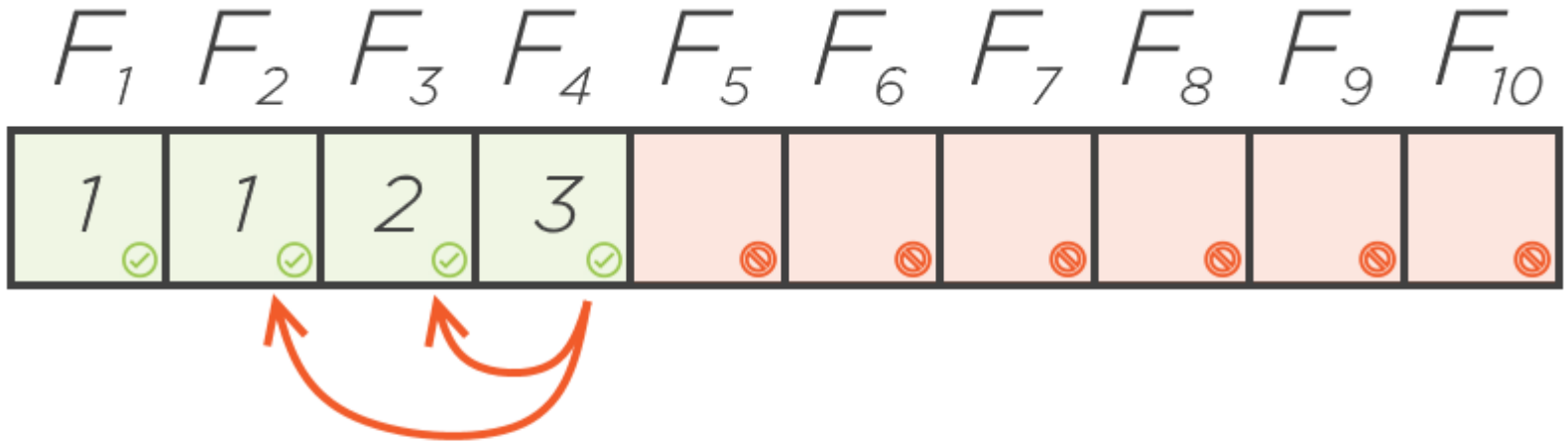

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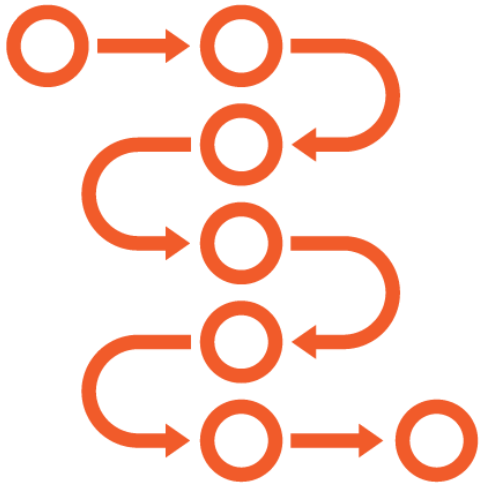

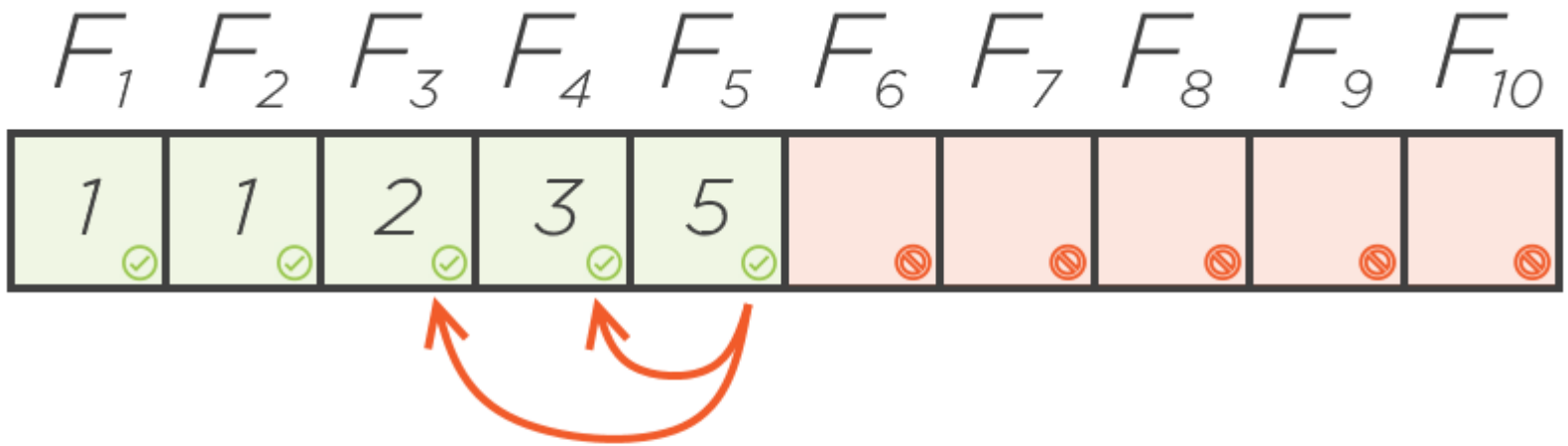

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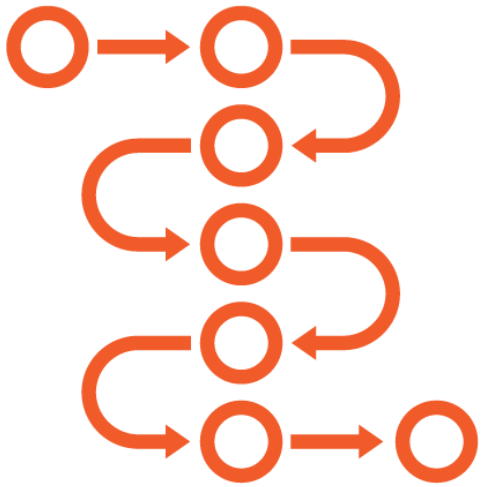

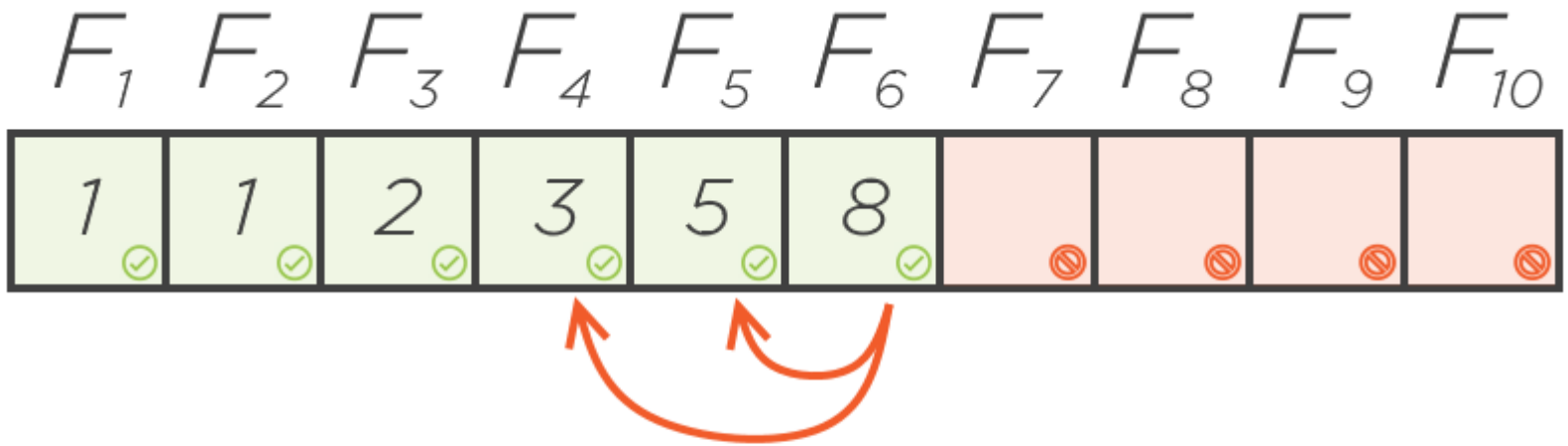

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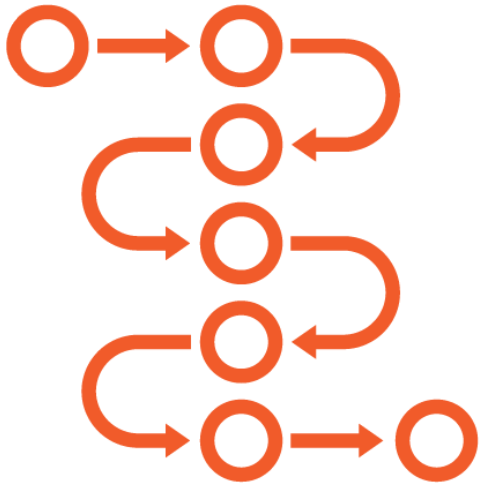

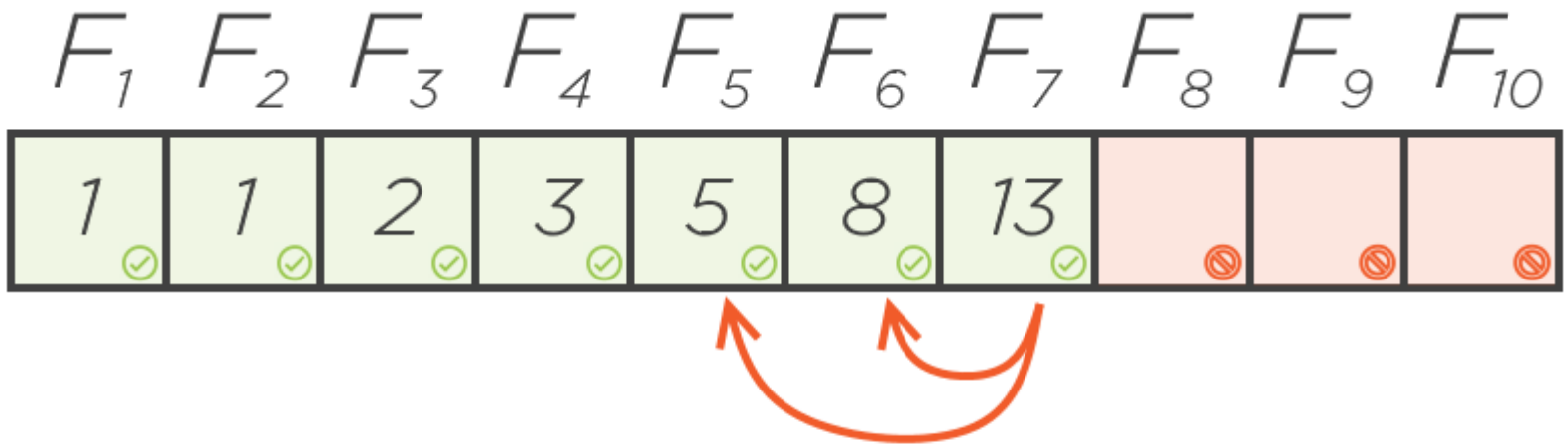

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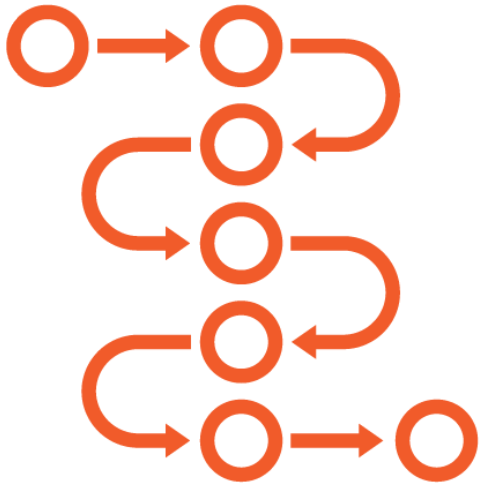

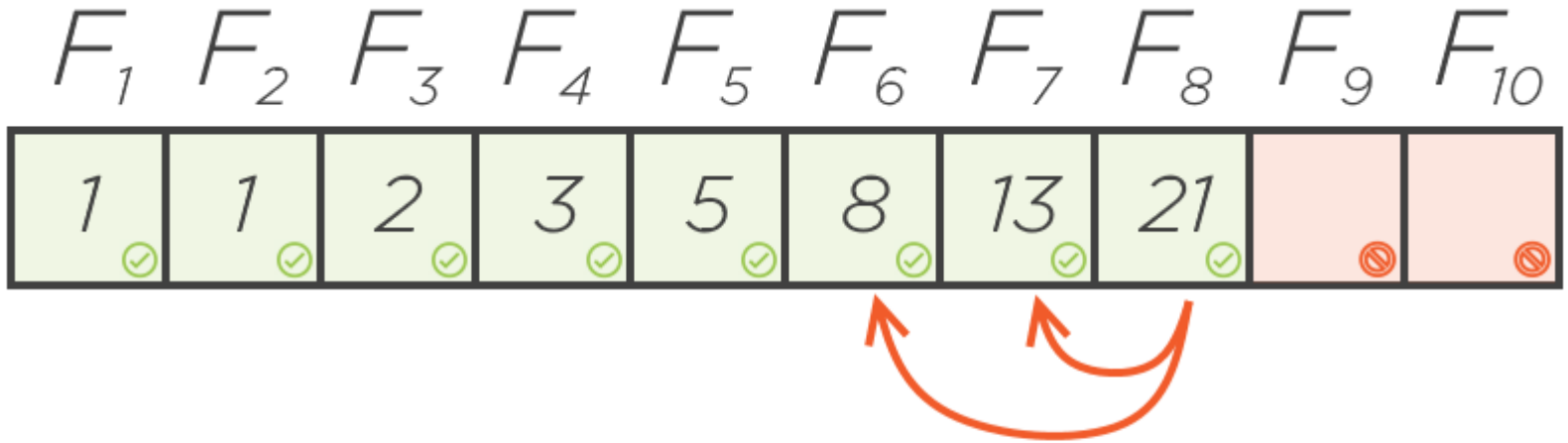

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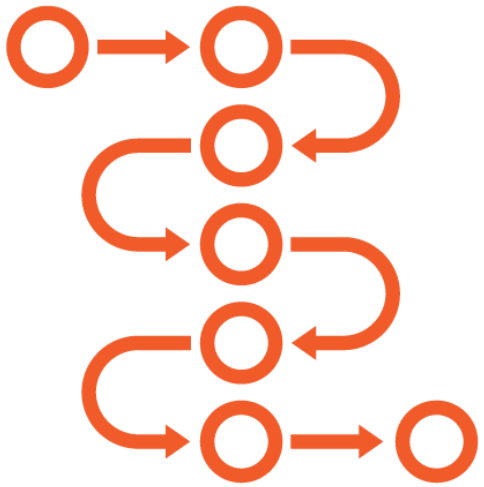

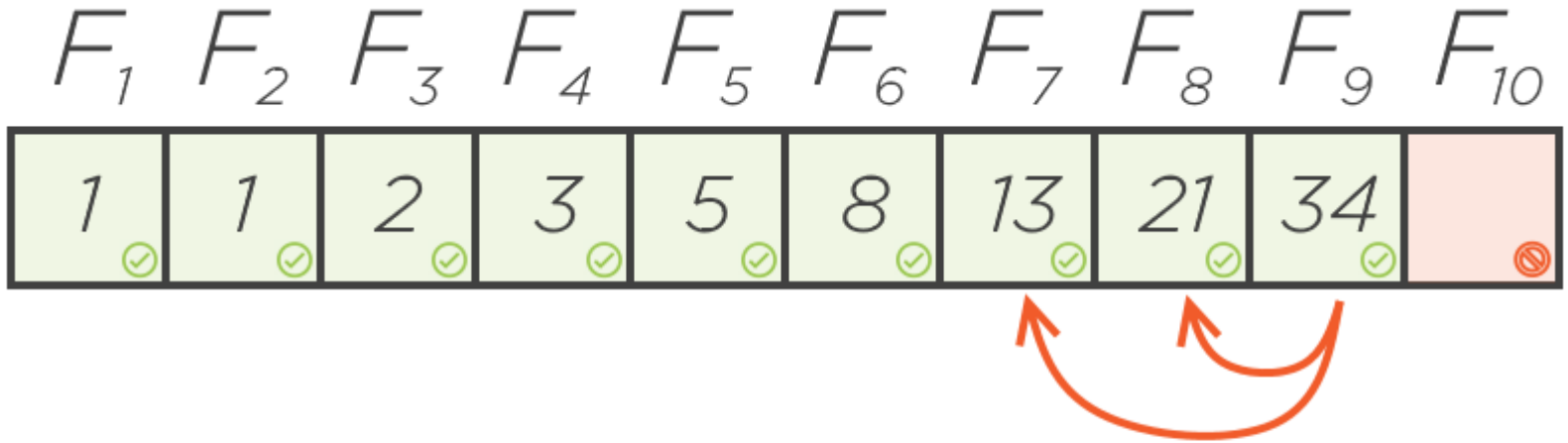

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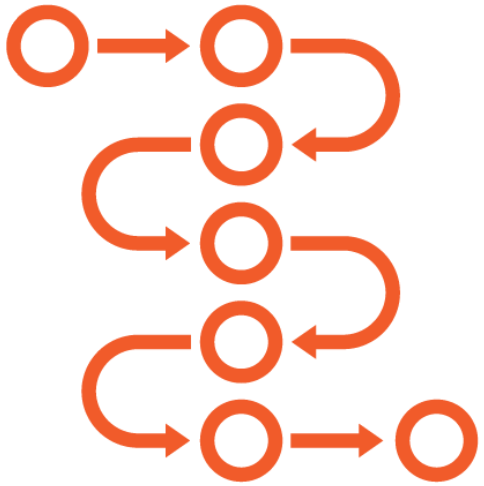
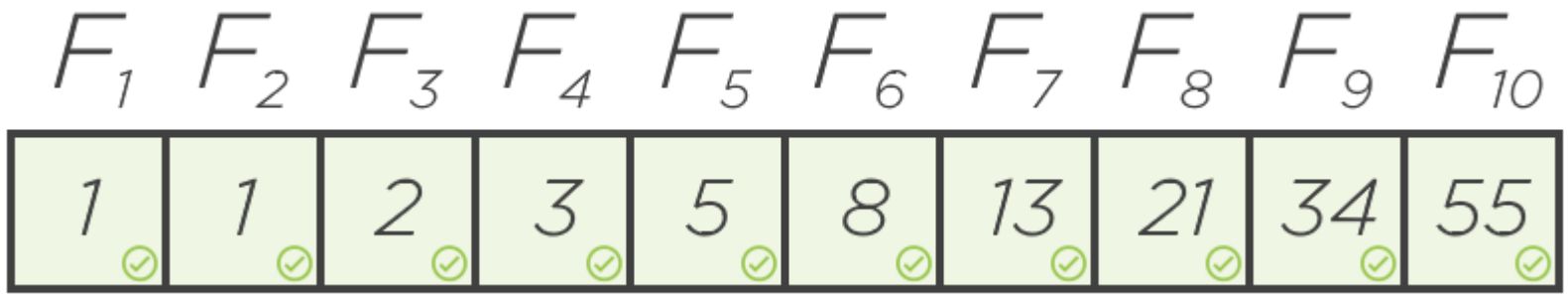
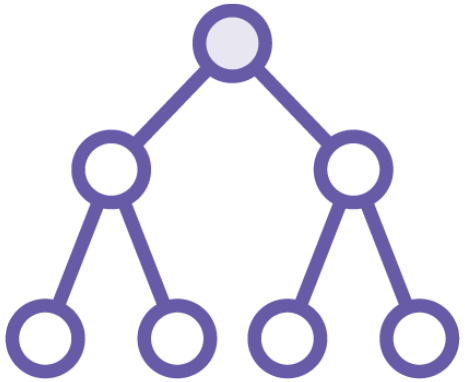




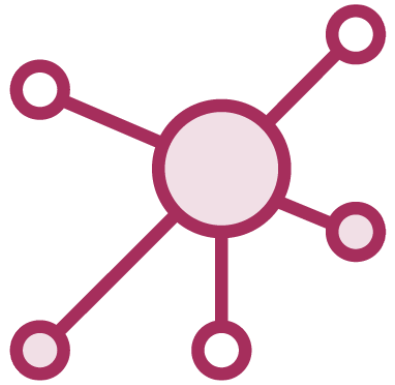
$F_{10}=55$

Memoization
as a special kind of
Dynamic Programming

Dynamic Programming

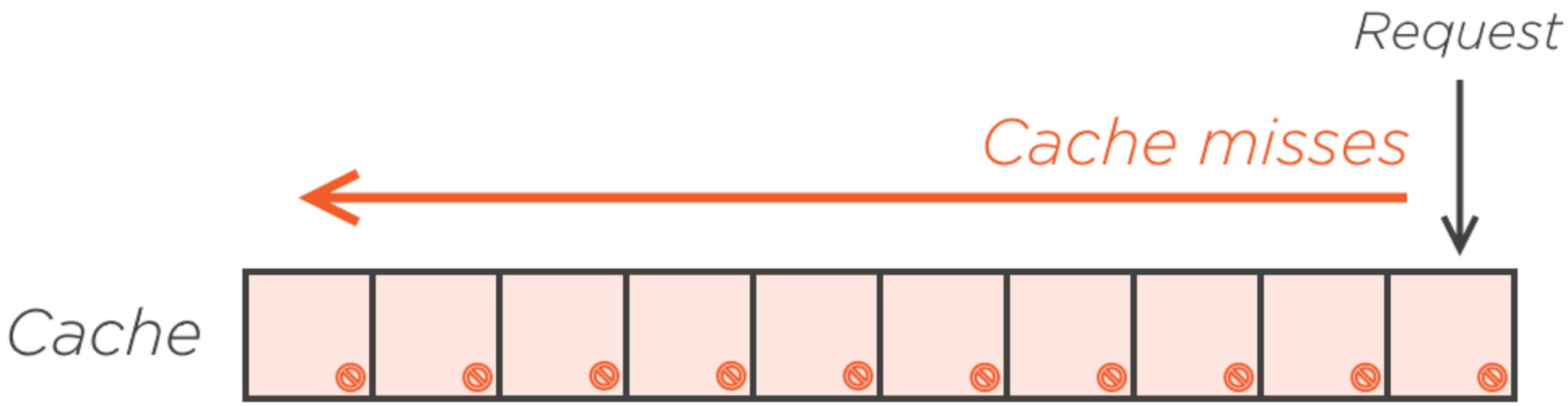


Memoization is
a special case of
Dynamic Programming

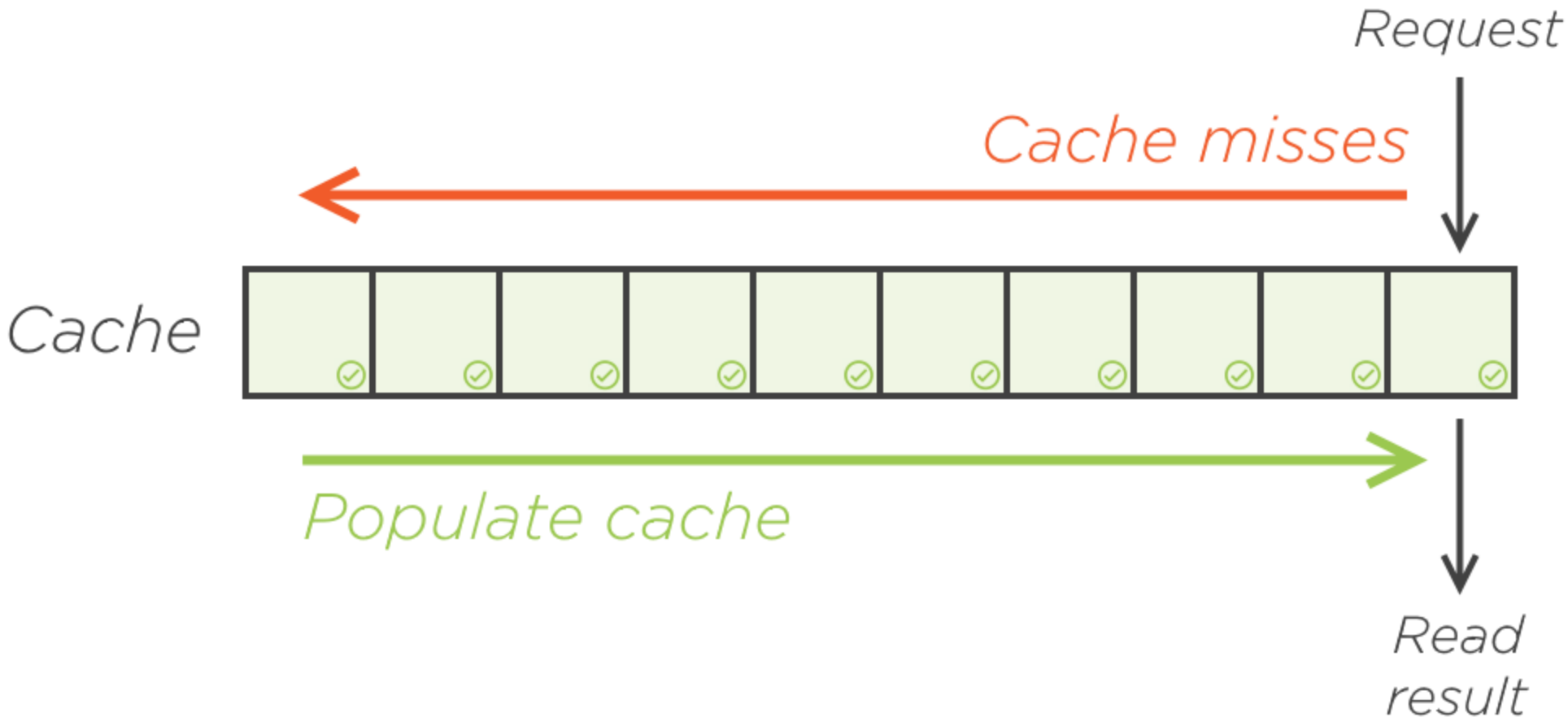


Dynamic Programming is
a generalization of
Memoization

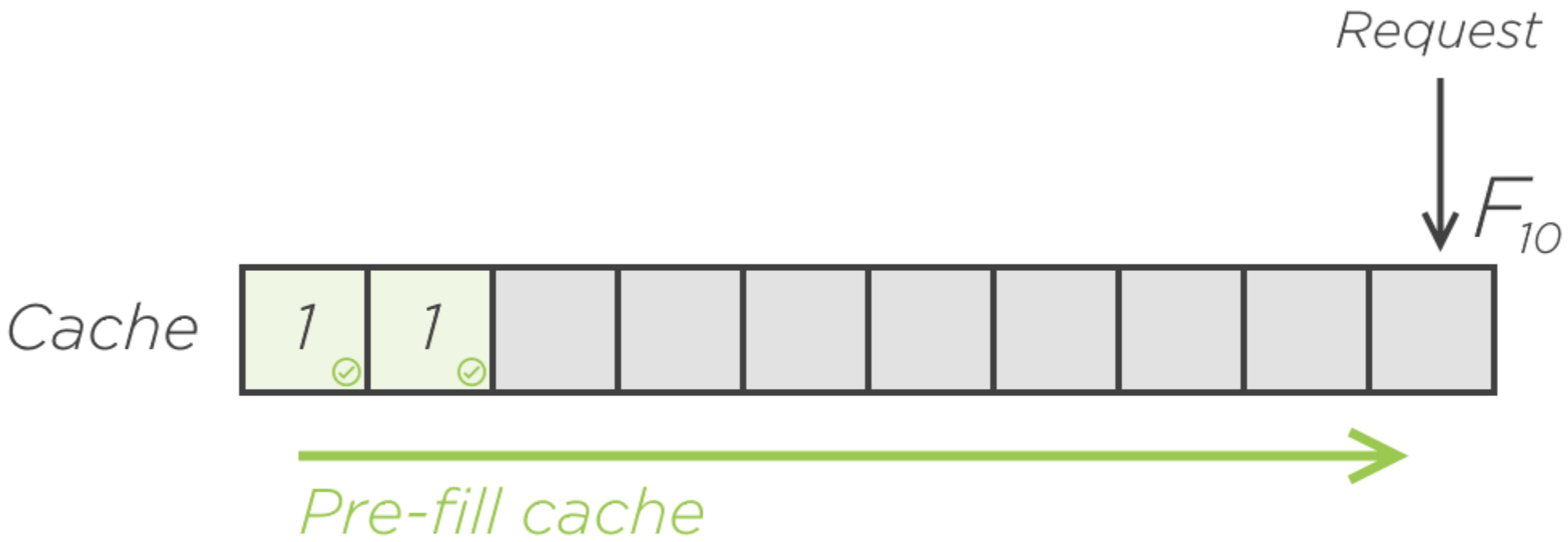
Dynamic Programming



Dynamic Programming



Dynamic Programming



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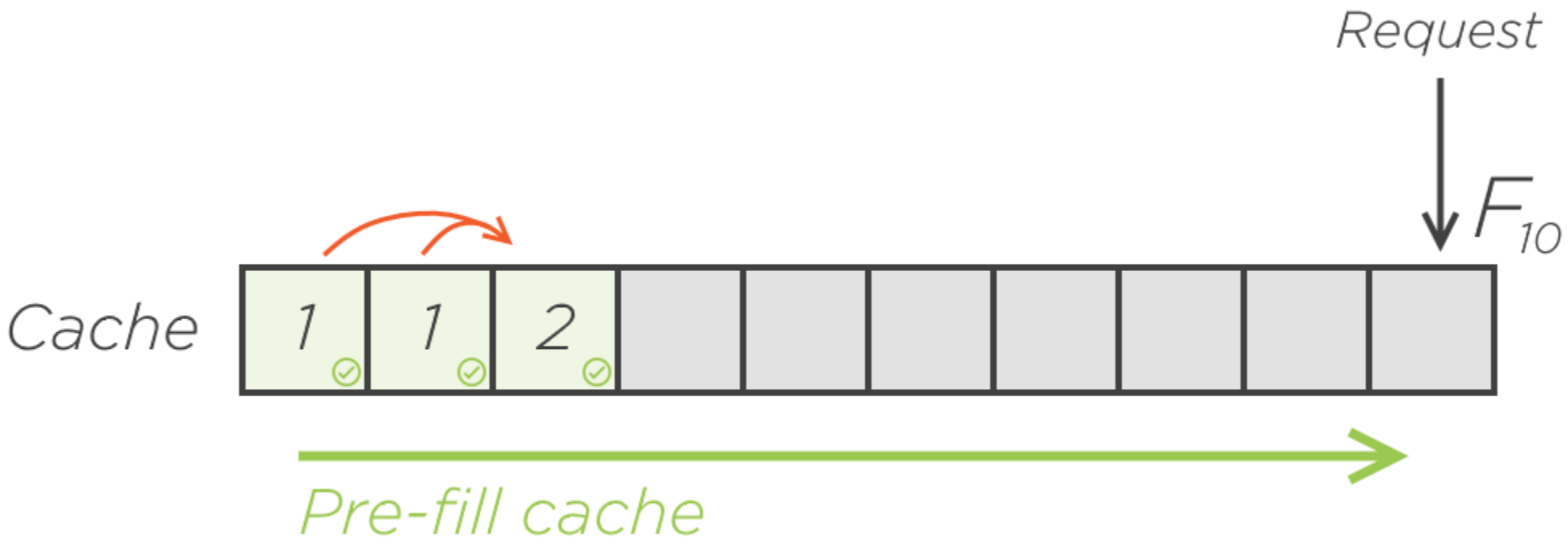

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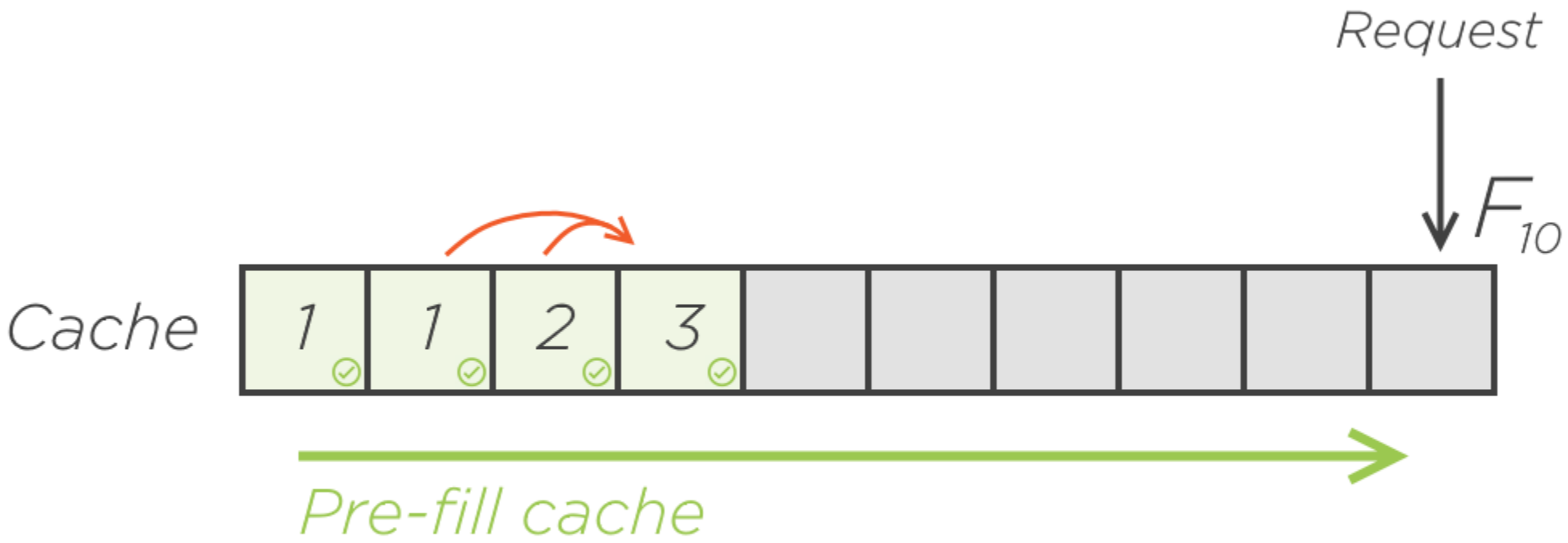

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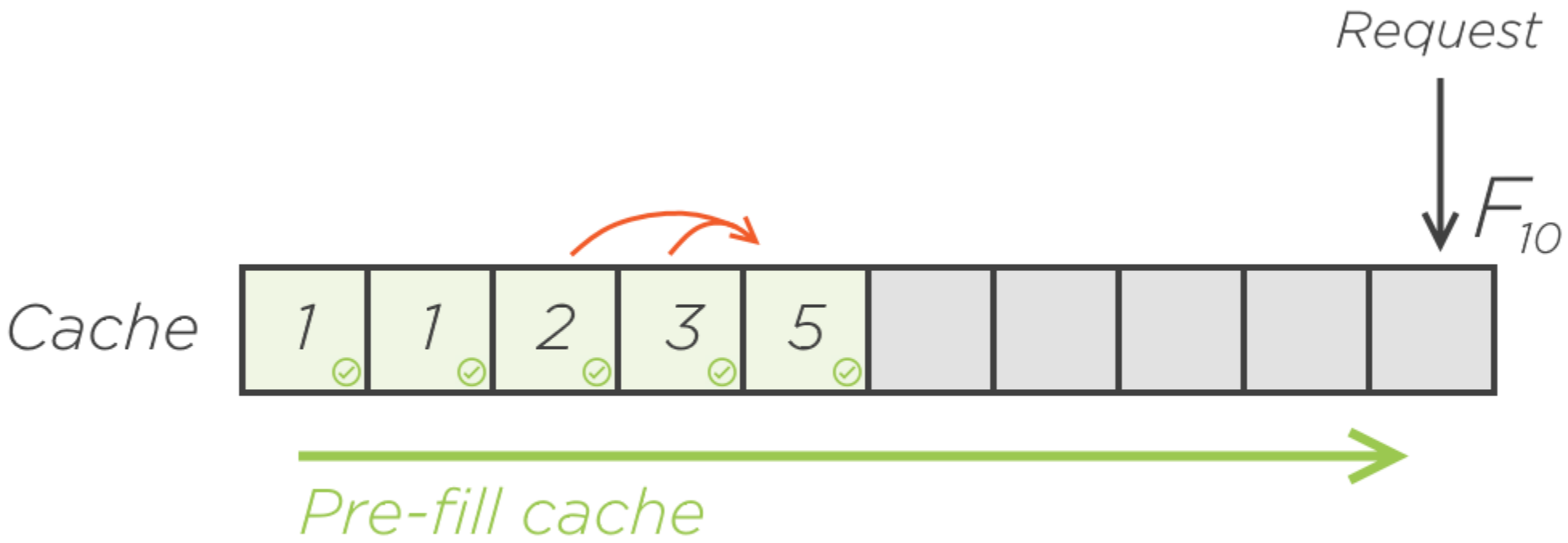

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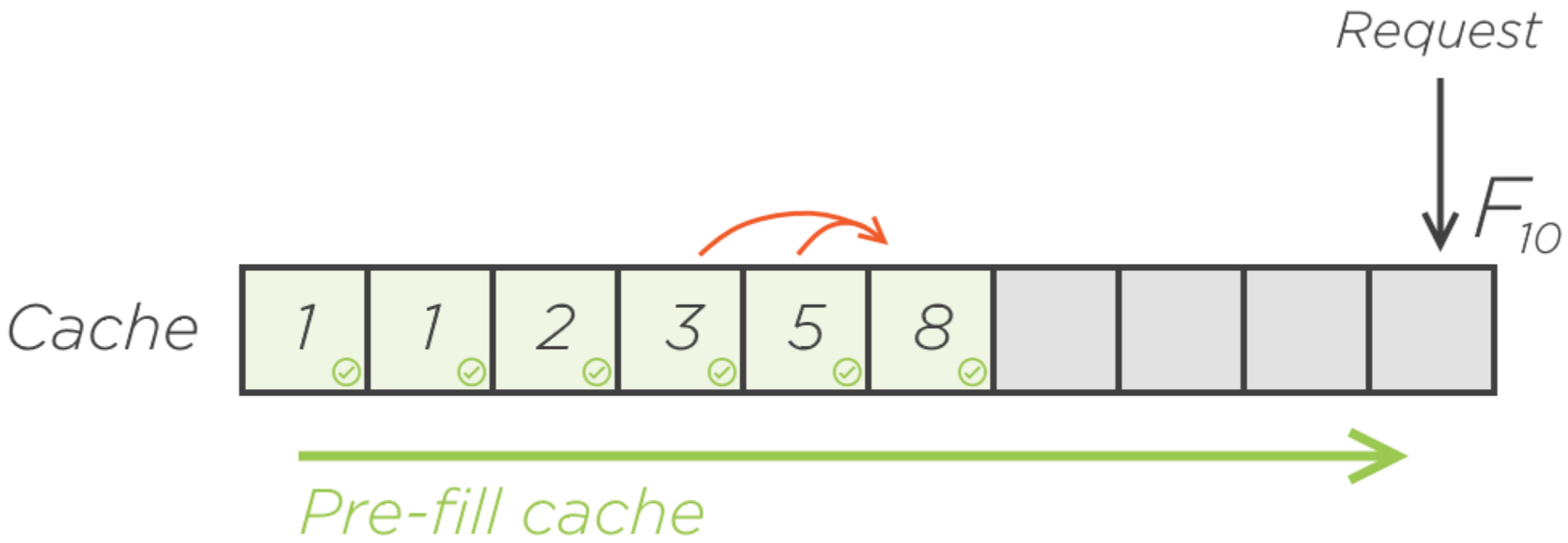

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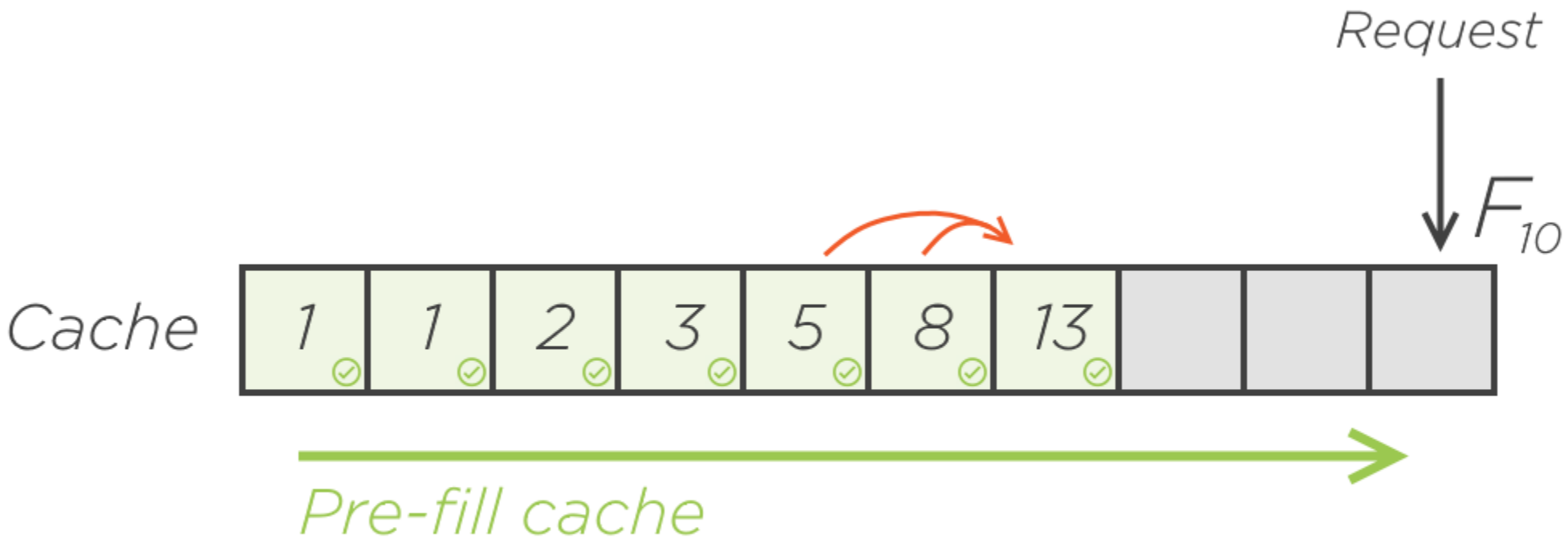

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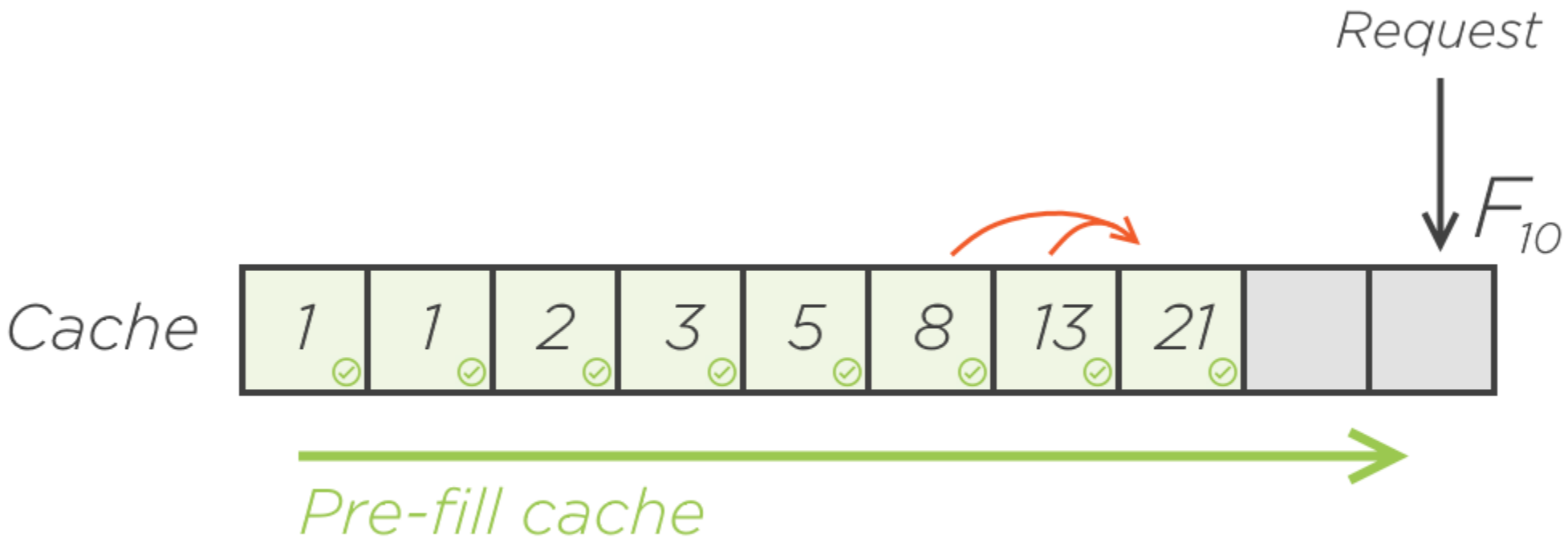

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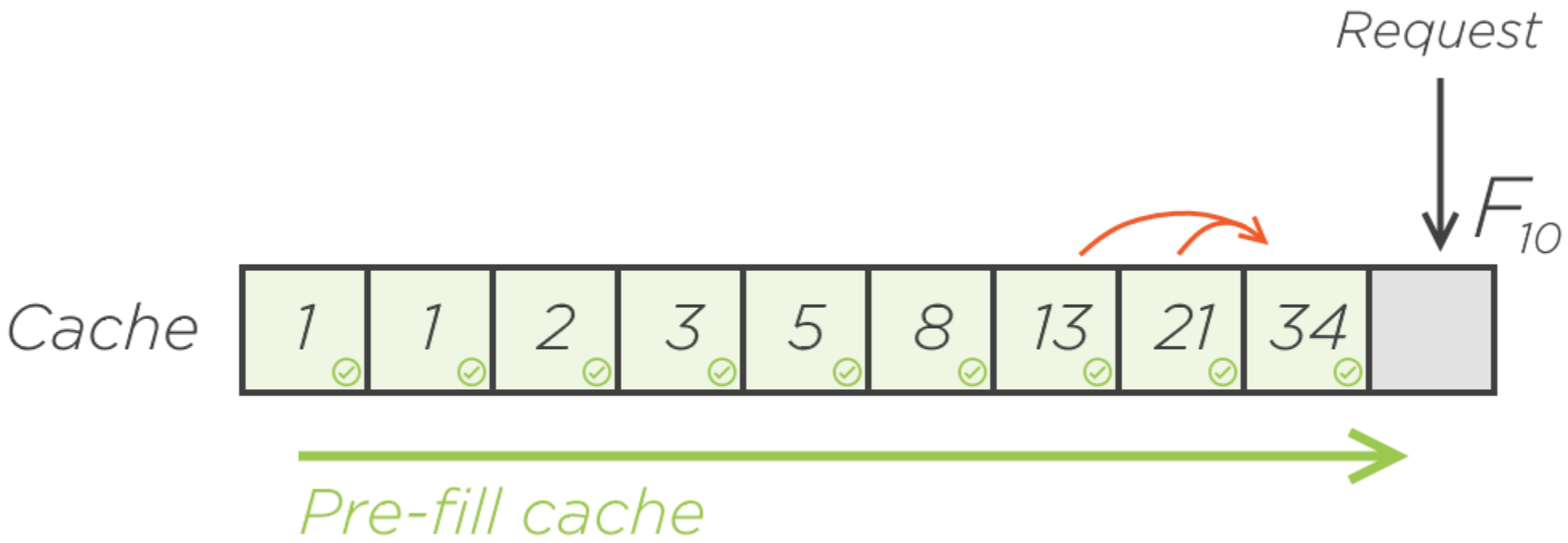

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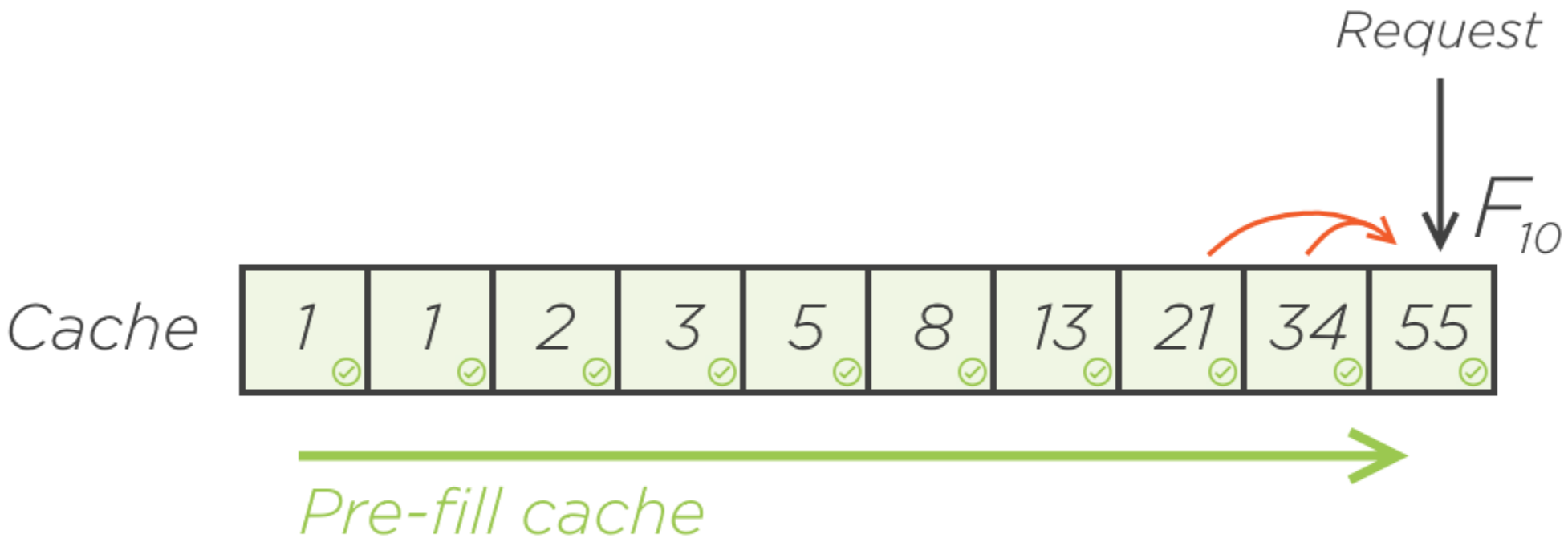

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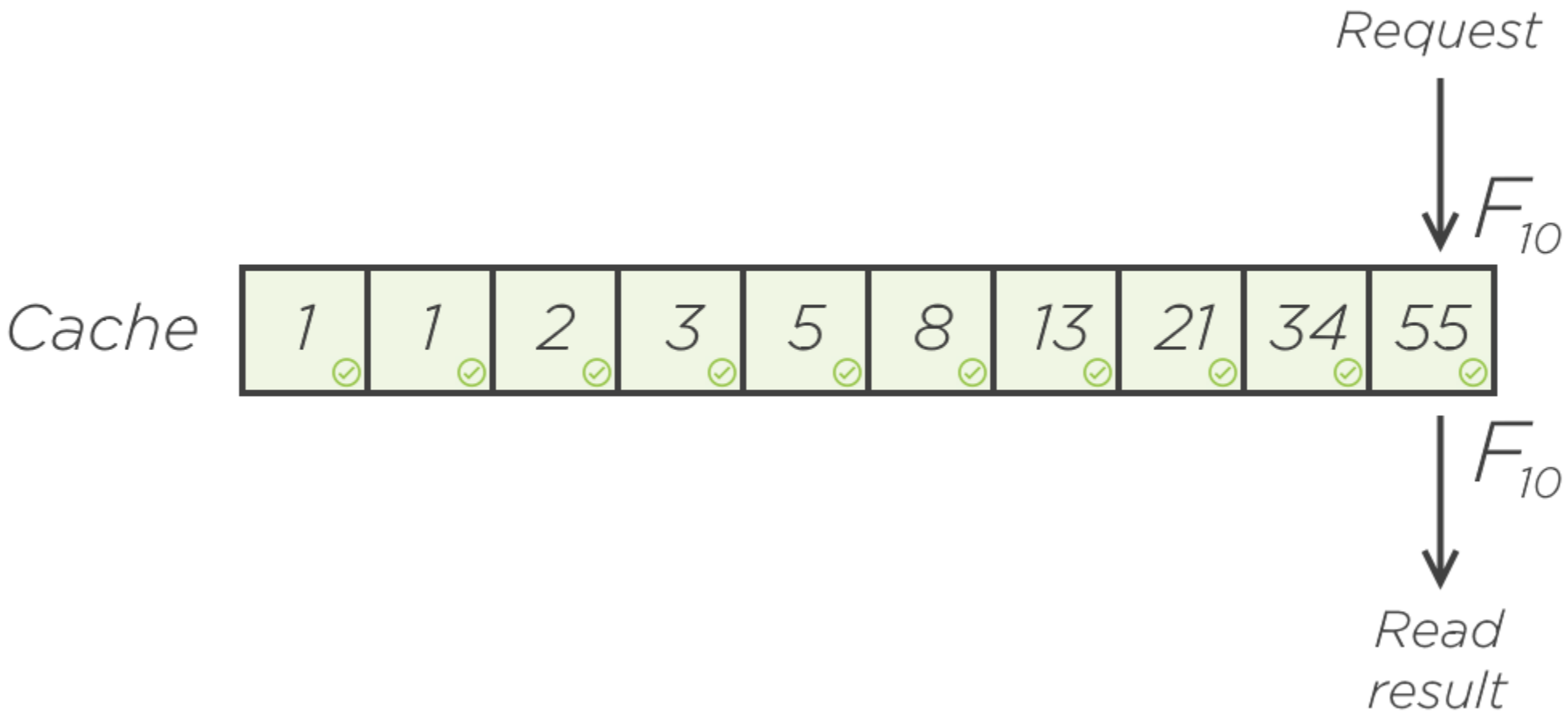
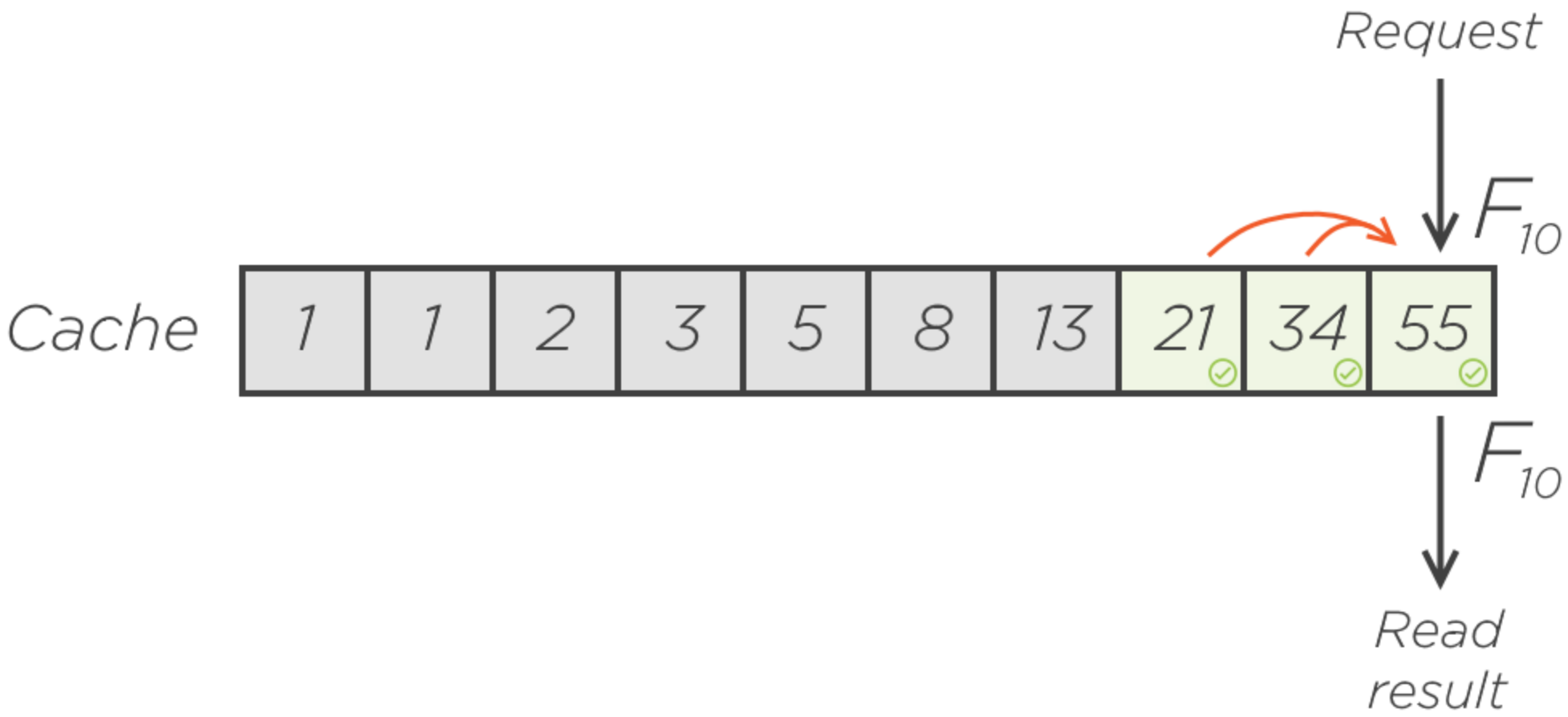


Inventing an Algorithm



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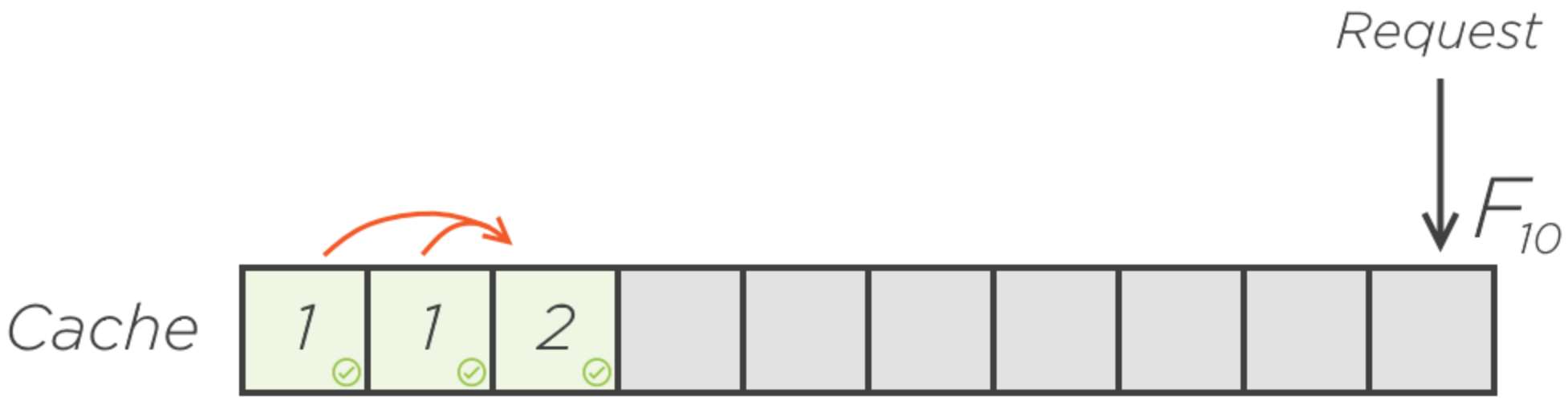

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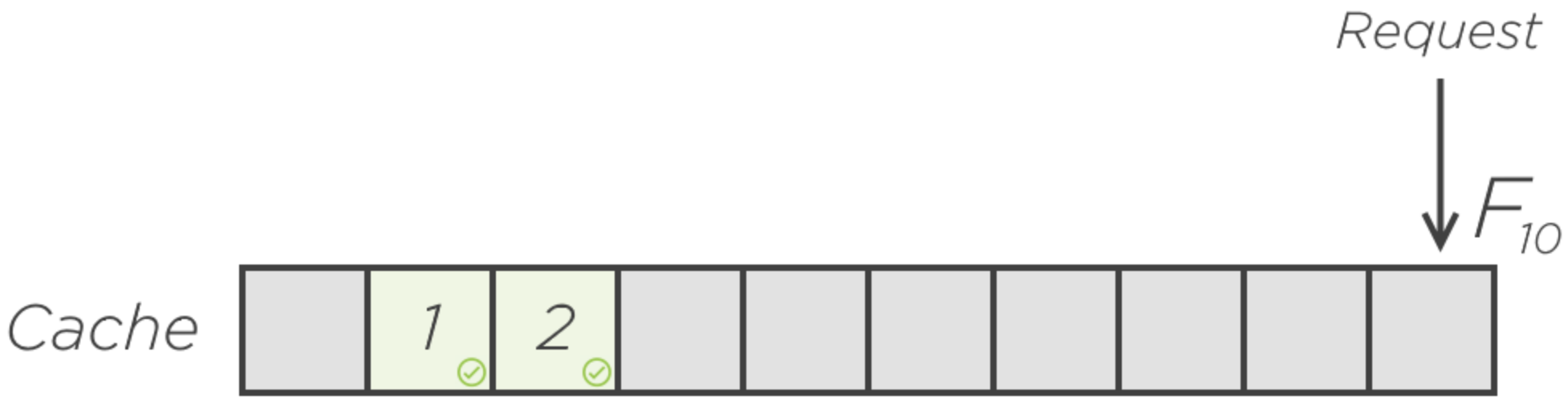

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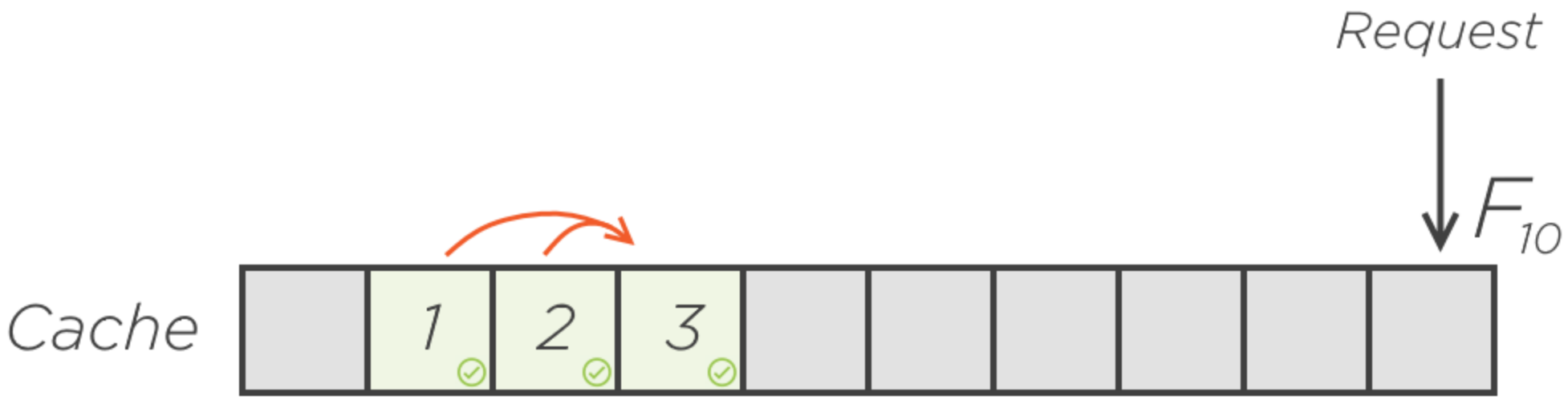

Inventing an Algorithm

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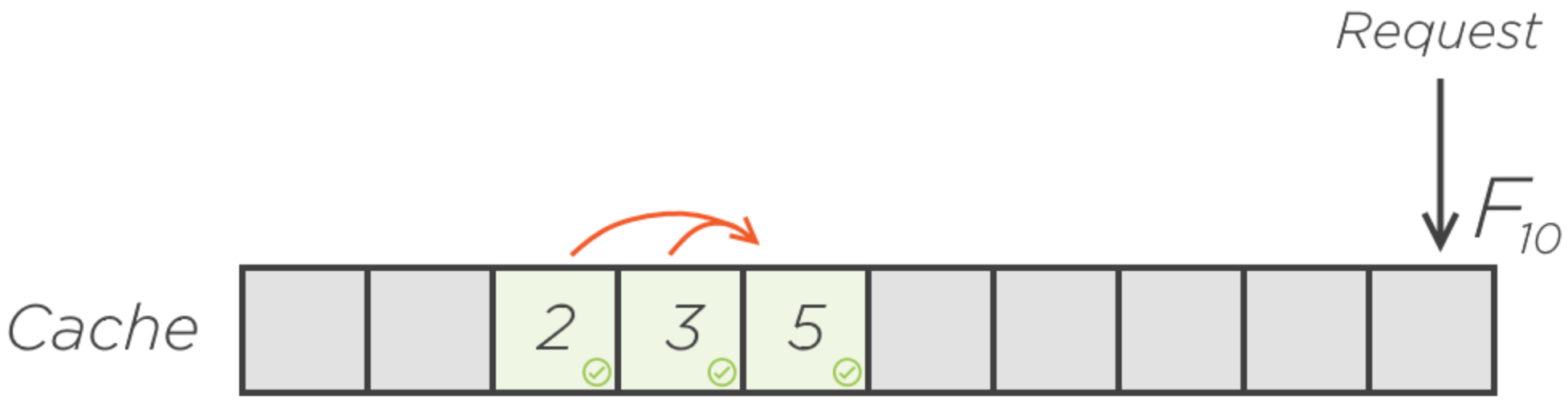

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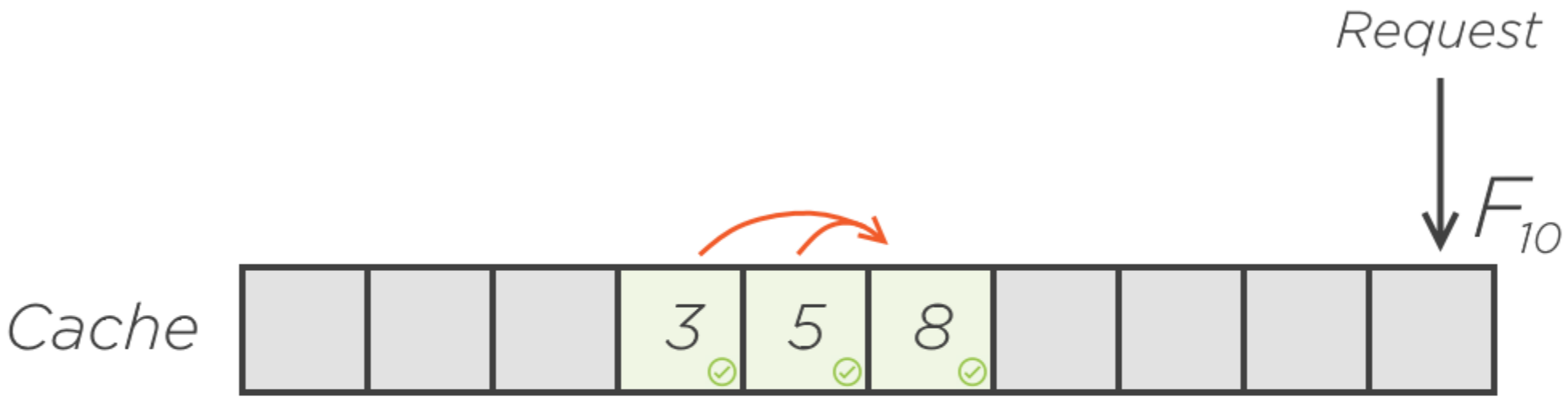

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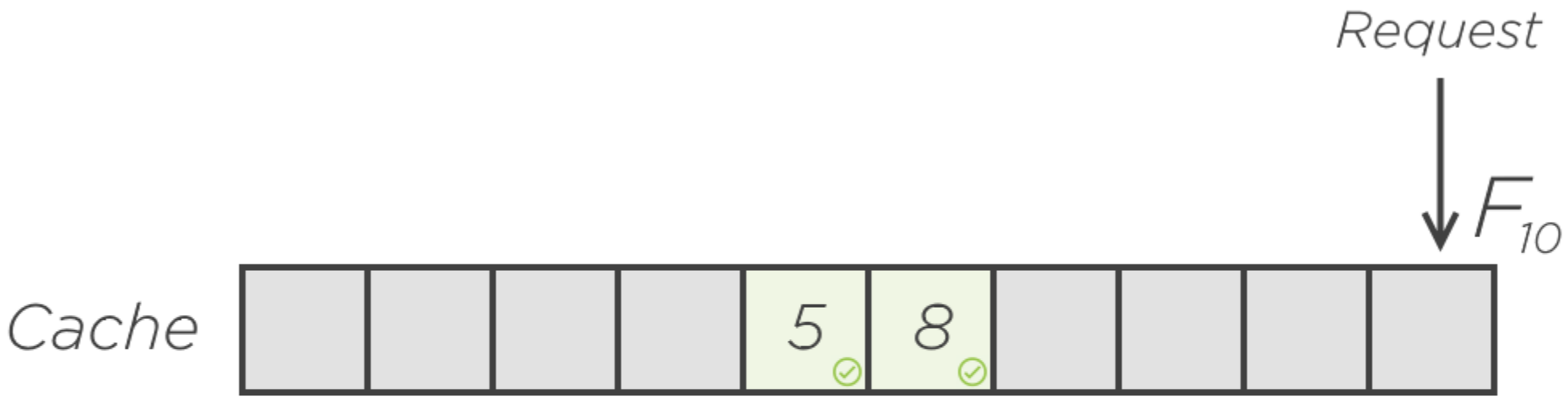

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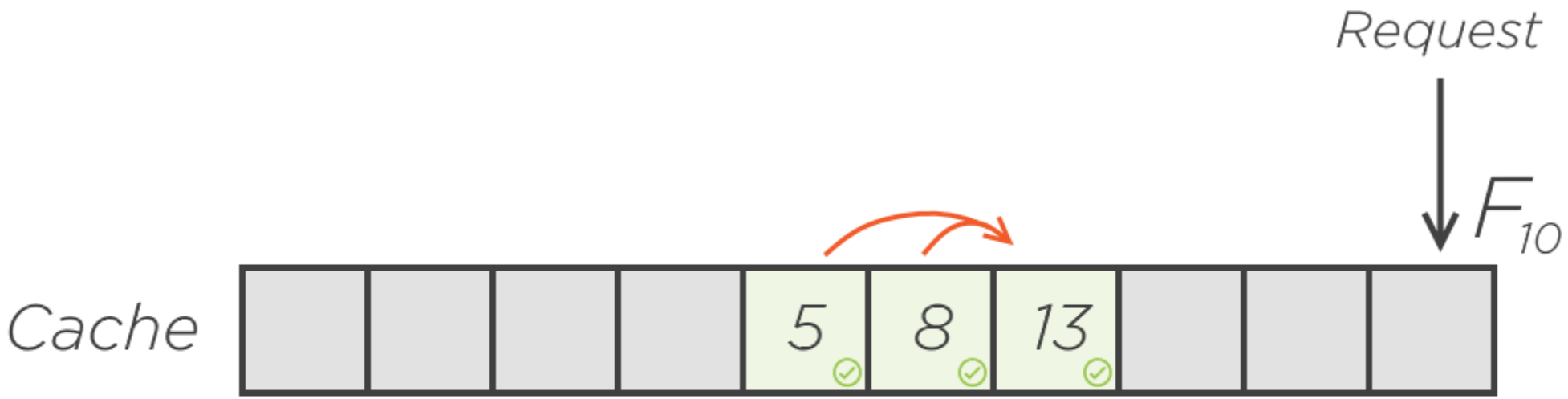

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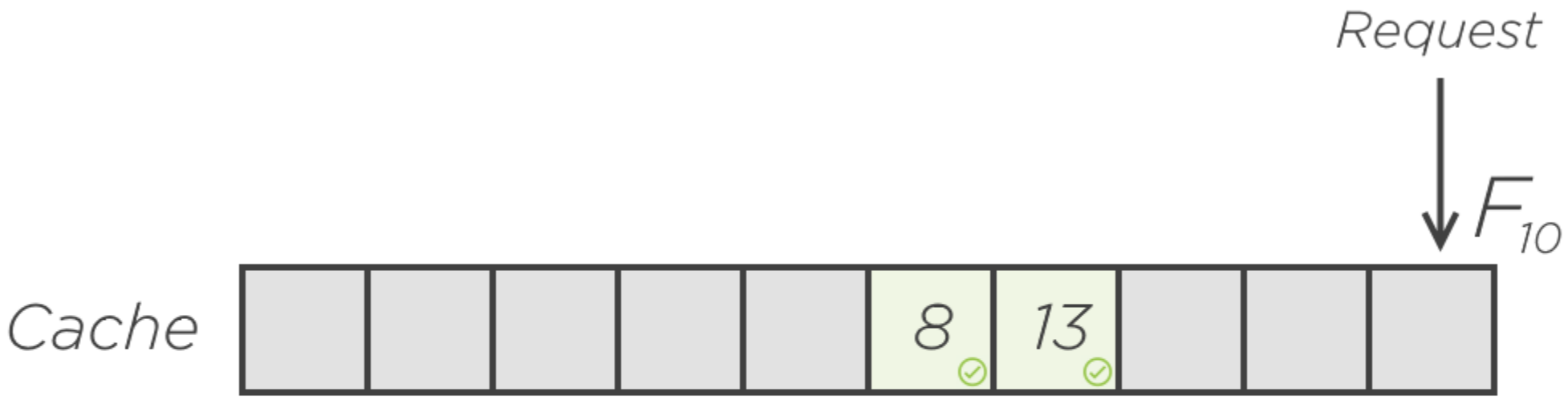

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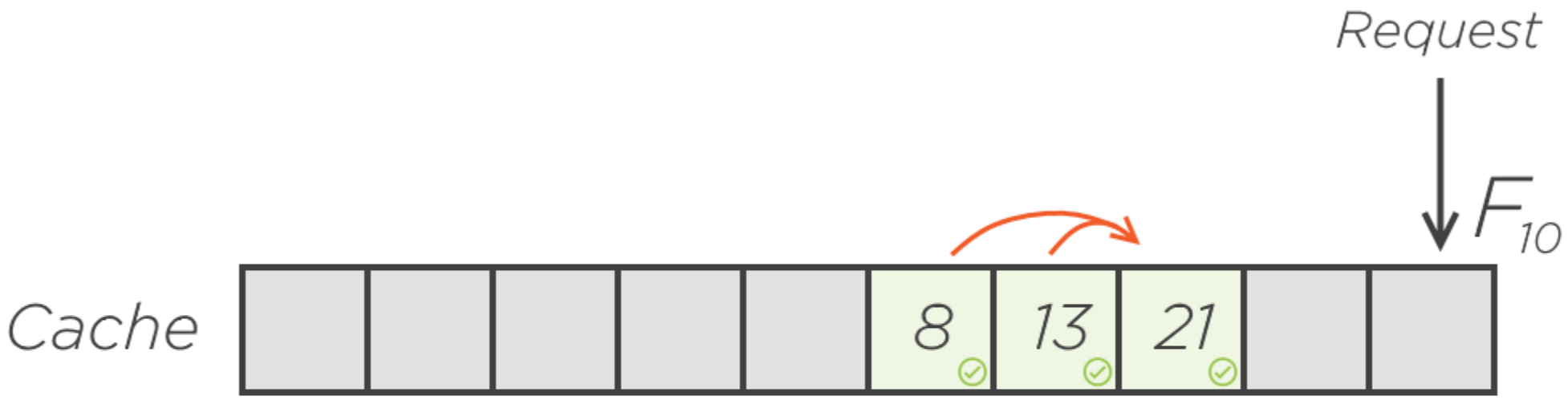

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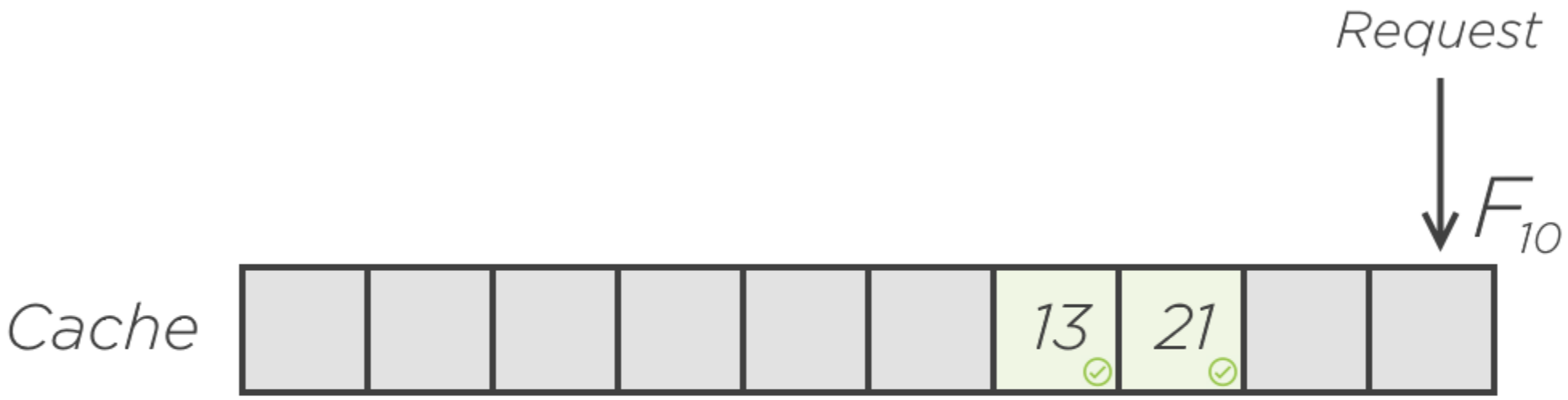

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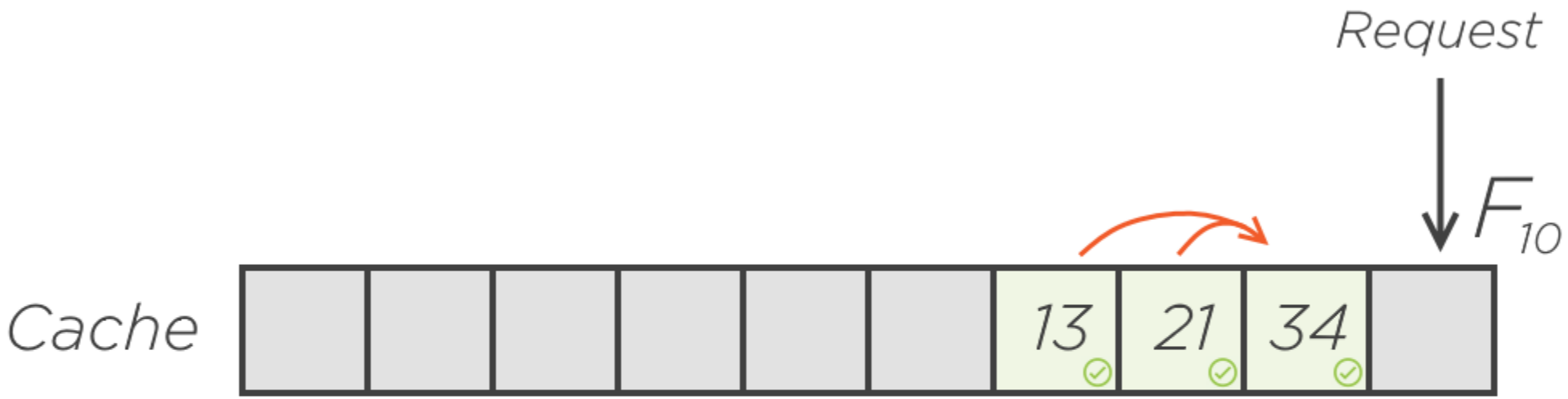

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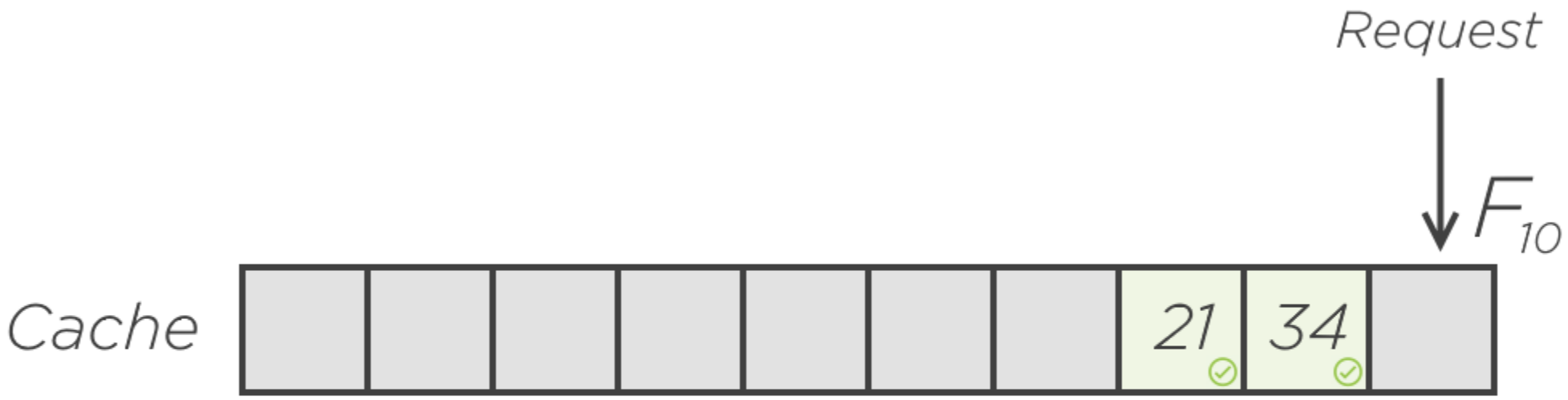

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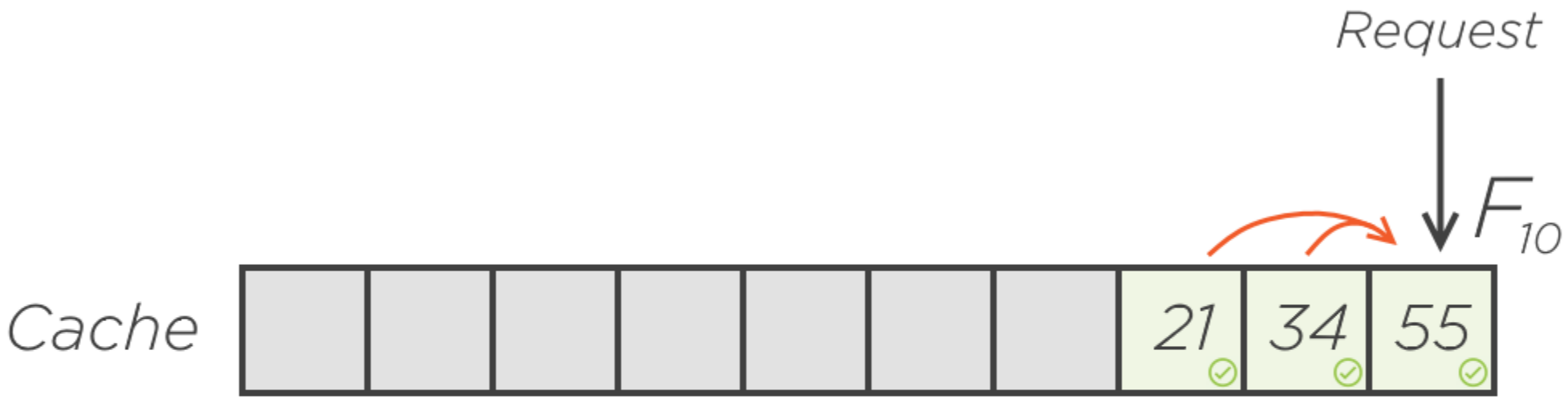

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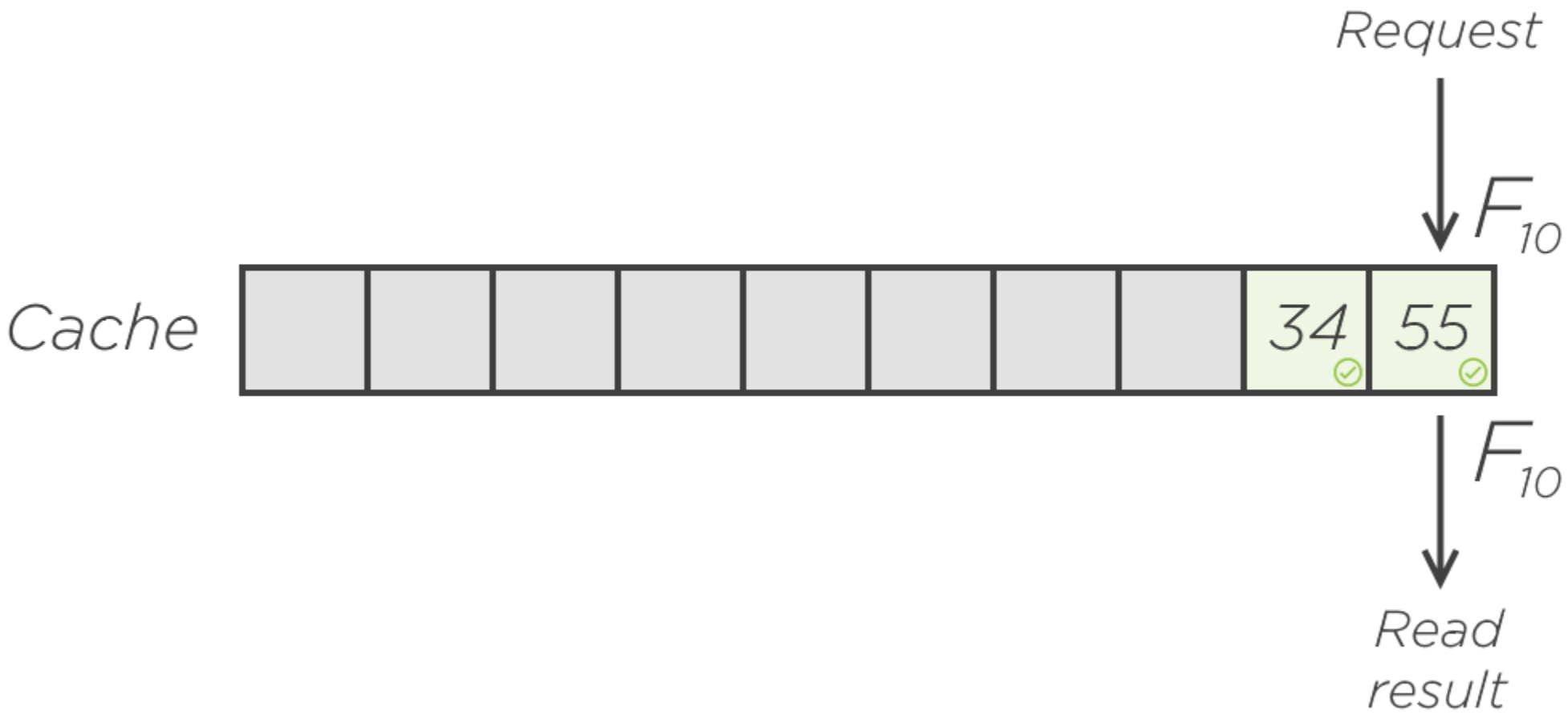


Leveraging Memoization

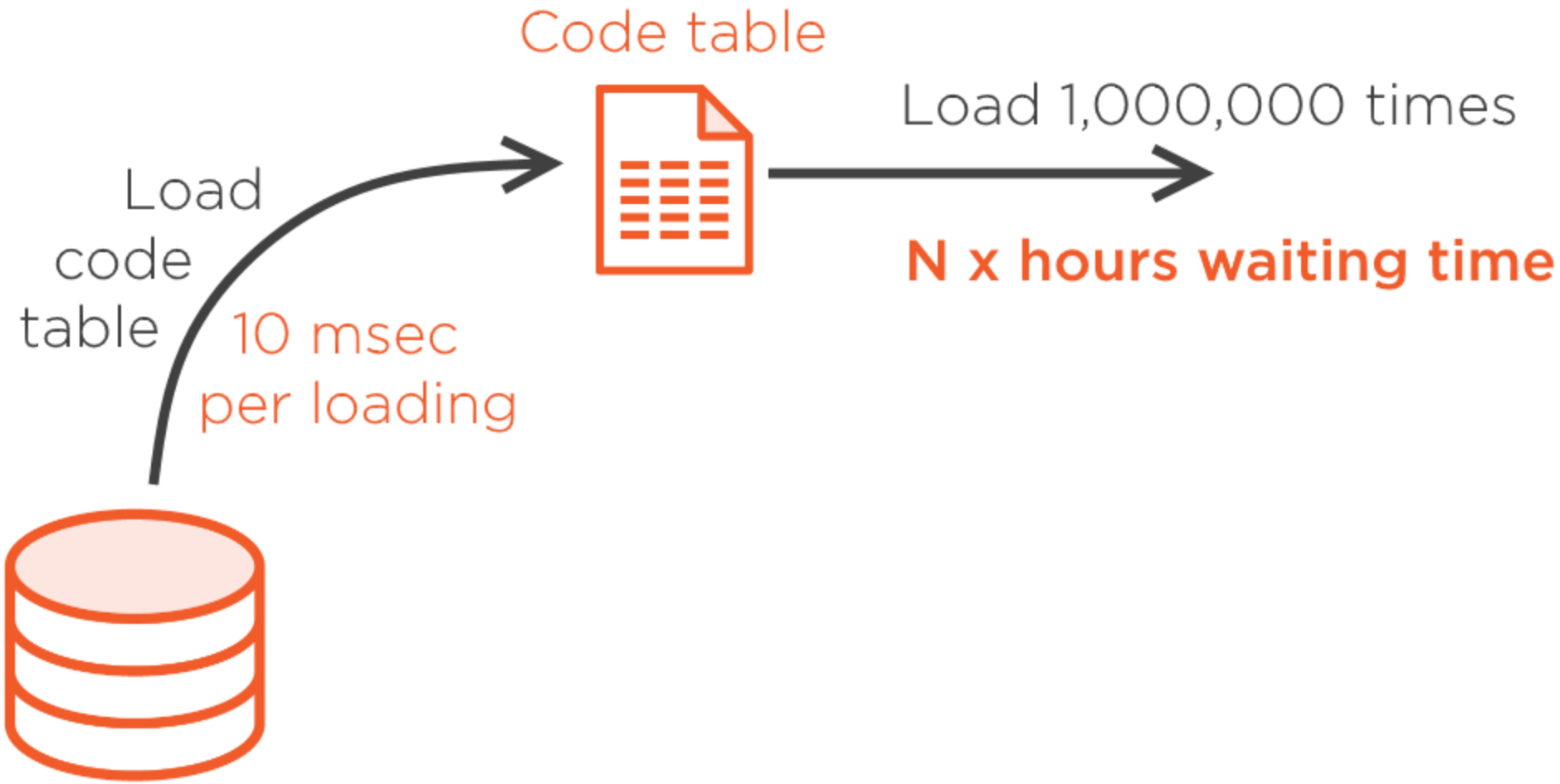
Only applies to pure functions

Makes sense when there is noticeable performance drop

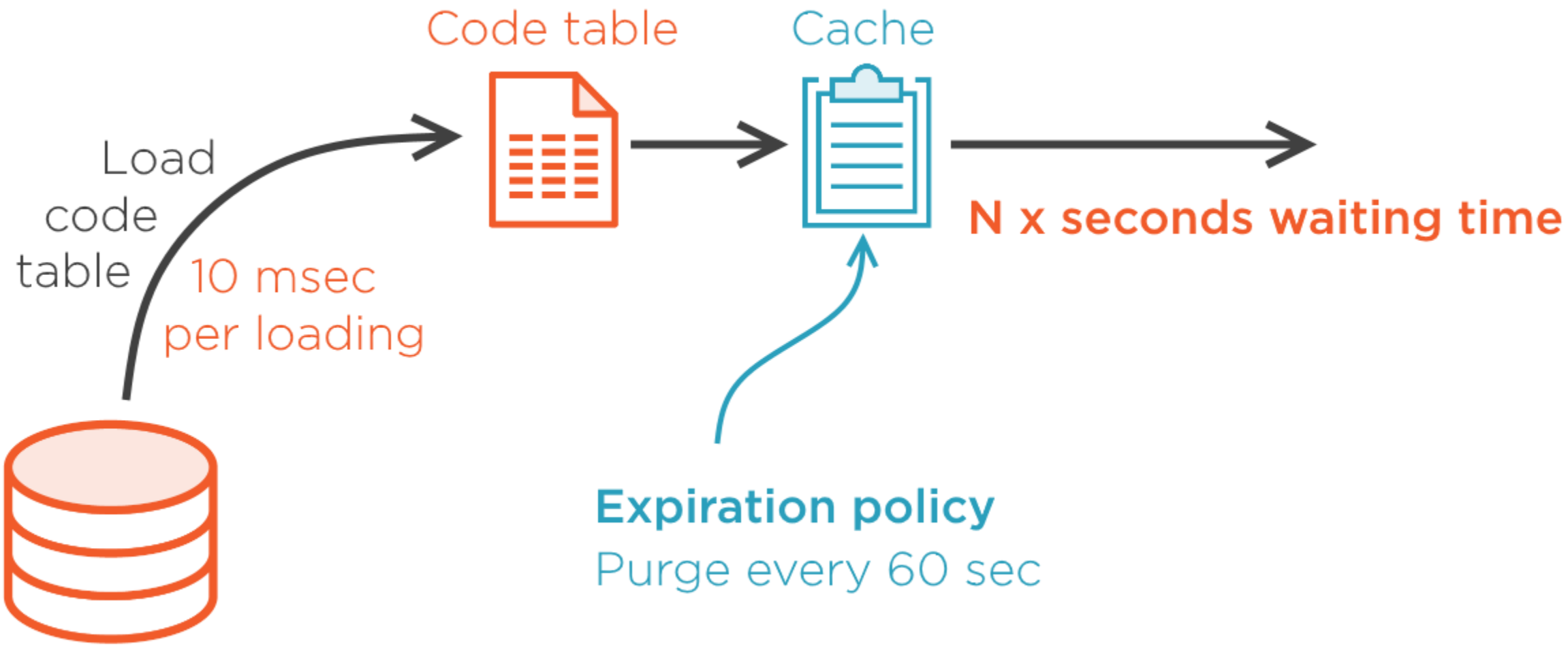
Trades time (CPU, I/O, etc.) for memory

Don’t forget to measure effects

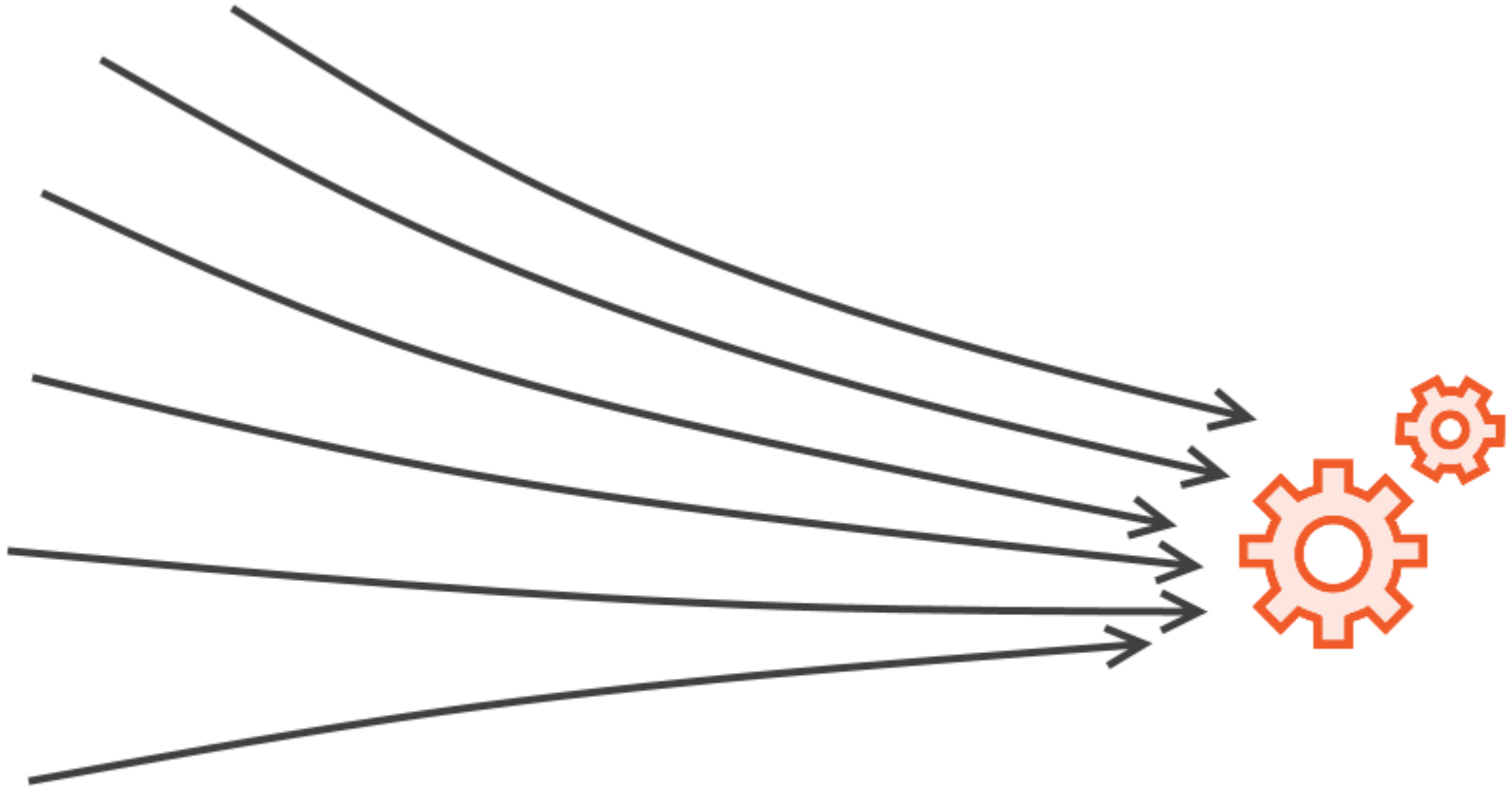
Leveraging Memoization



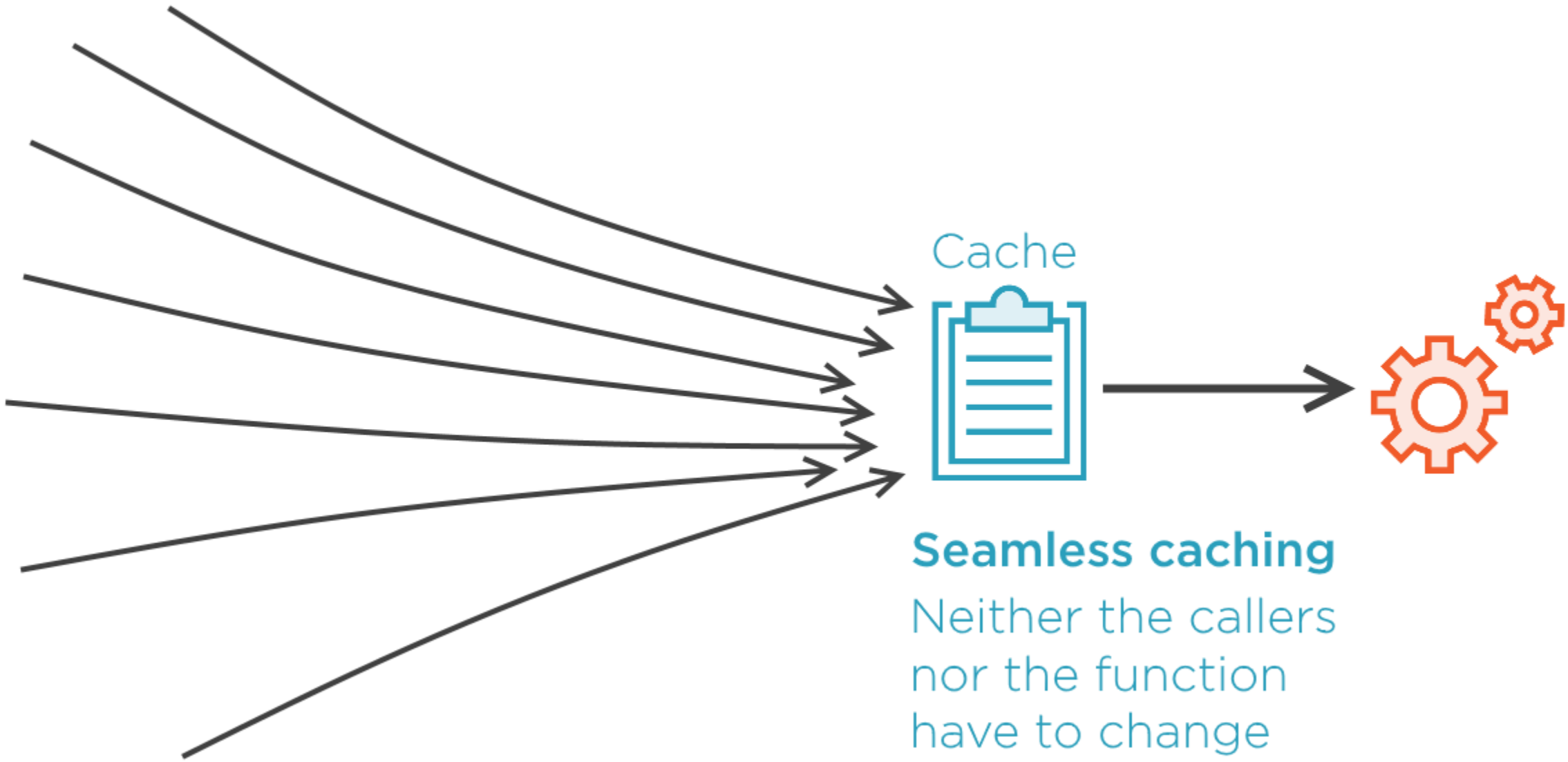
Leveraging Memoization



Leveraging Memoization



Leveraging Memoization



Seamless caching

Neither the callers nor the function have to change

Summary

Memoization of pure functions

- Special case of Dynamic Programming
- Every subproblem evaluated once
- Improves run time performance

General memoization

- Wrap a function and cache its results
- PostSharp defines caching attribute
- Becomes orthogonal concern

Next module:
Working with Pure Member Functions