Queues

William Fiset

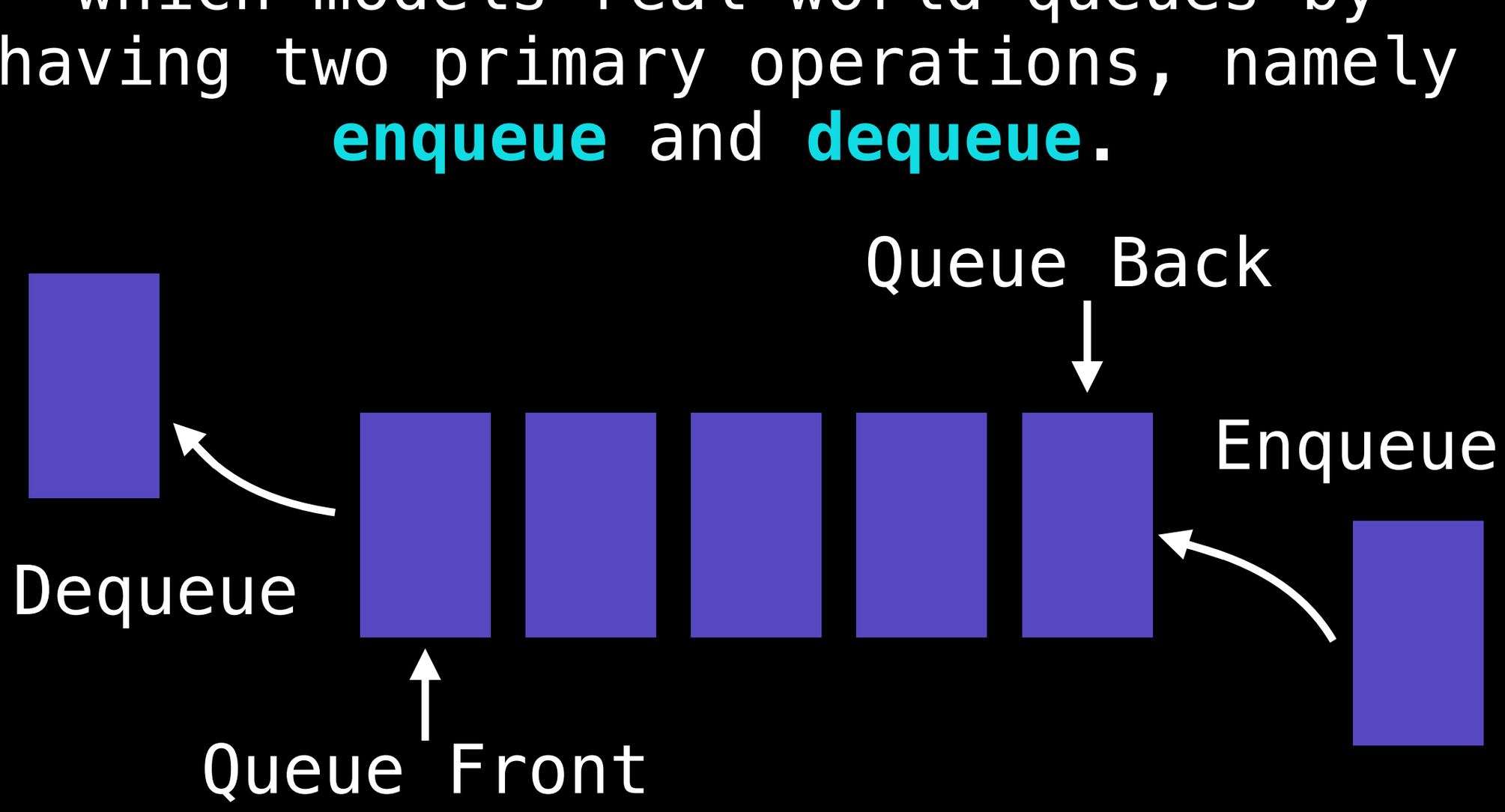
Outline

- Discussion About Queues
  - What is a queue?
  - Terminology
  - When and where is a queue used?
  - Complexity Analysis
  - Queue Breadth First Search (BFS) example
- Implementation Details
  - How to enqueue (add) elements to a queue
  - How to dequeue (remove) elements from a queue
- Code Implementation

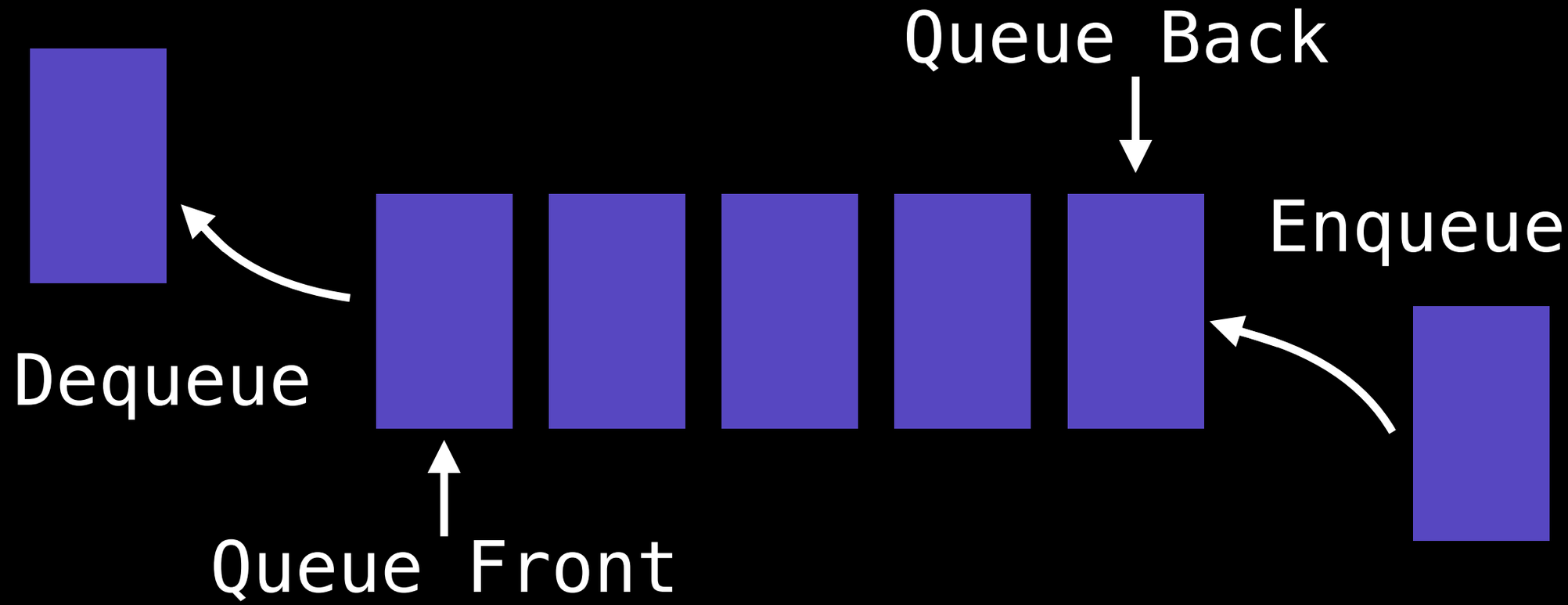
Discussion

What is a Queue?

A queue is a linear data structure which models real world queues by having two primary operations, namely **enqueue** and **dequeue**.



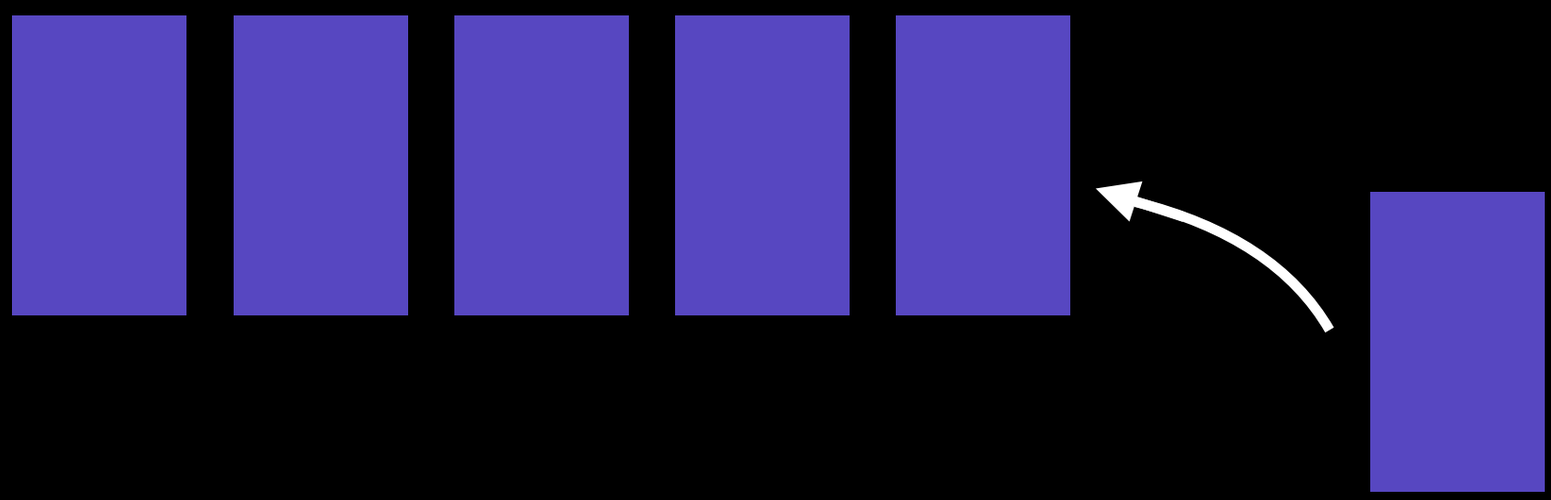
Queue Terminology



Queue Terminology

There does not seem to be consistent terminology for inserting and removing elements from queues.

Enqueue = Adding = Offering



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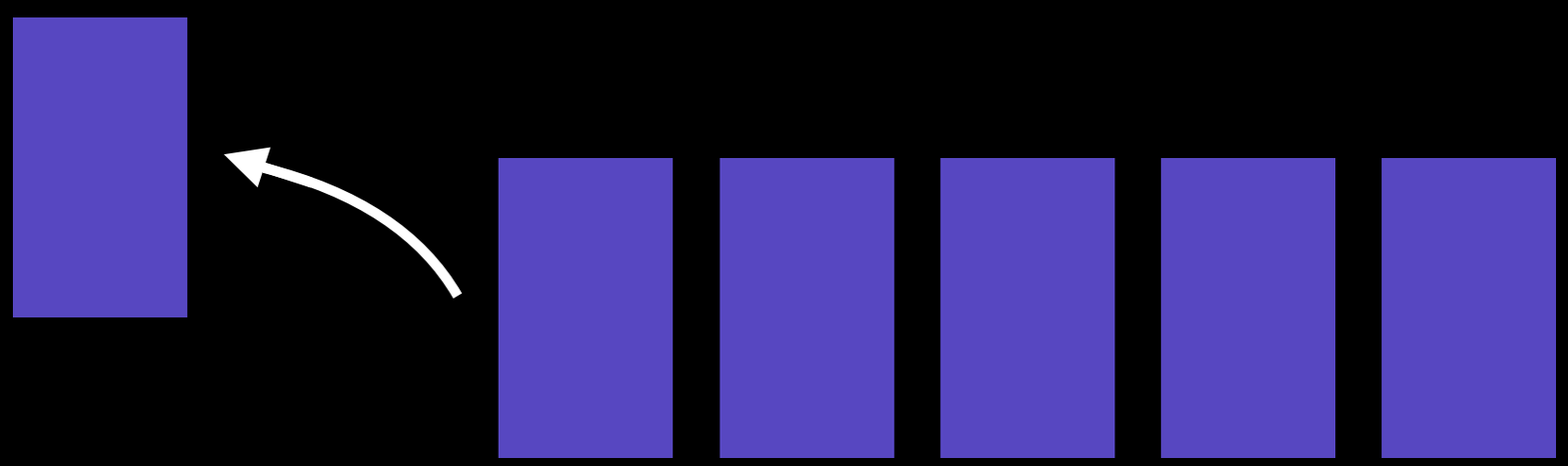
Dequeue = Polling

(These are also sometimes called *removing*, but I find this ambiguous)



Queue Example

<u>Instructions</u>:

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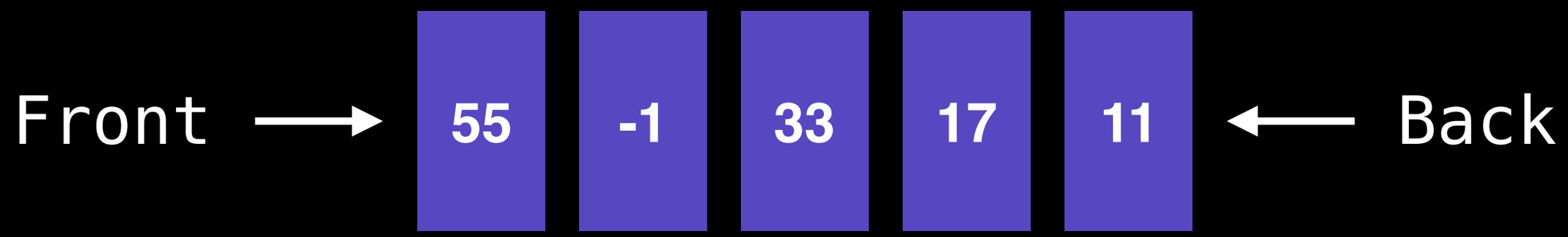

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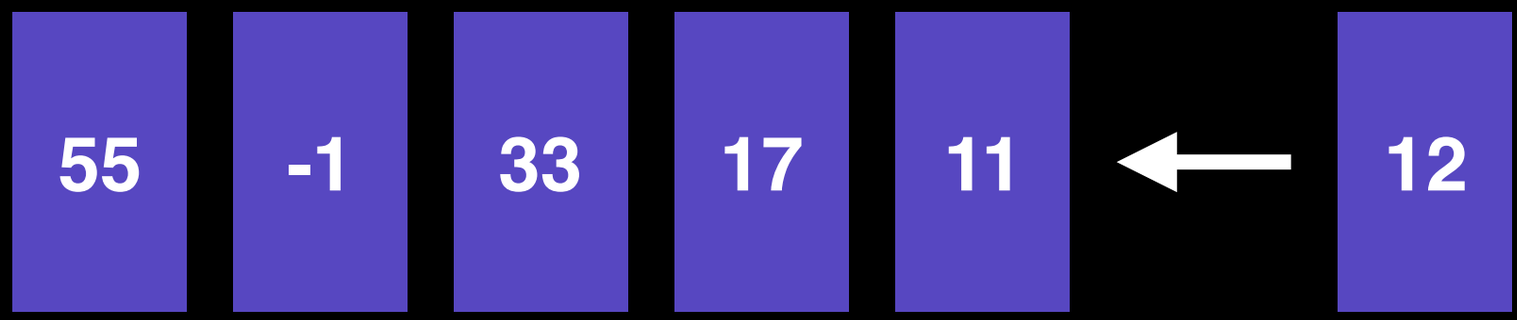

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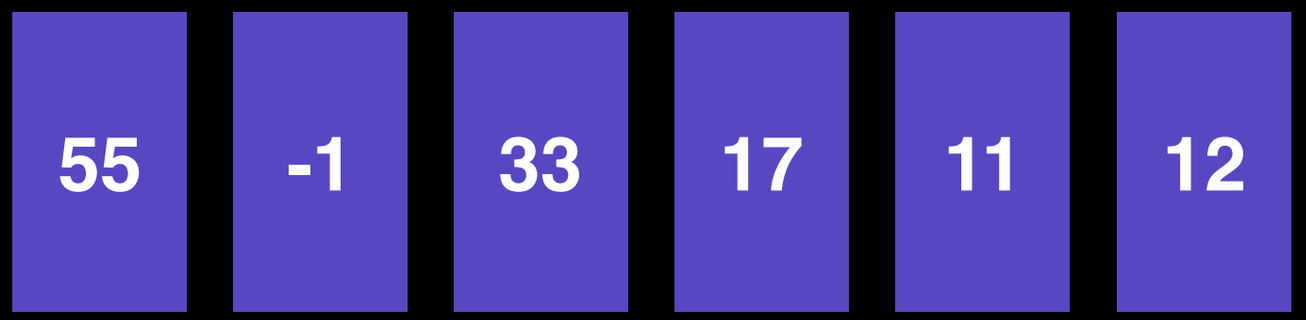

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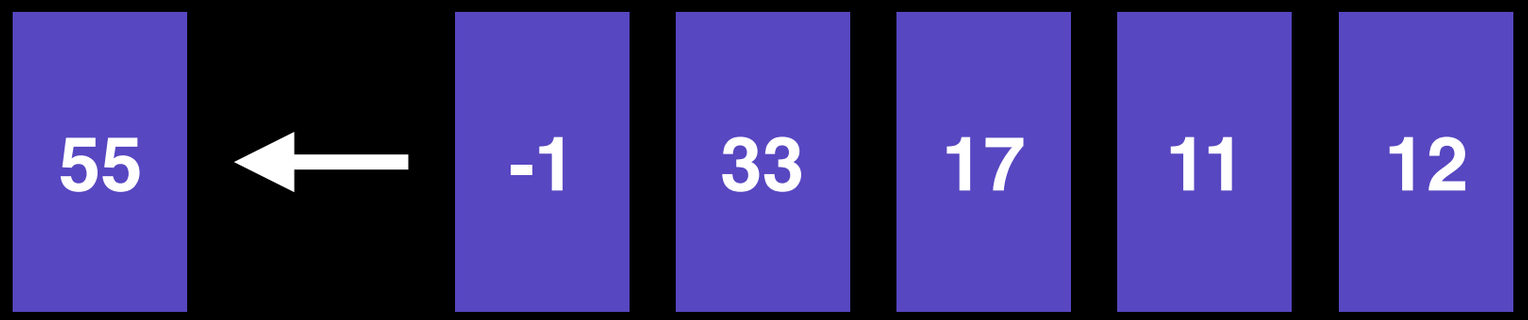

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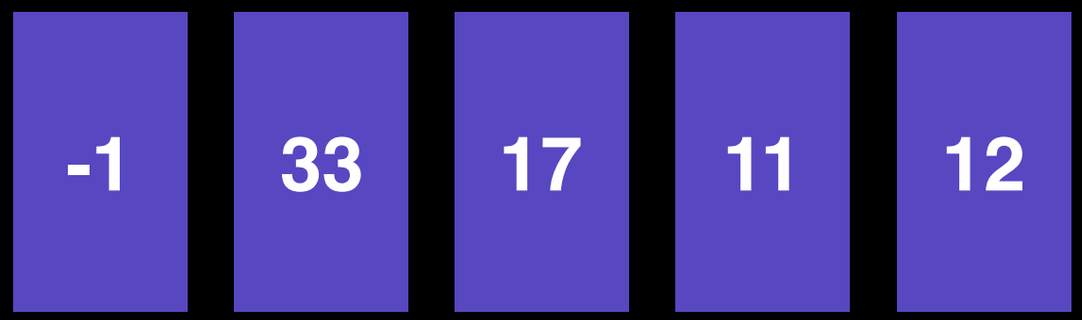

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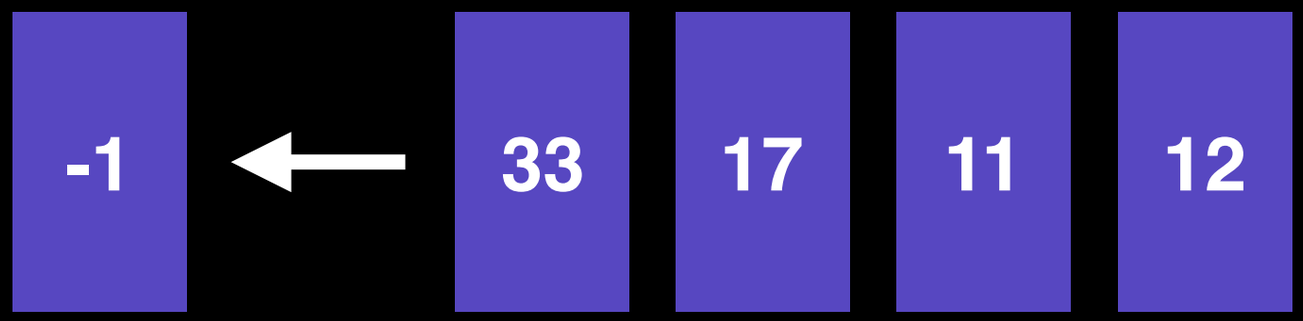

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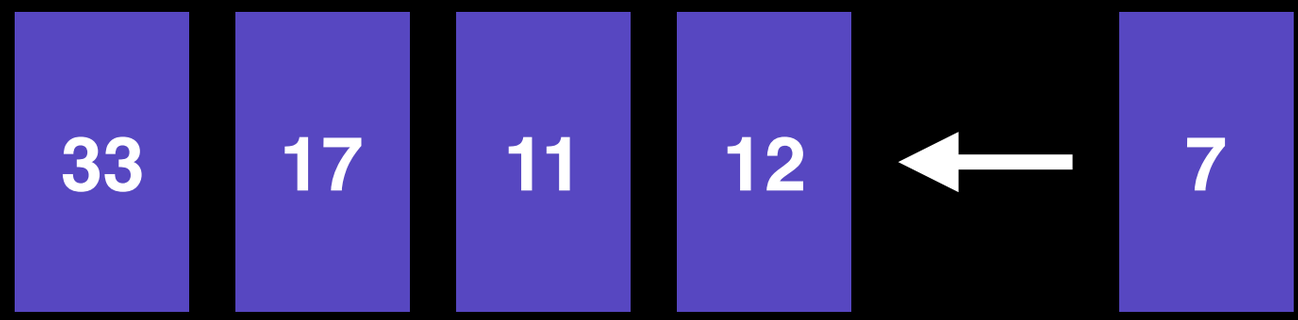

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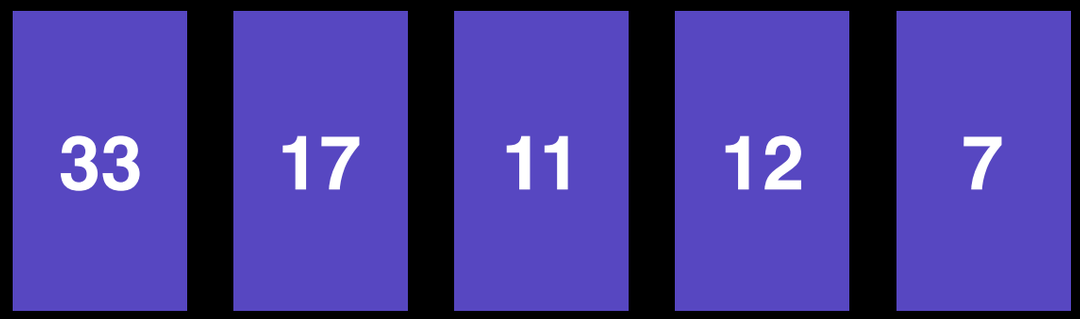

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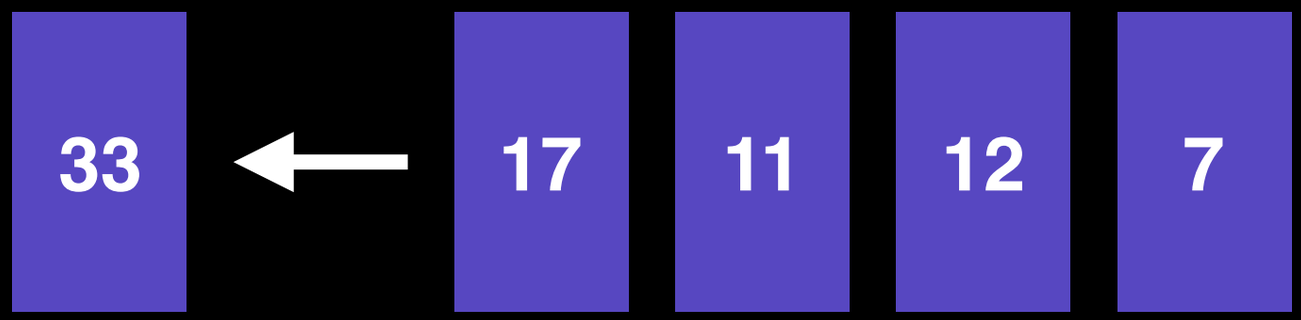

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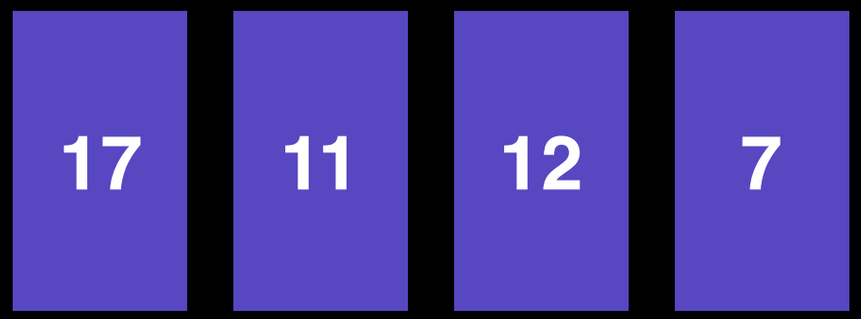

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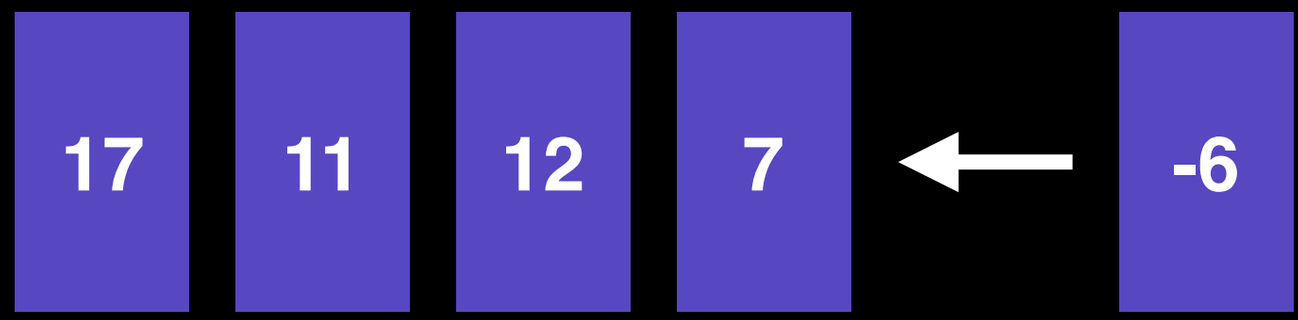

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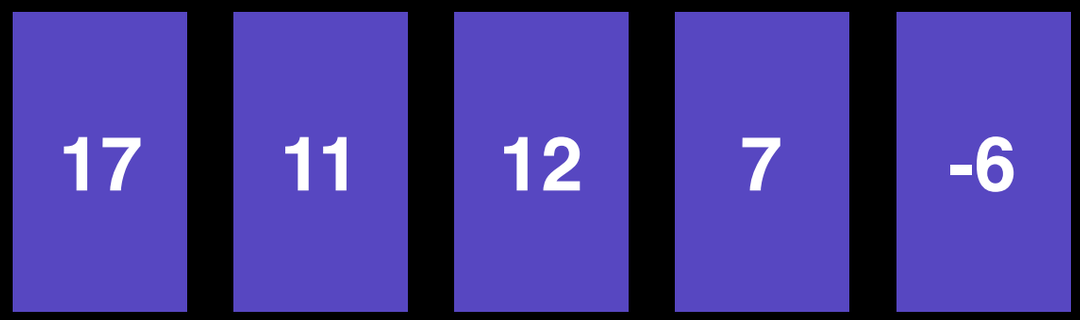

When and where is a Queue used?

- Any waiting line models a queue, for example a lineup at a movie theatre.
- Can be used to efficiently keep track of the ***x*** most recently added elements.
- Web server request management where you want first come first serve.
- Breadth first search (BFS) graph traversal.

Complexity Analysis

Complexity

Enqueue	O(1)
Dequeue	O(1)
Peeking	O(1)
Contains	O(n)
Removal	O(n)
Is Empty	O(1)

Enqueuing & Dequeuing

Enqueuing

Instructions:

Enqueue(5)
Enqueue(1)
Enqueue(6)
Enqueue(17)
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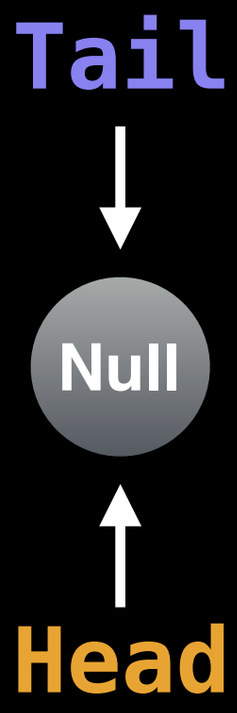

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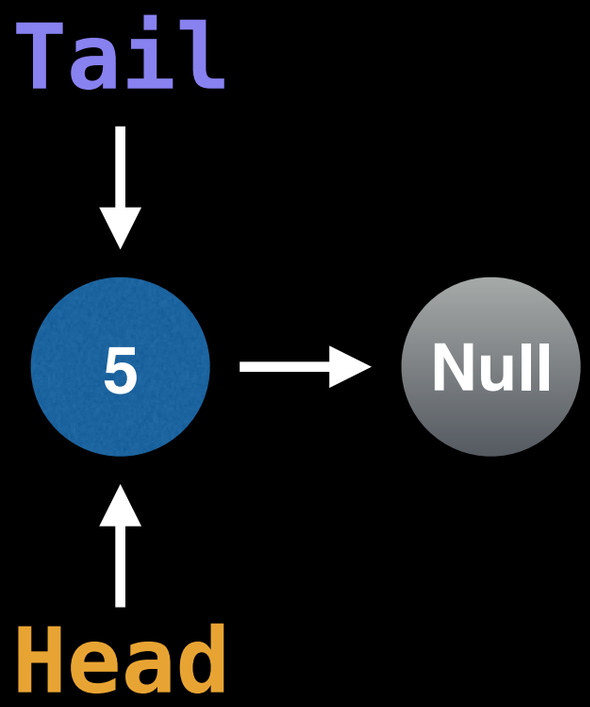

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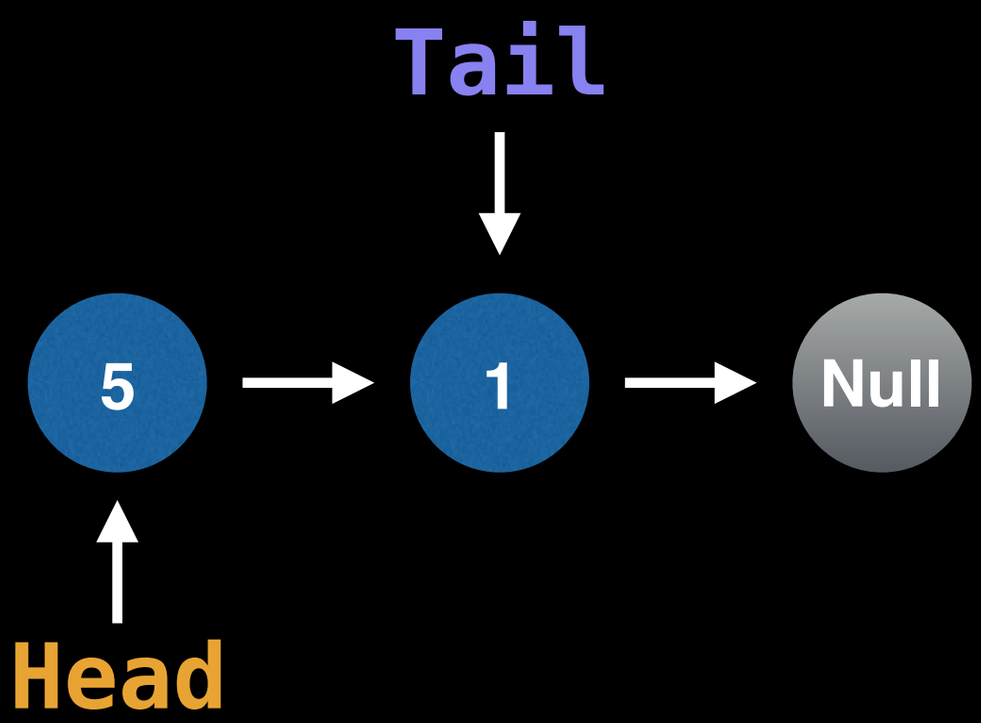

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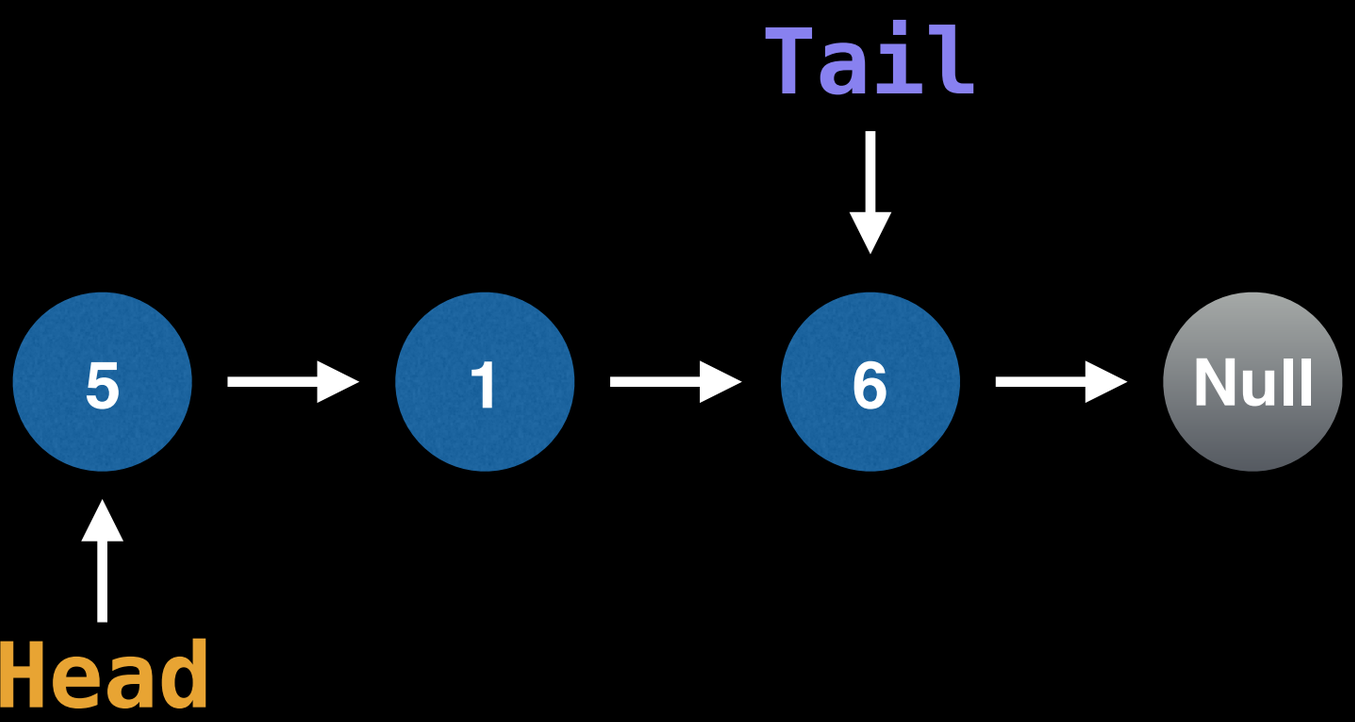

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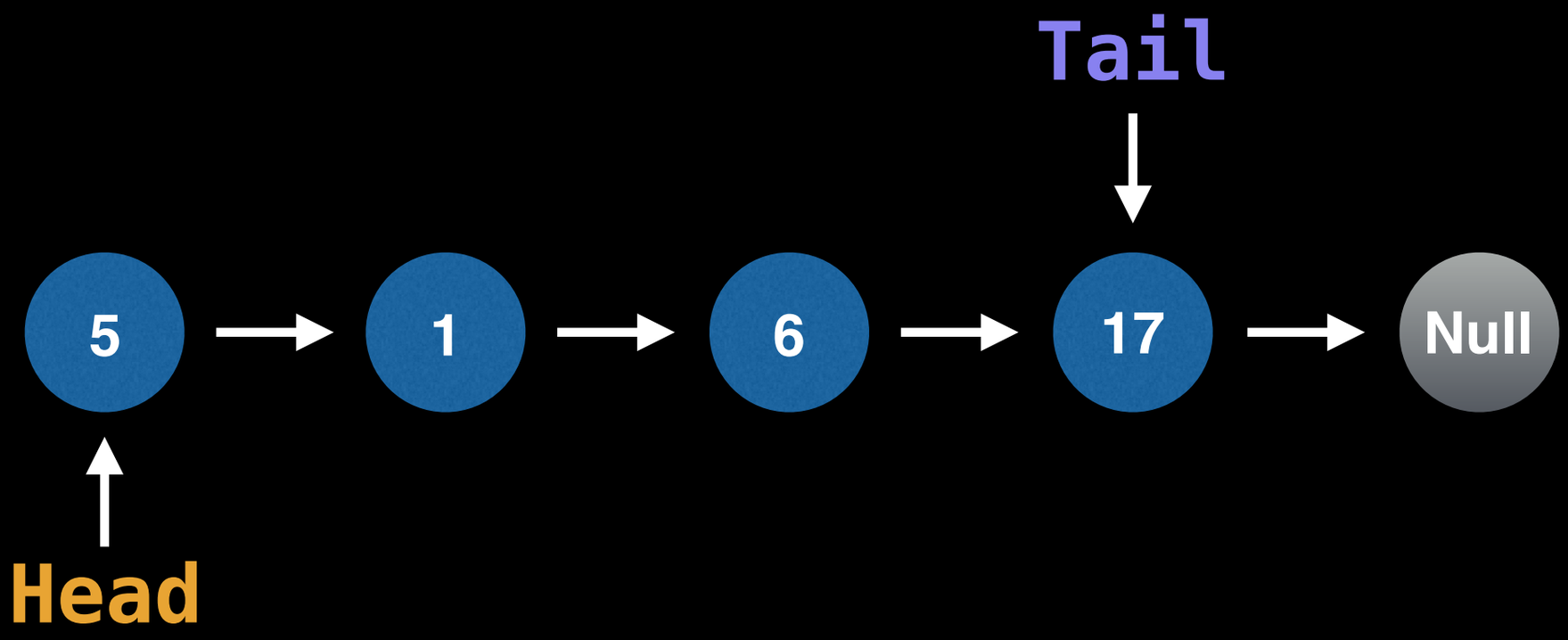

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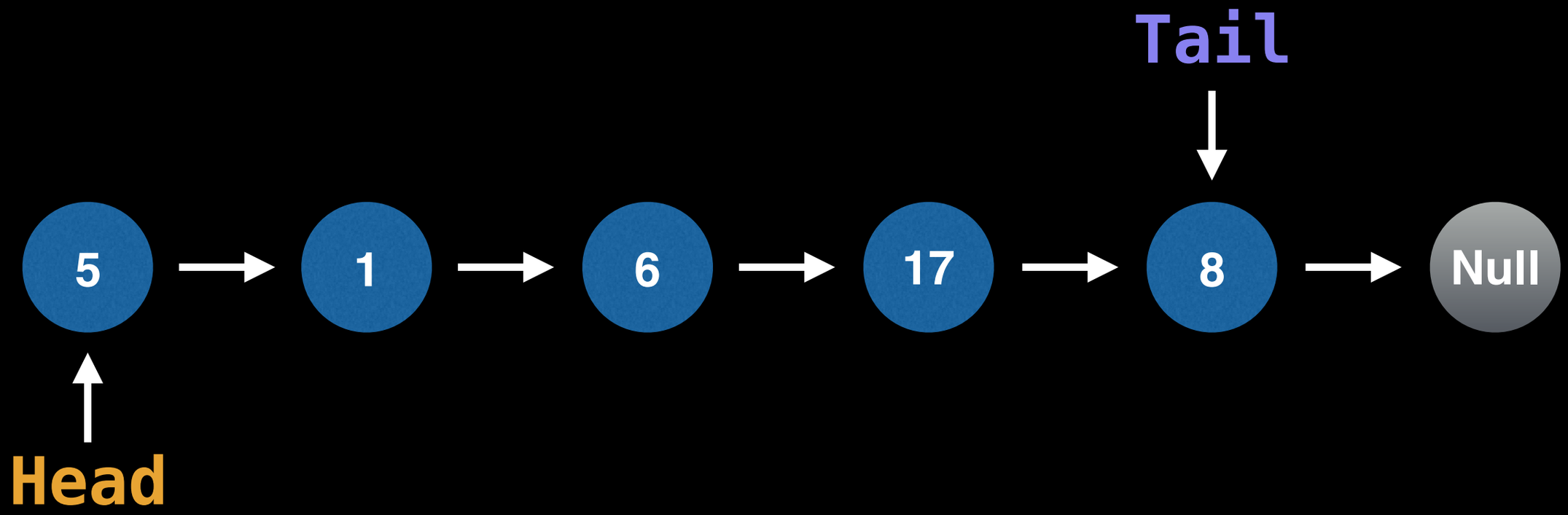

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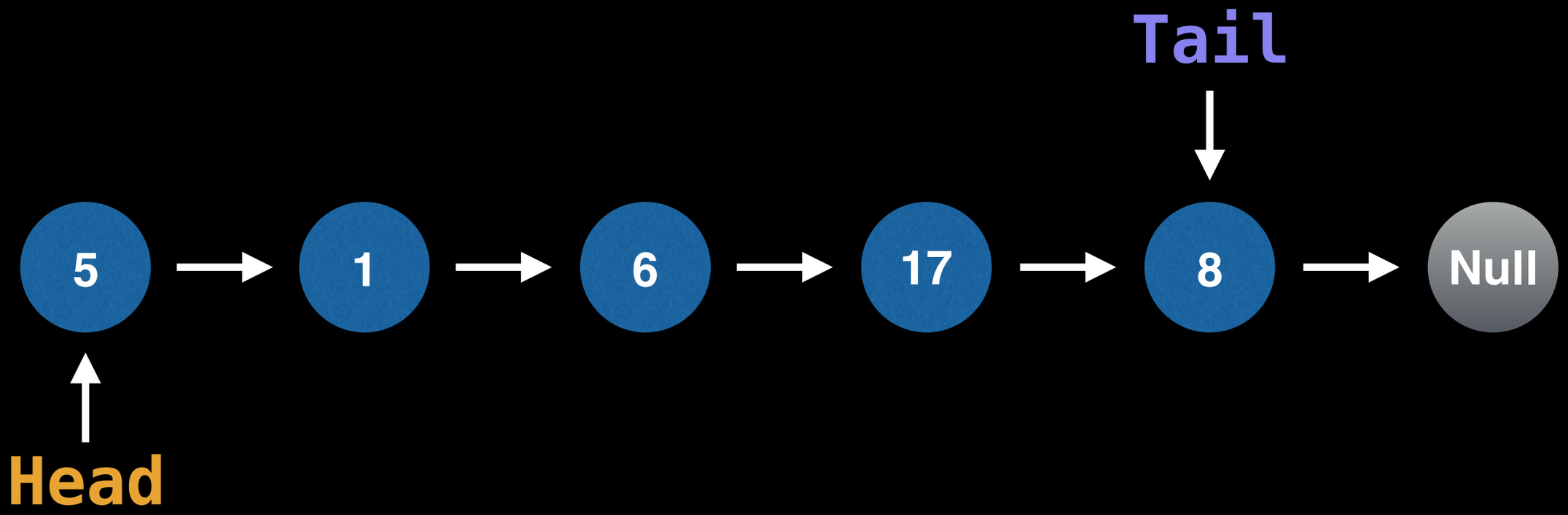

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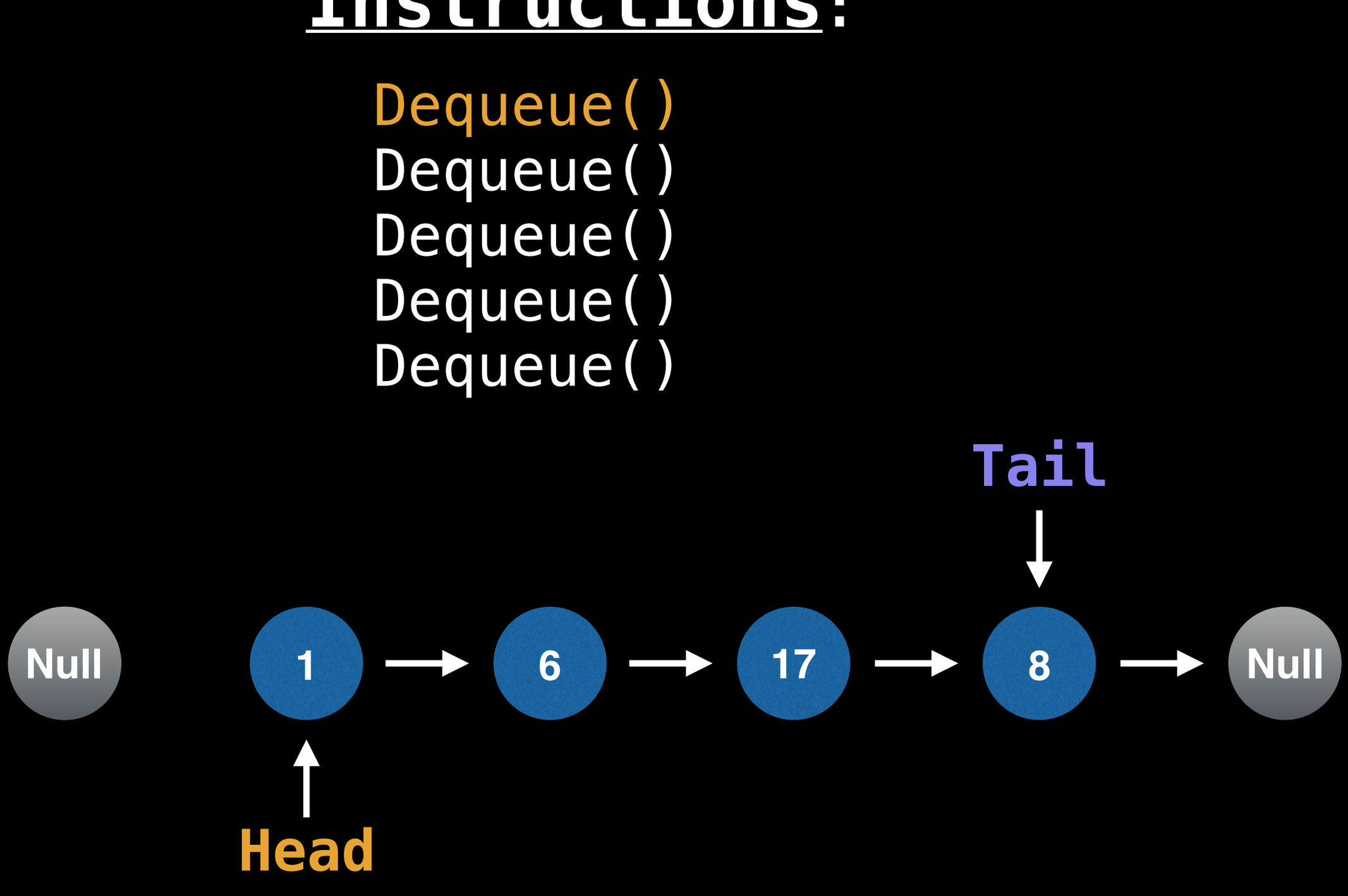

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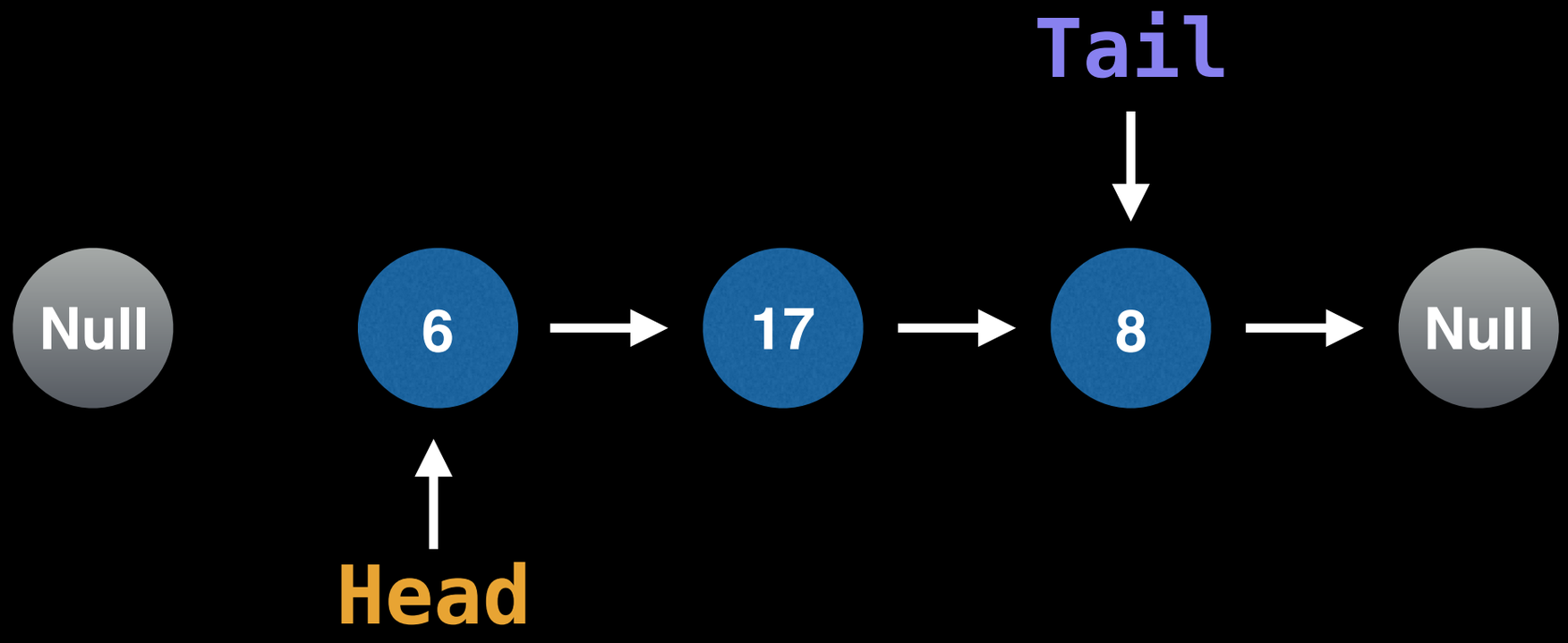

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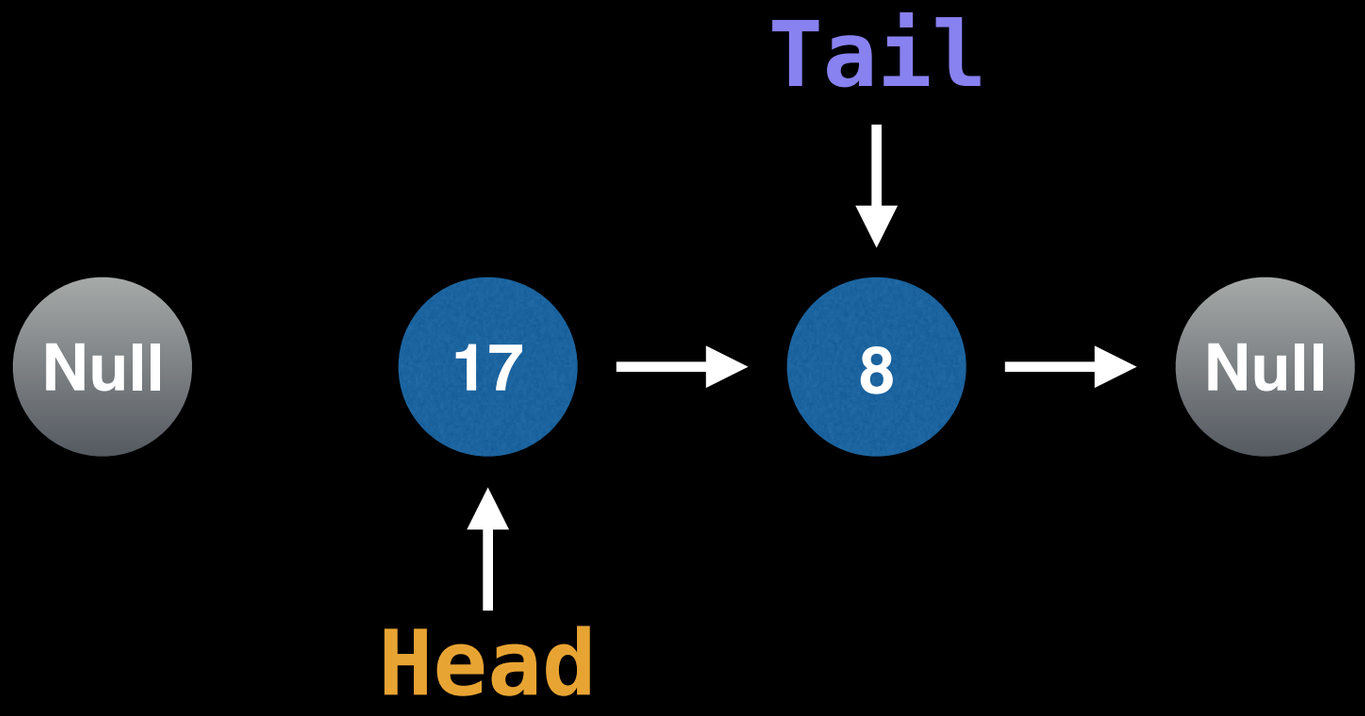

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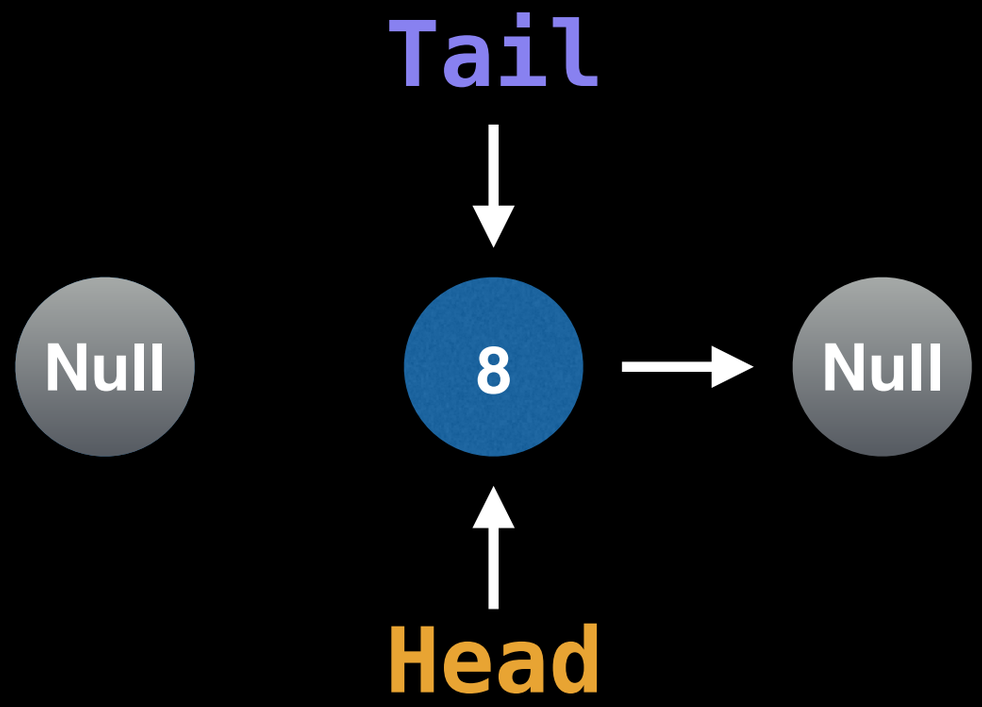

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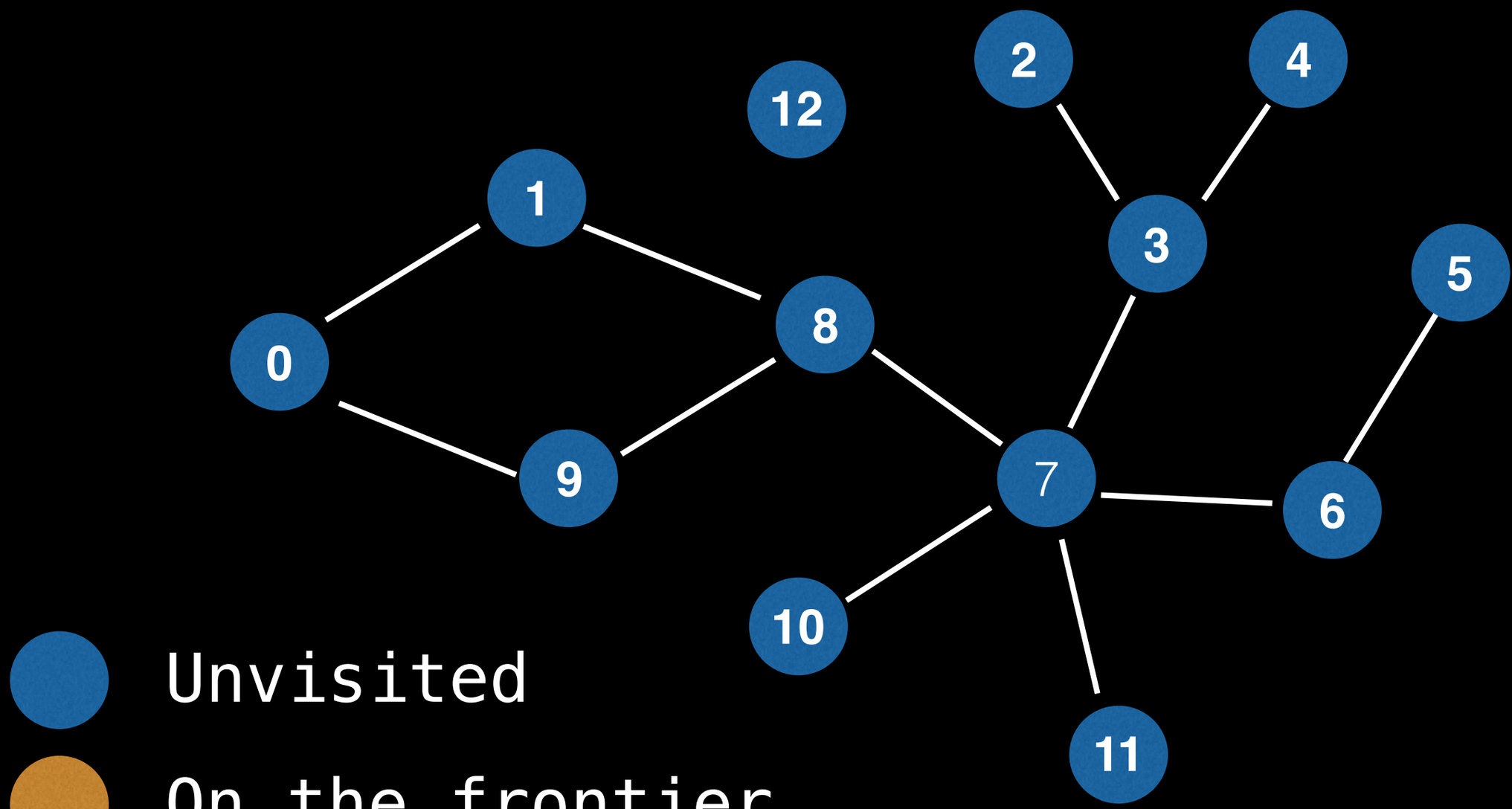
Queue Example – BFS



Unvisited

On the frontier

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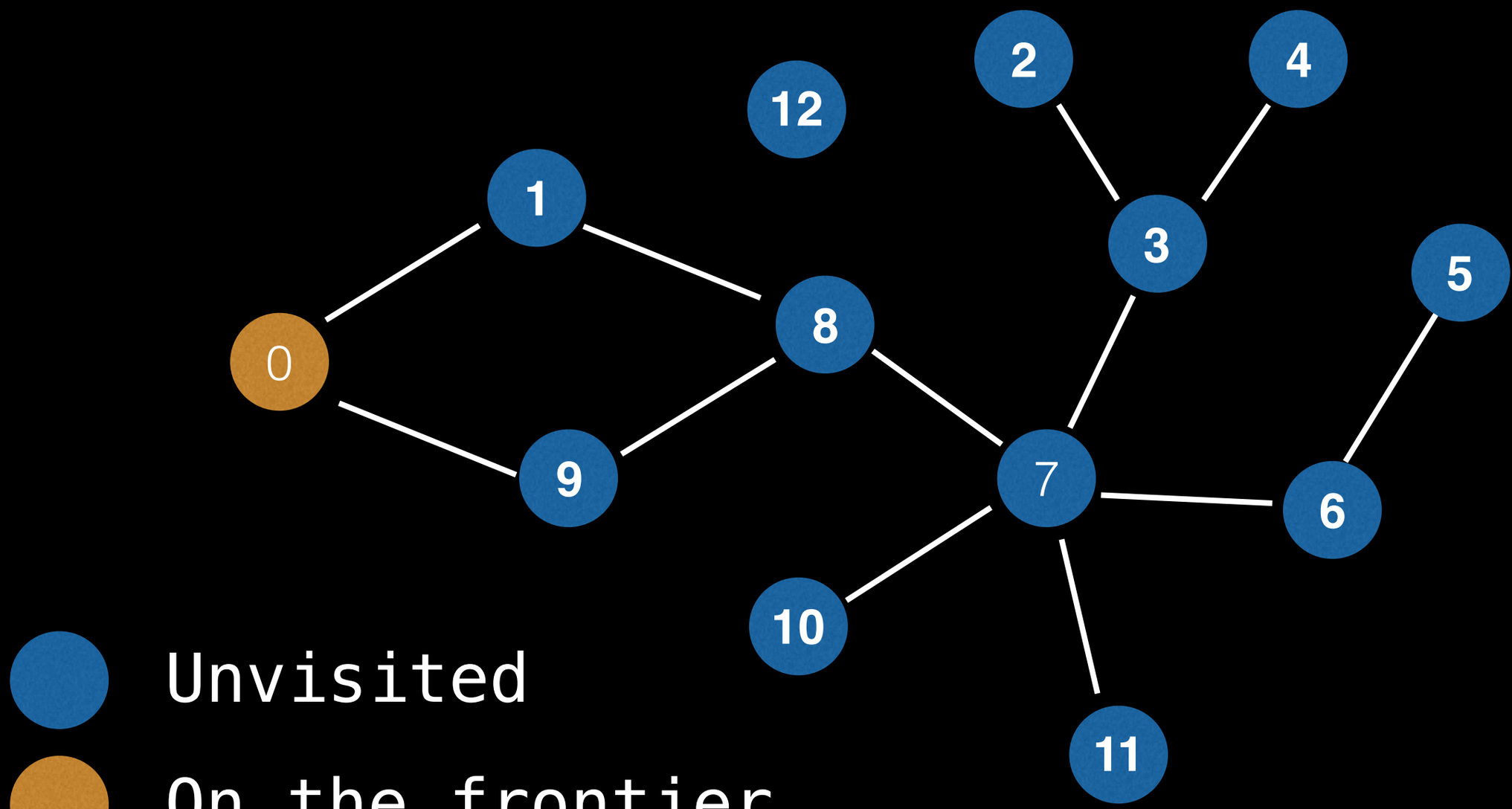

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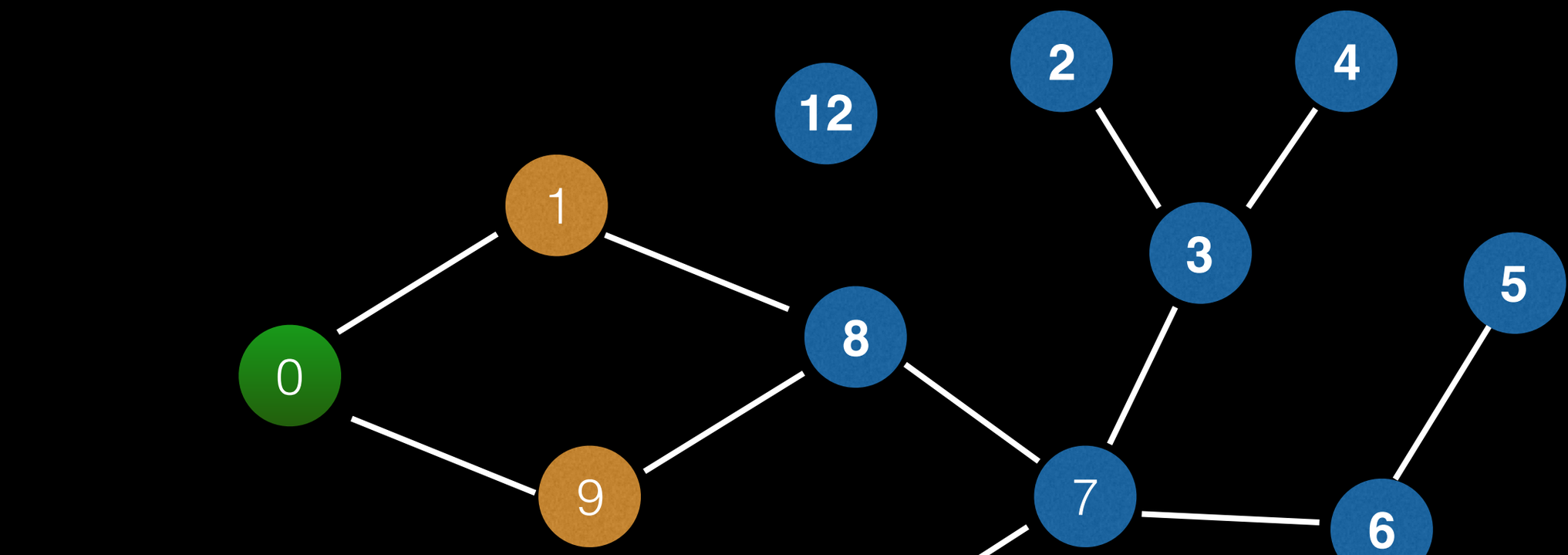

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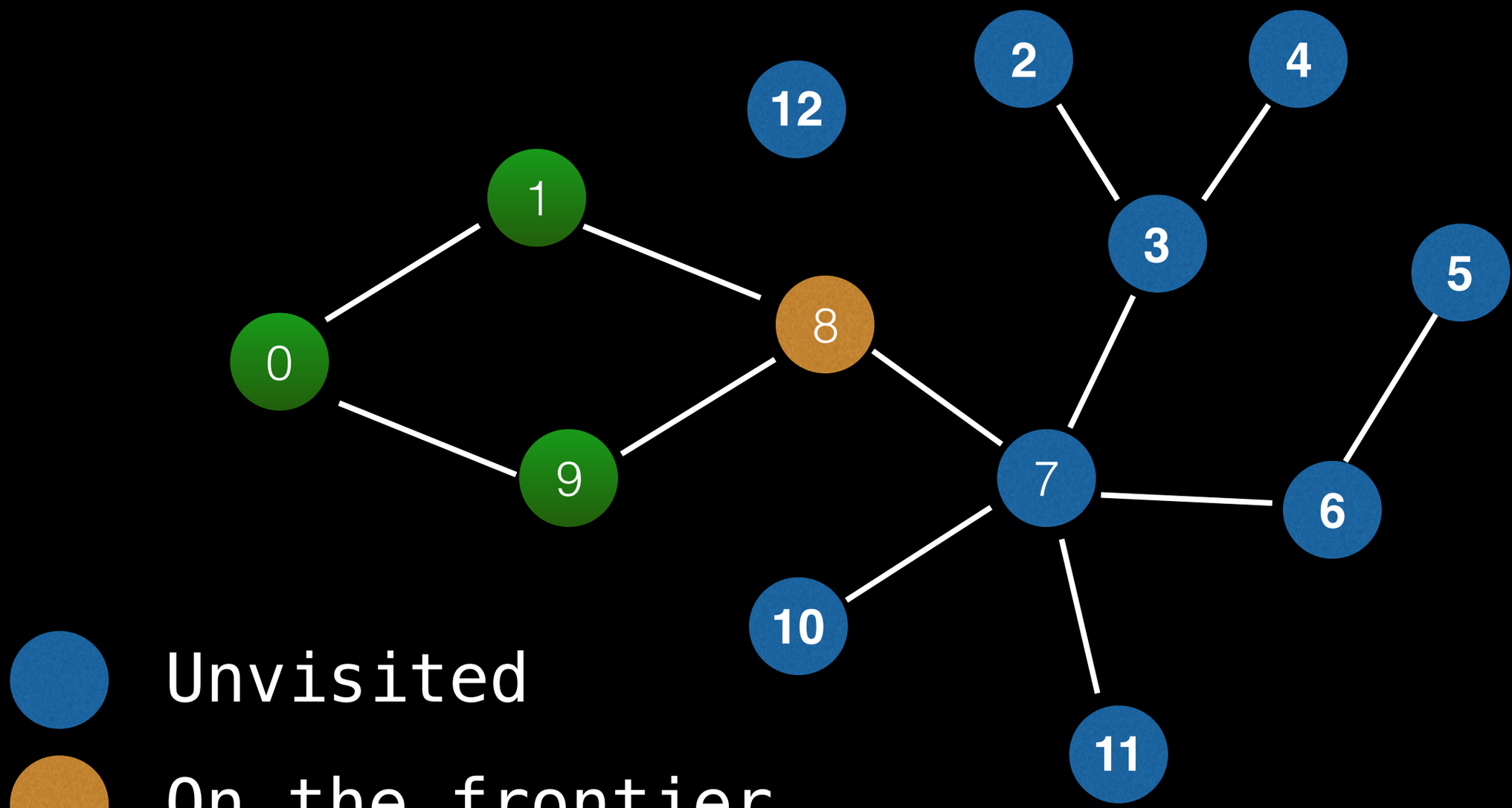

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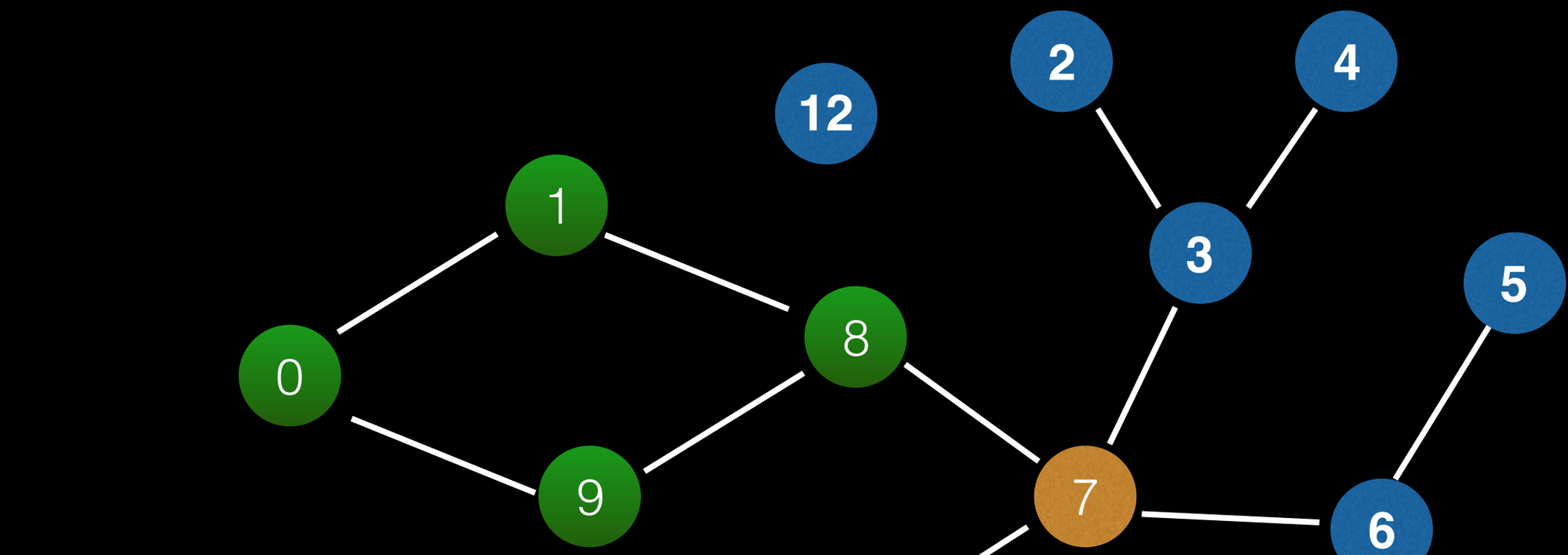

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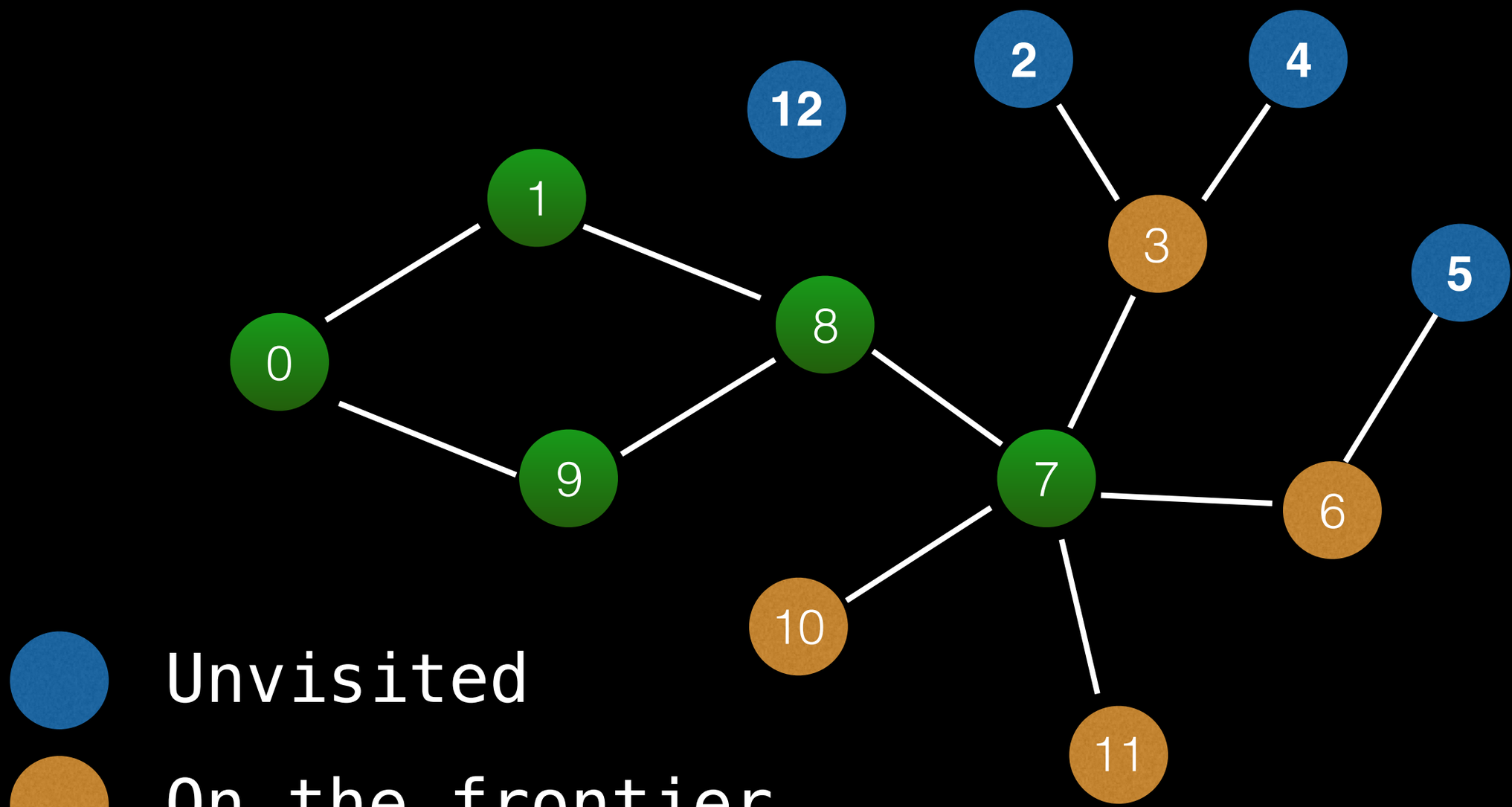

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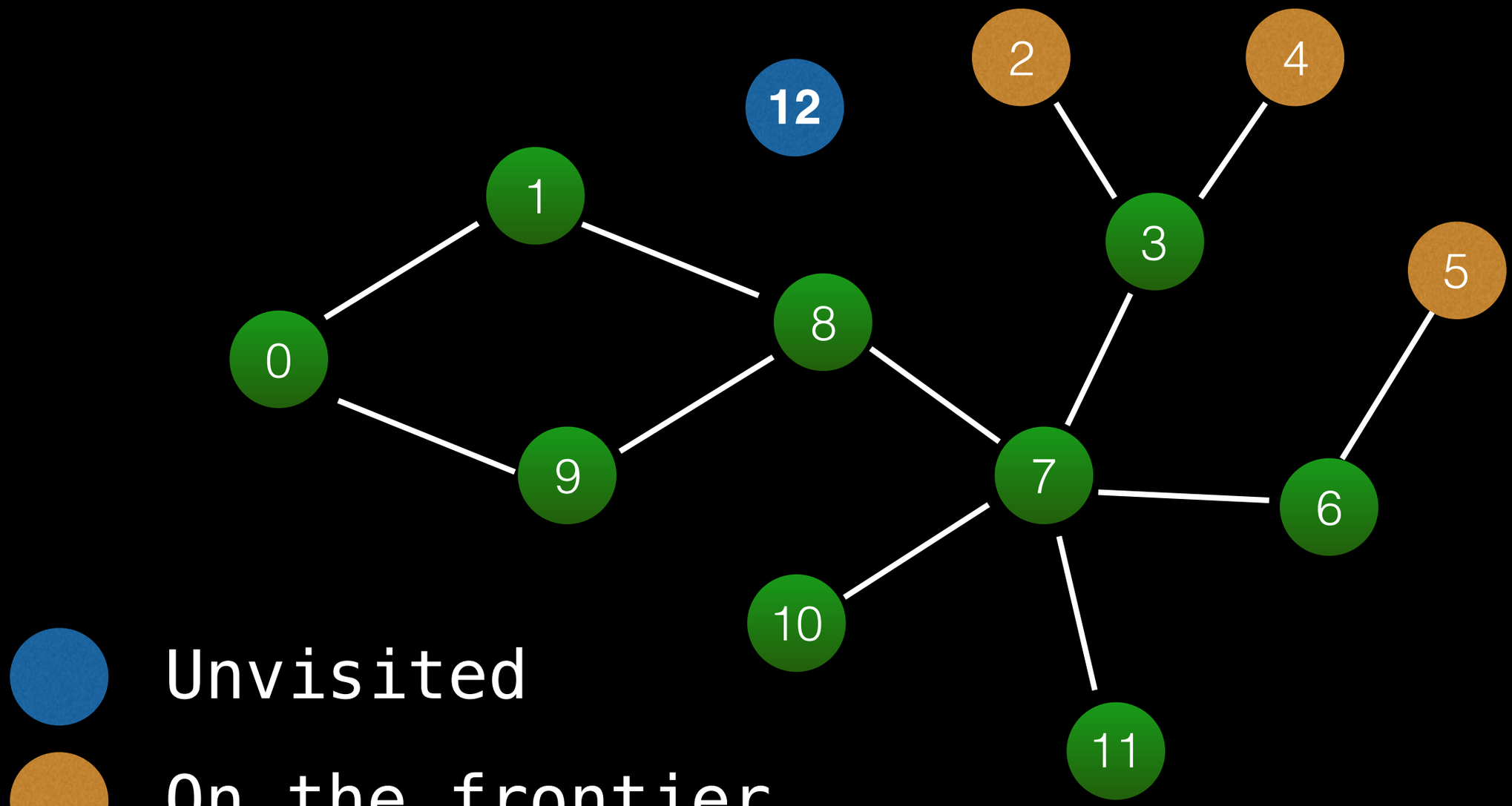

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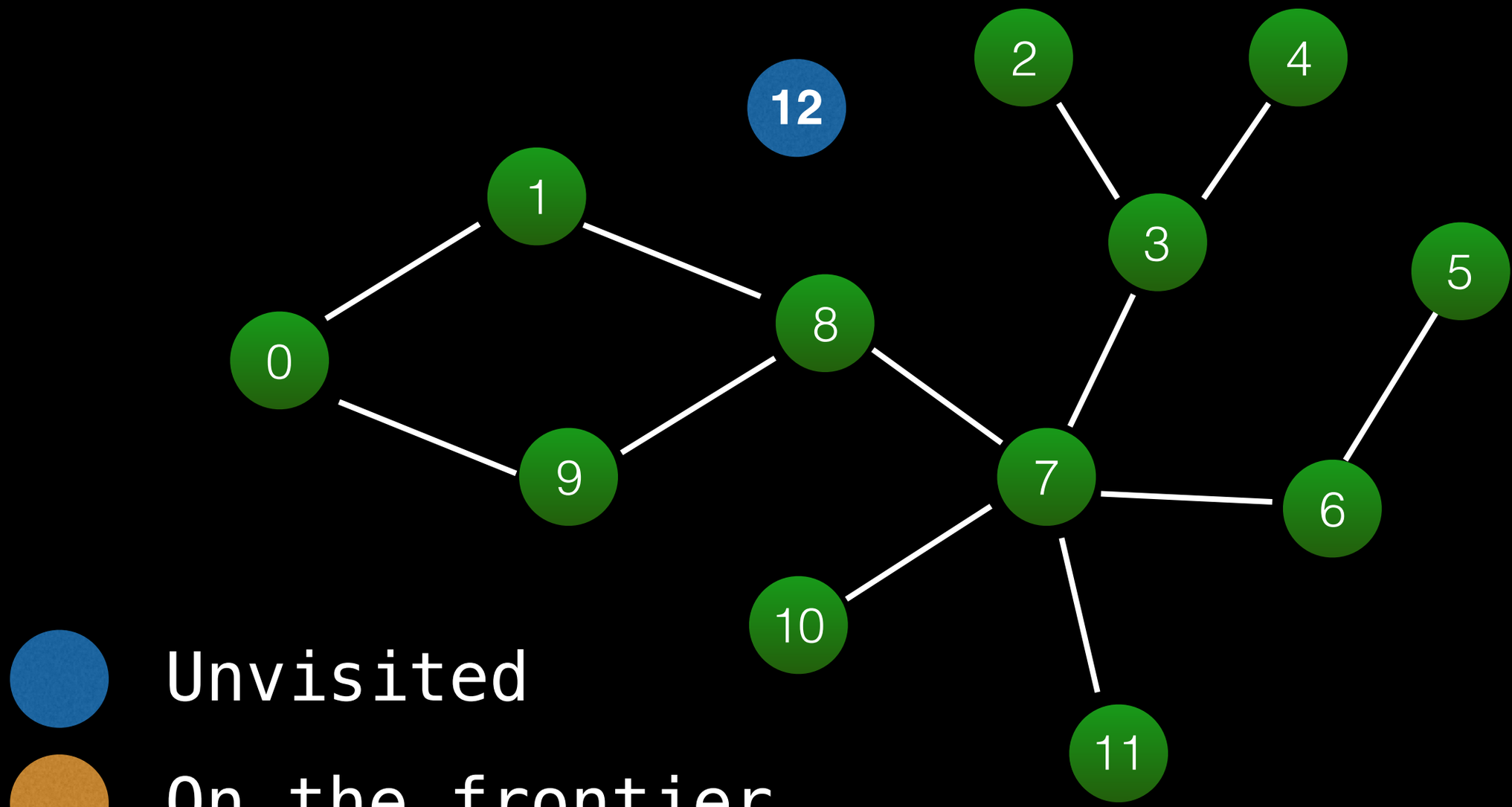

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Queue Example - BFS

```
Let Q be a Queue
Q.enqueue(starting_node)
starting_node.visited = true

While Q is not empty Do
    node = Q.dequeue()

    For neighbour in neighbours(node):
        If neighbour has not been visited:
            neighbour.visited = true
            Q.enqueue(neighbour)
```