# Introduction to Artificial Intelligence with Python

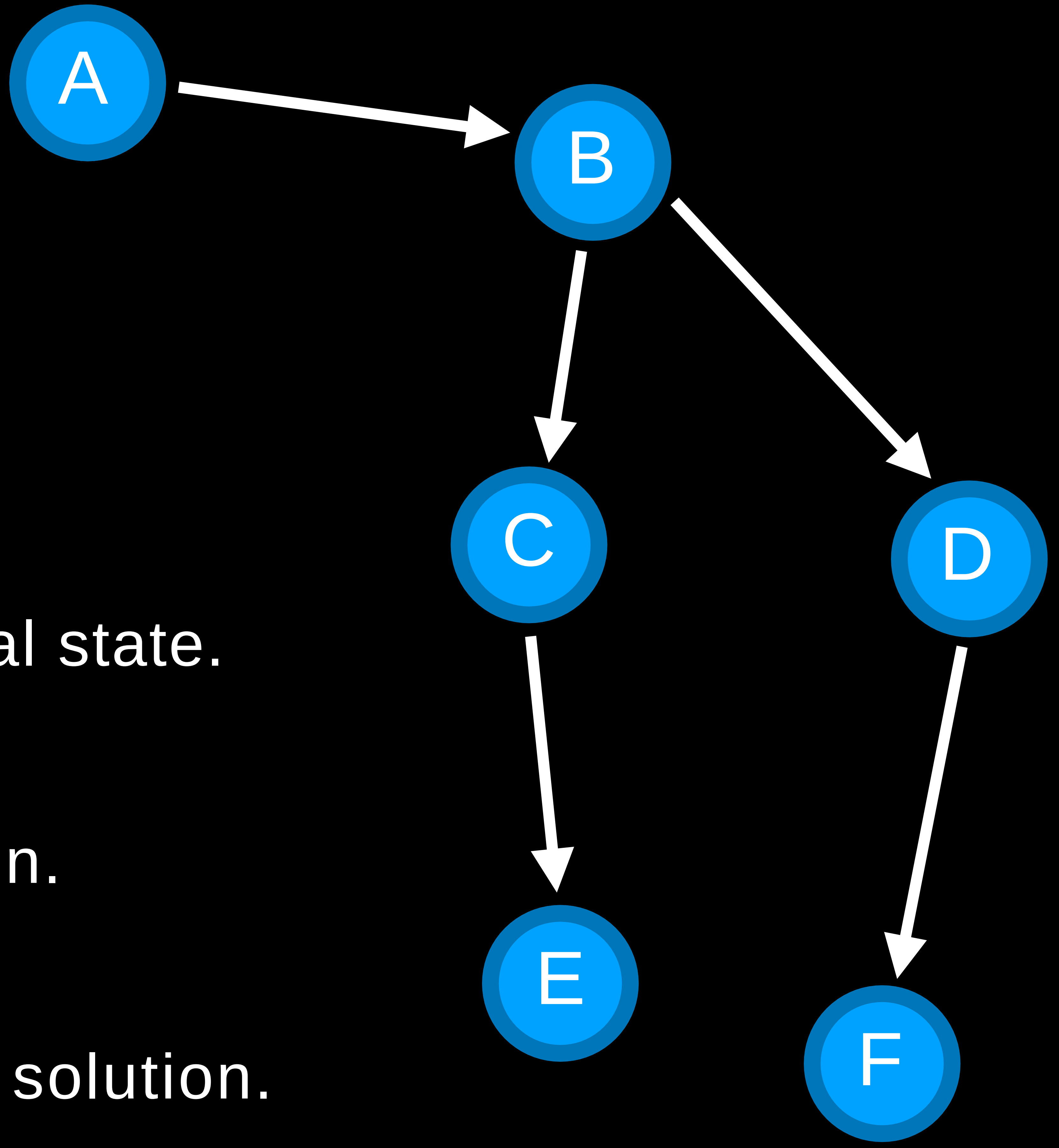
# Search

# Approach

- Start with a **frontier** that contains the initial state.
- Repeat:
    - If the frontier is empty, then no solution.
    - Remove a node from the frontier.
    - If node contains goal state, return the solution.
    - **Expand** node, add resulting nodes to the frontier.

# Find a path from A to E.

**Frontier**



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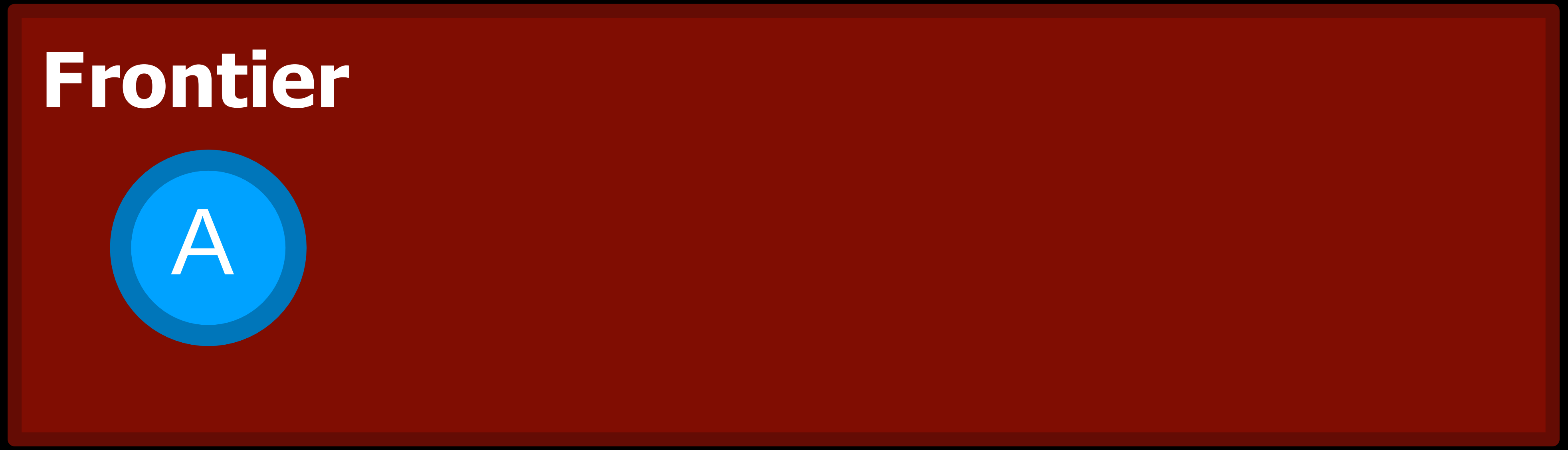
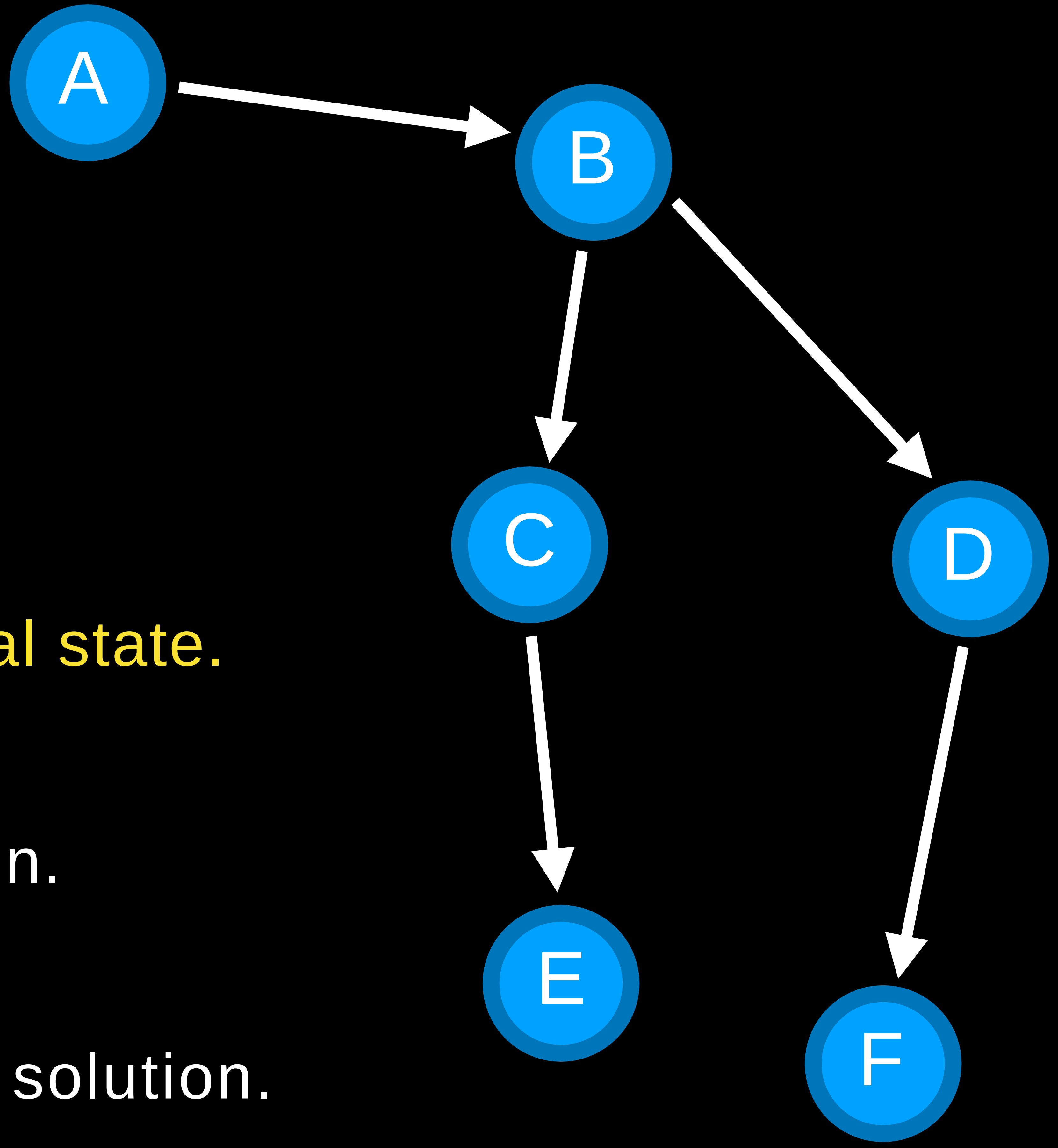


**Frontier**



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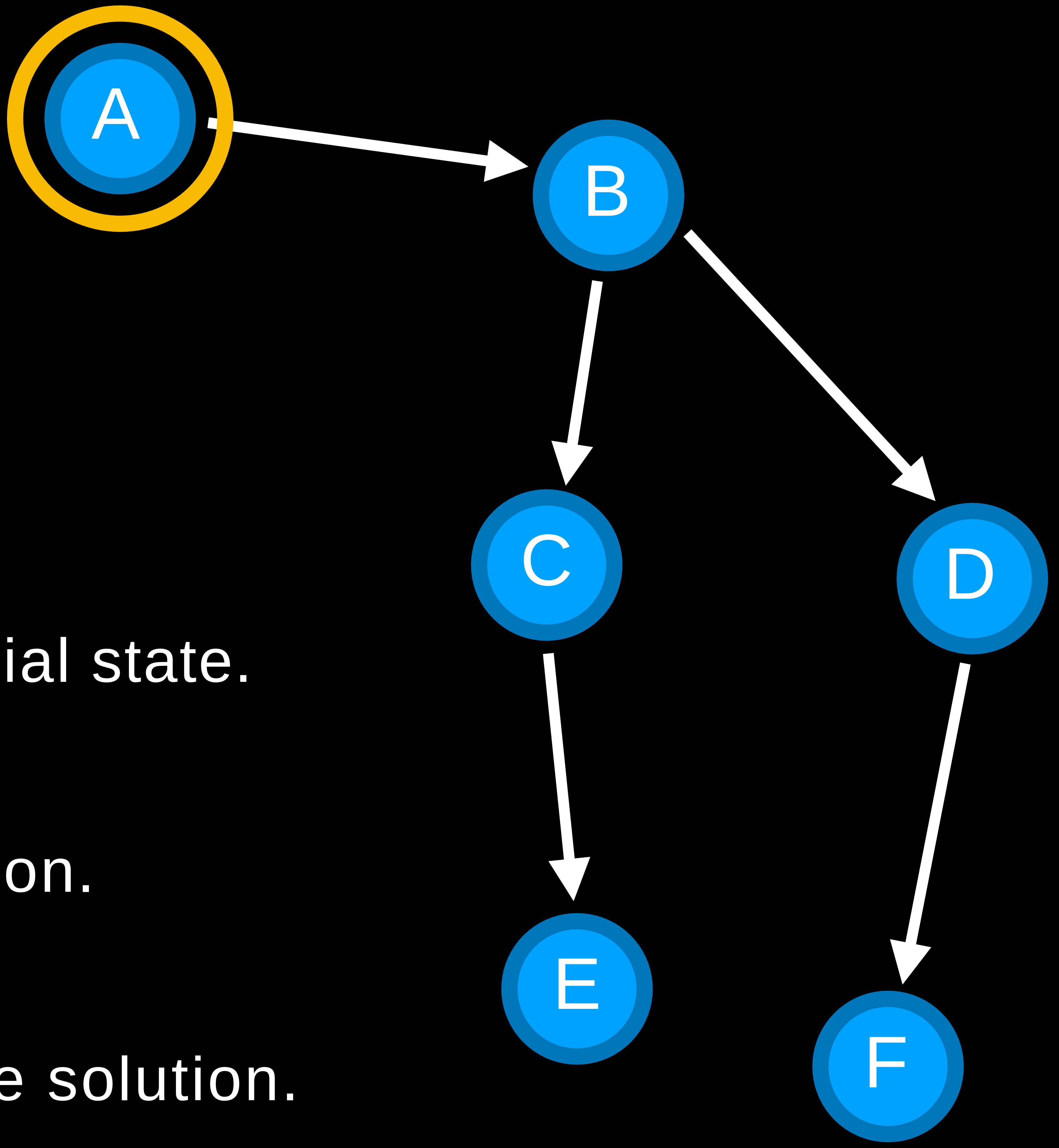

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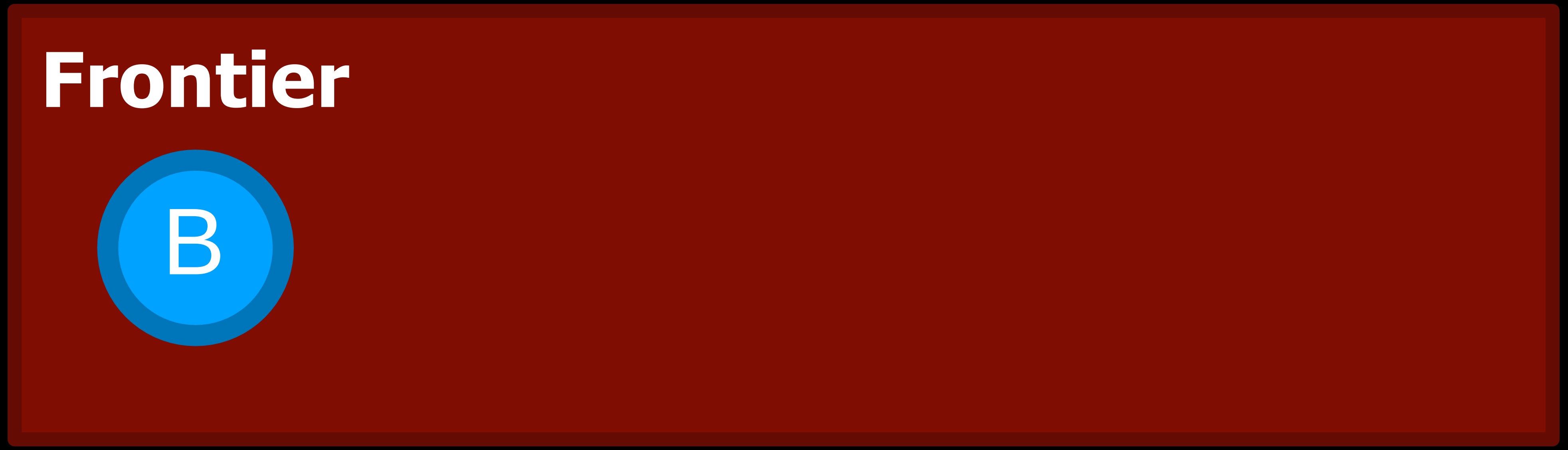

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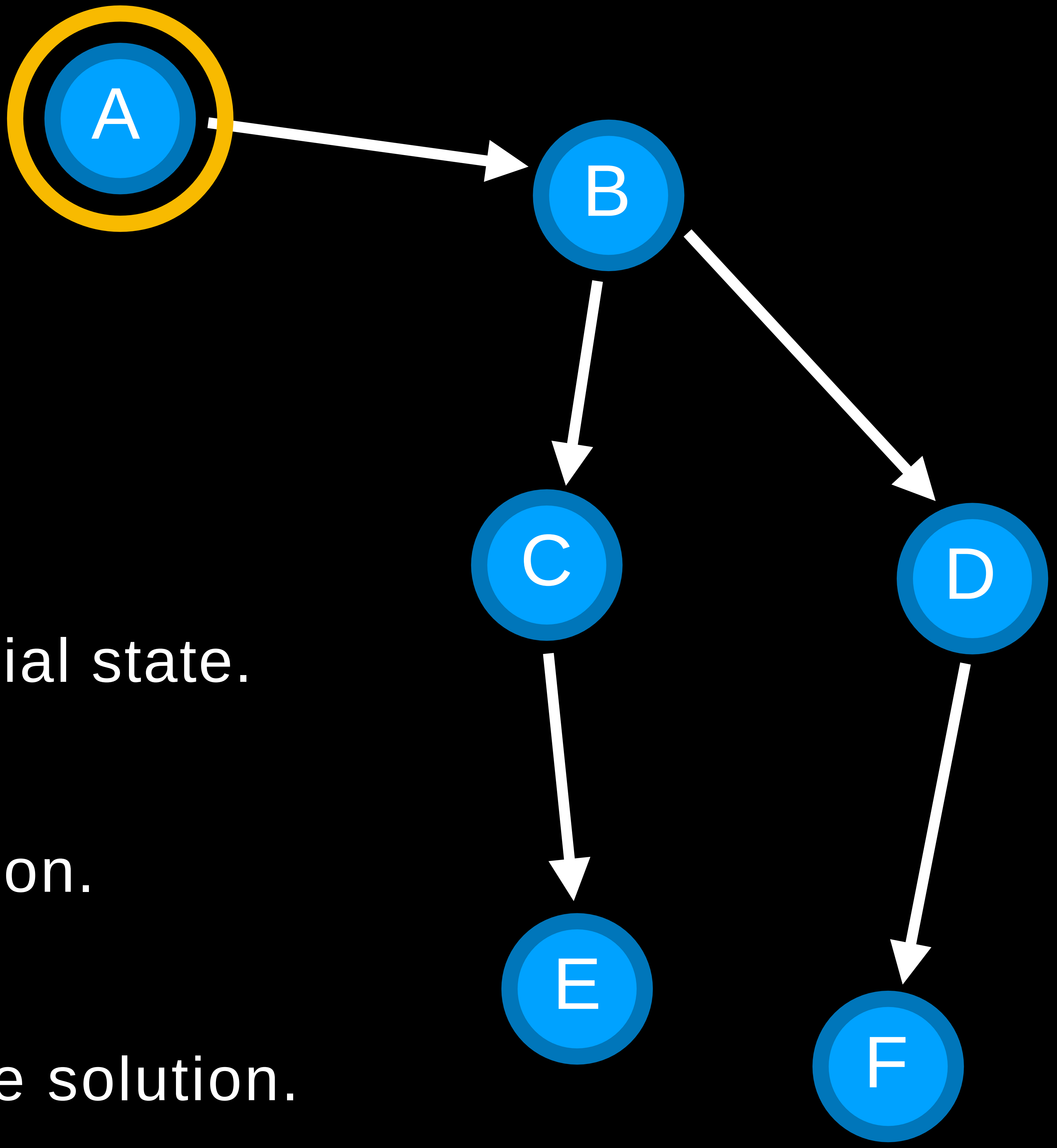

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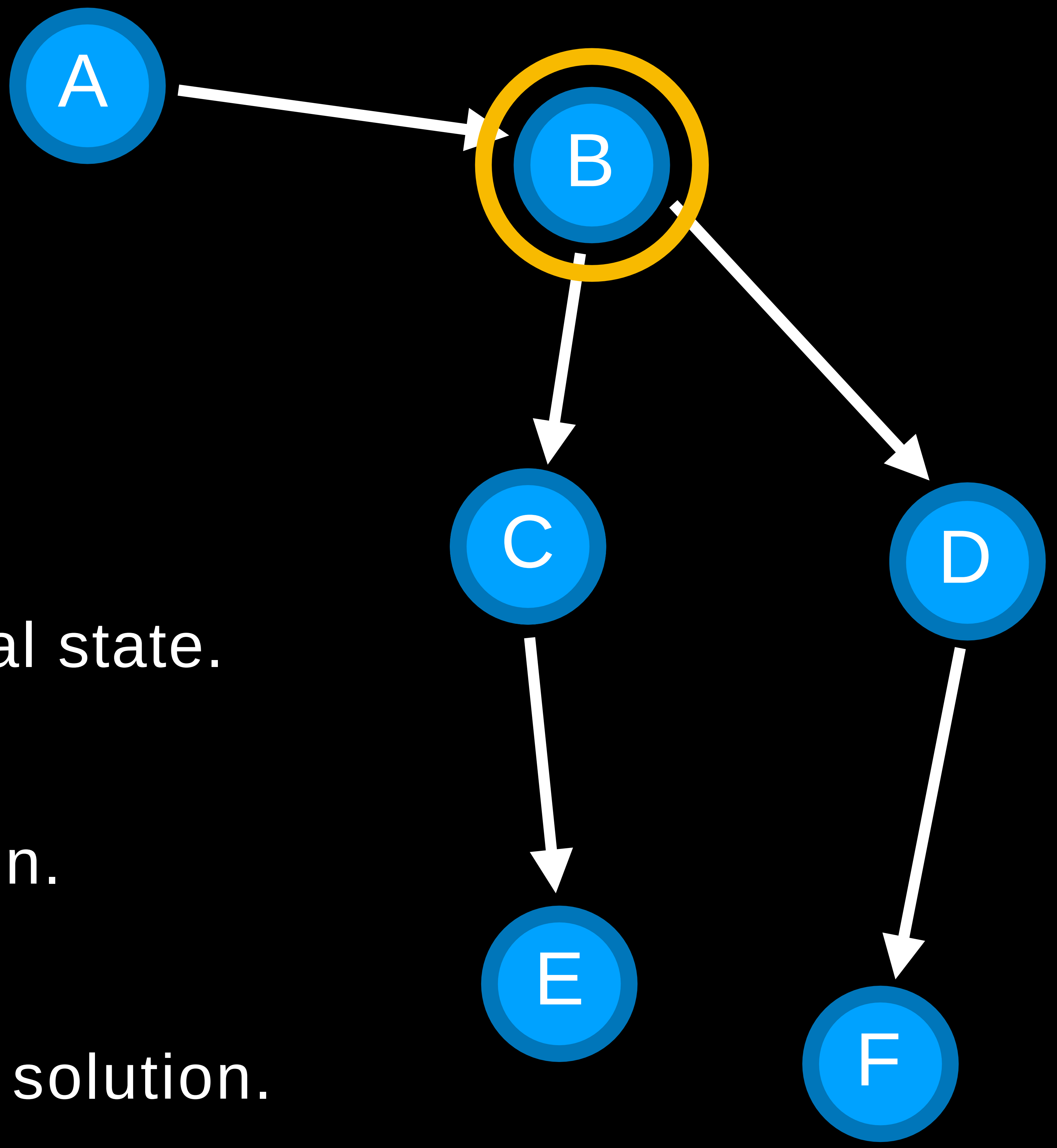

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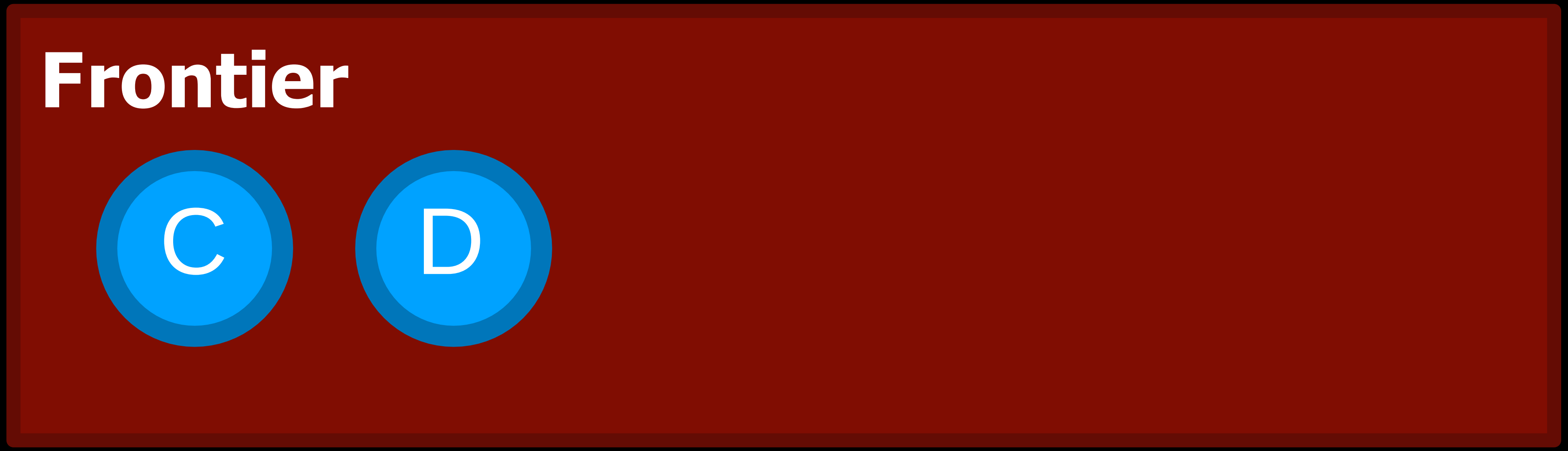

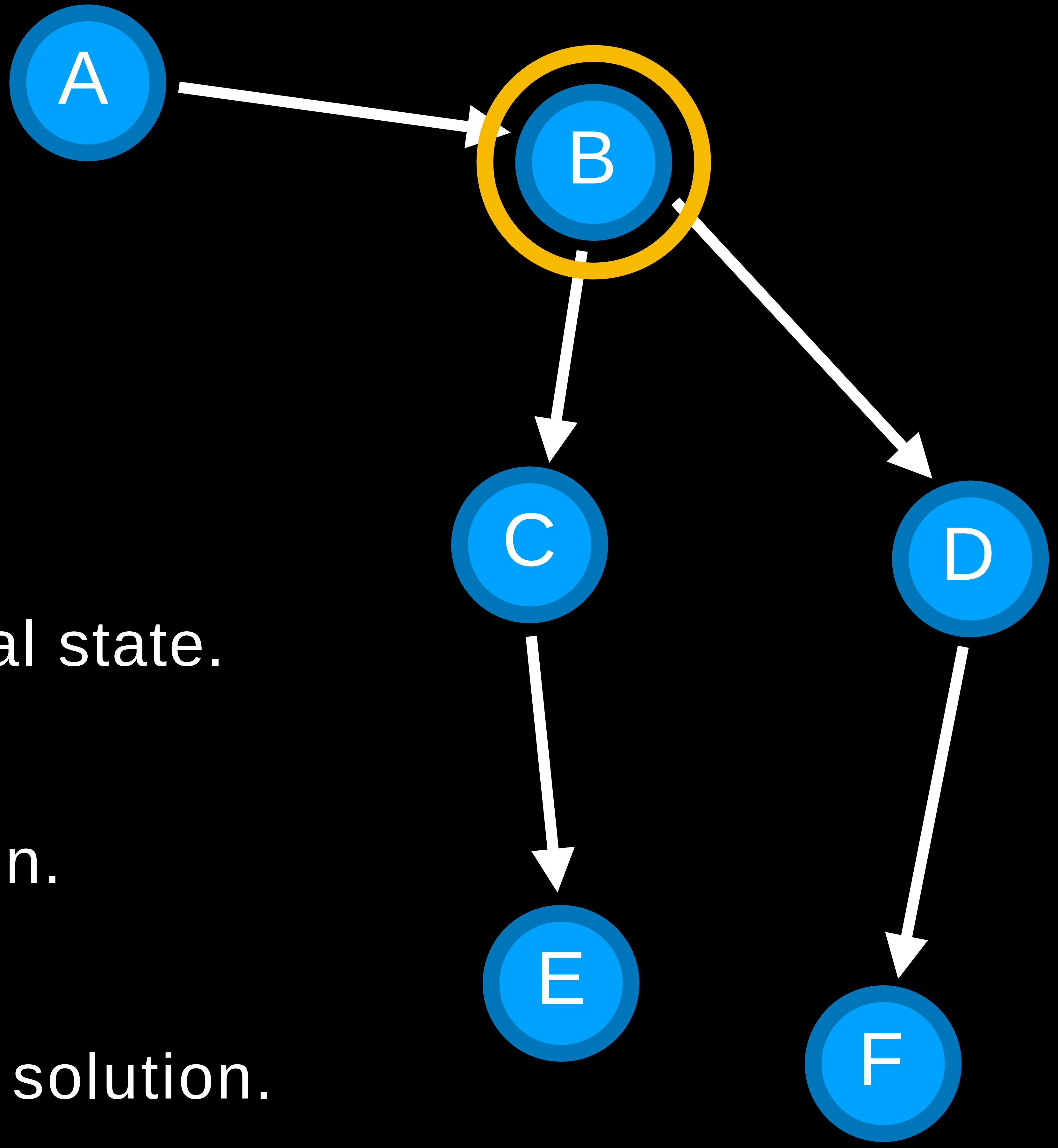

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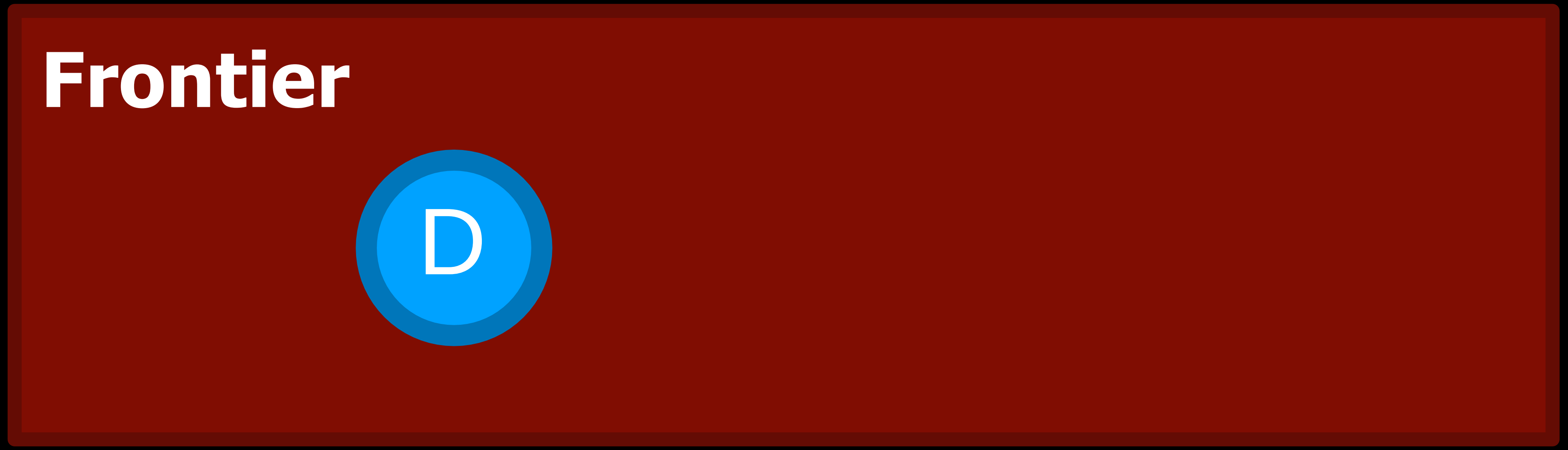

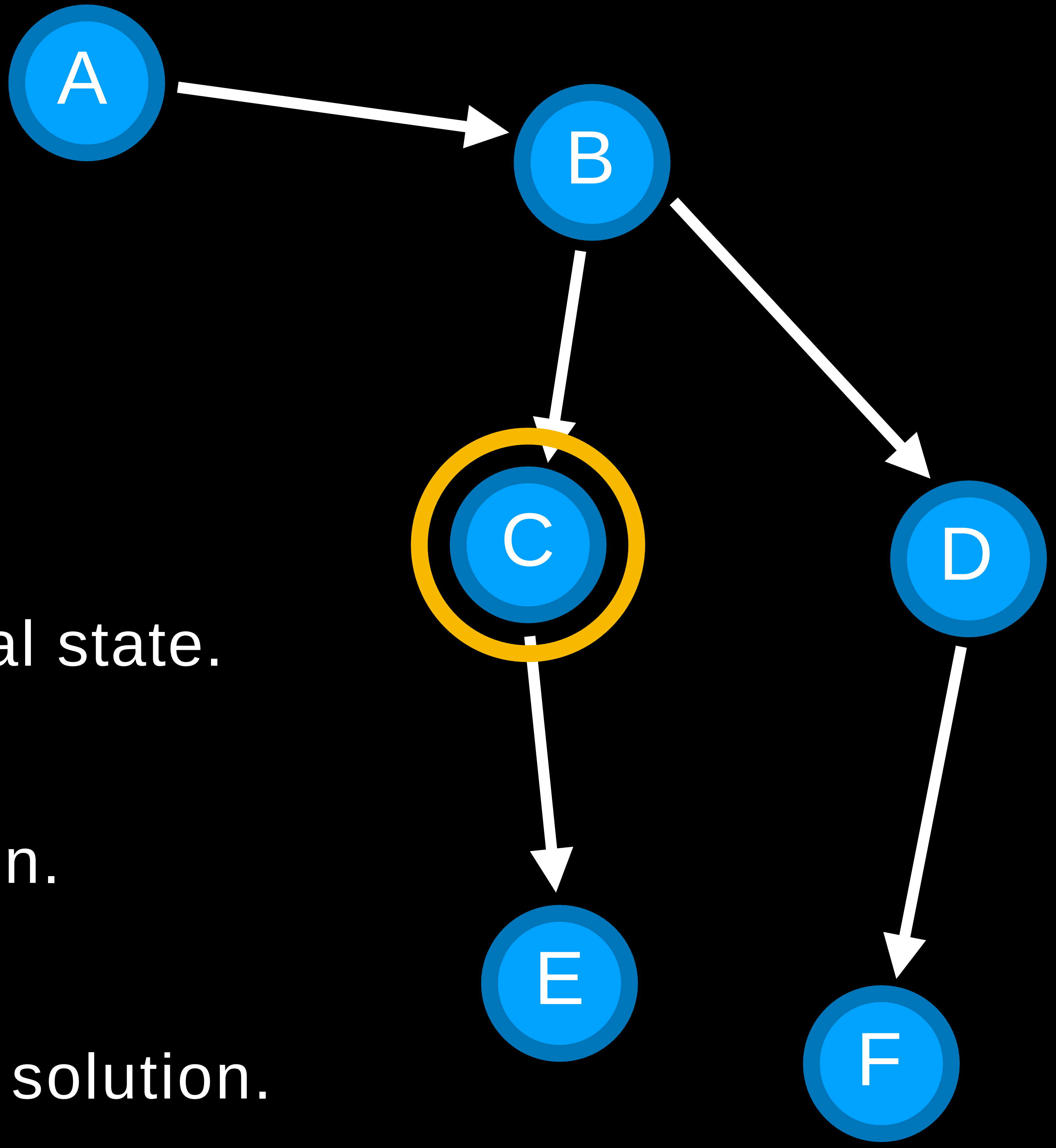

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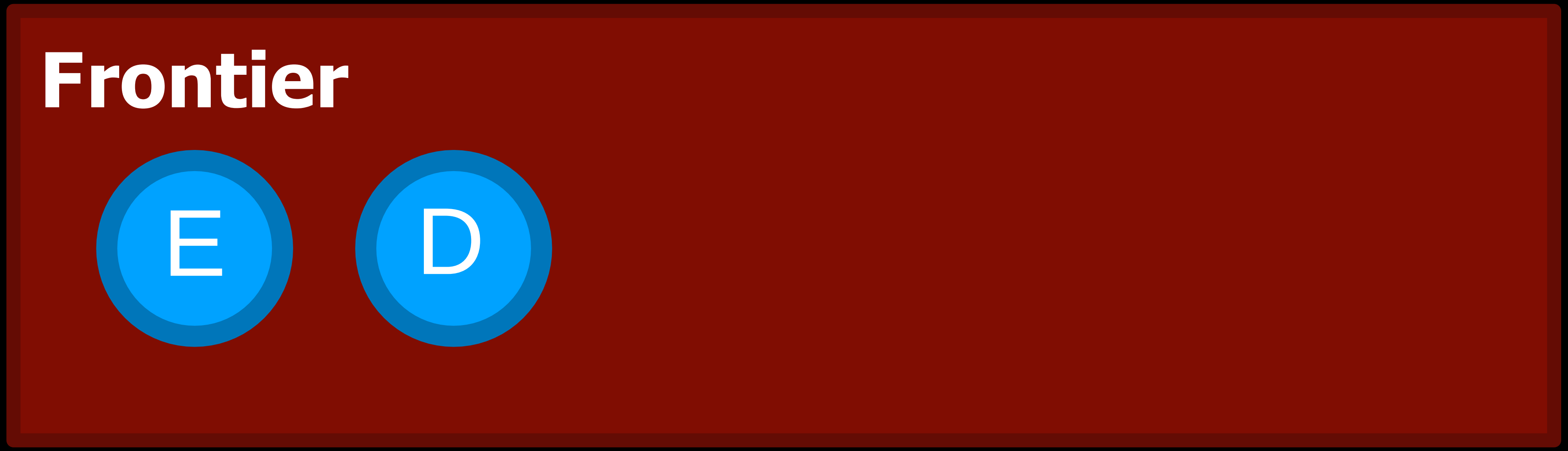
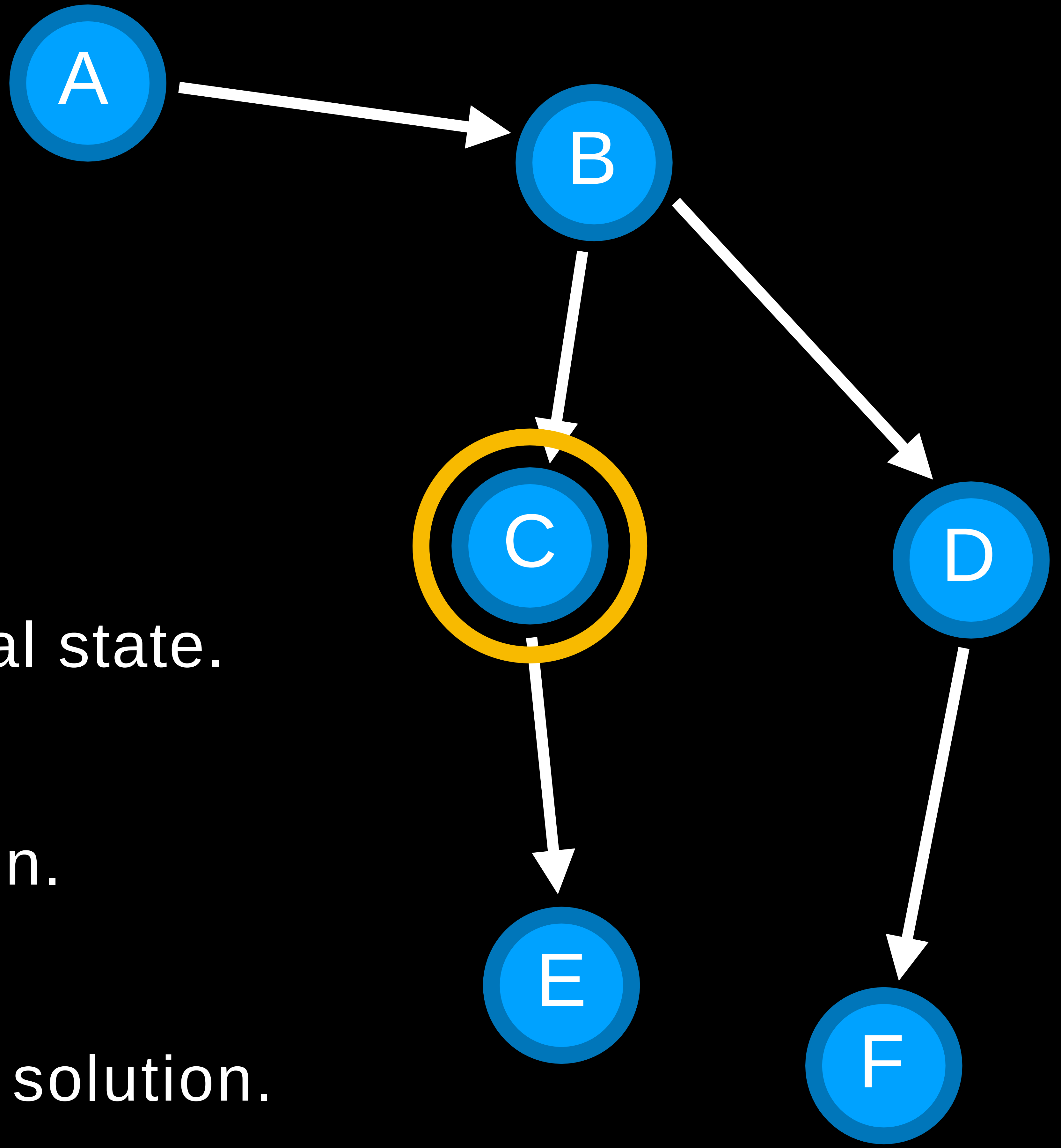

Frontier



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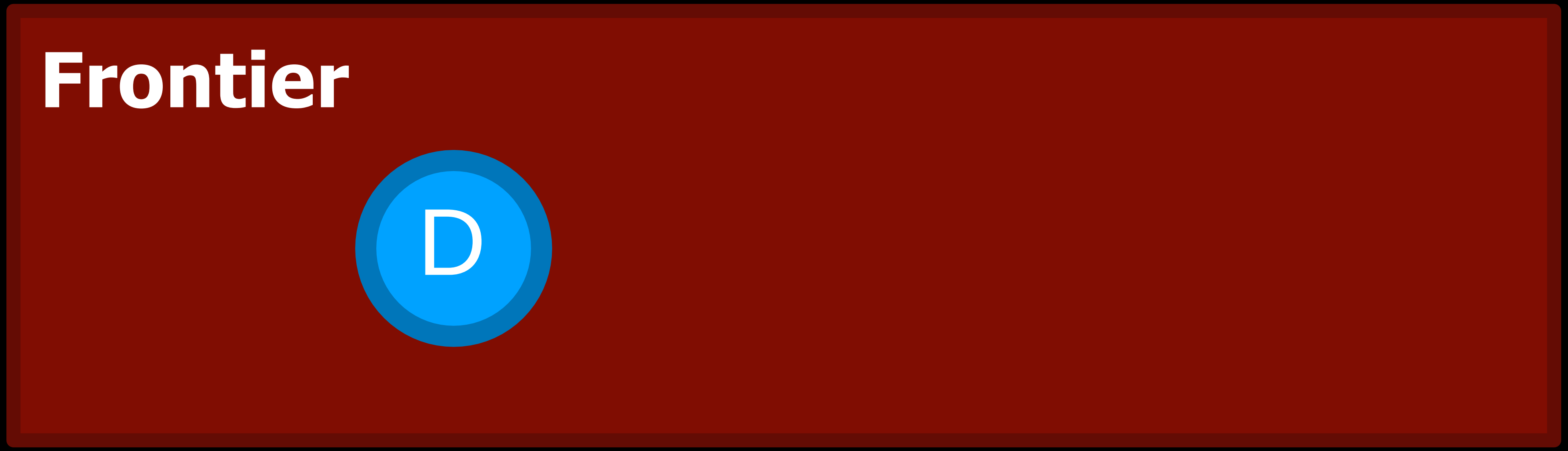

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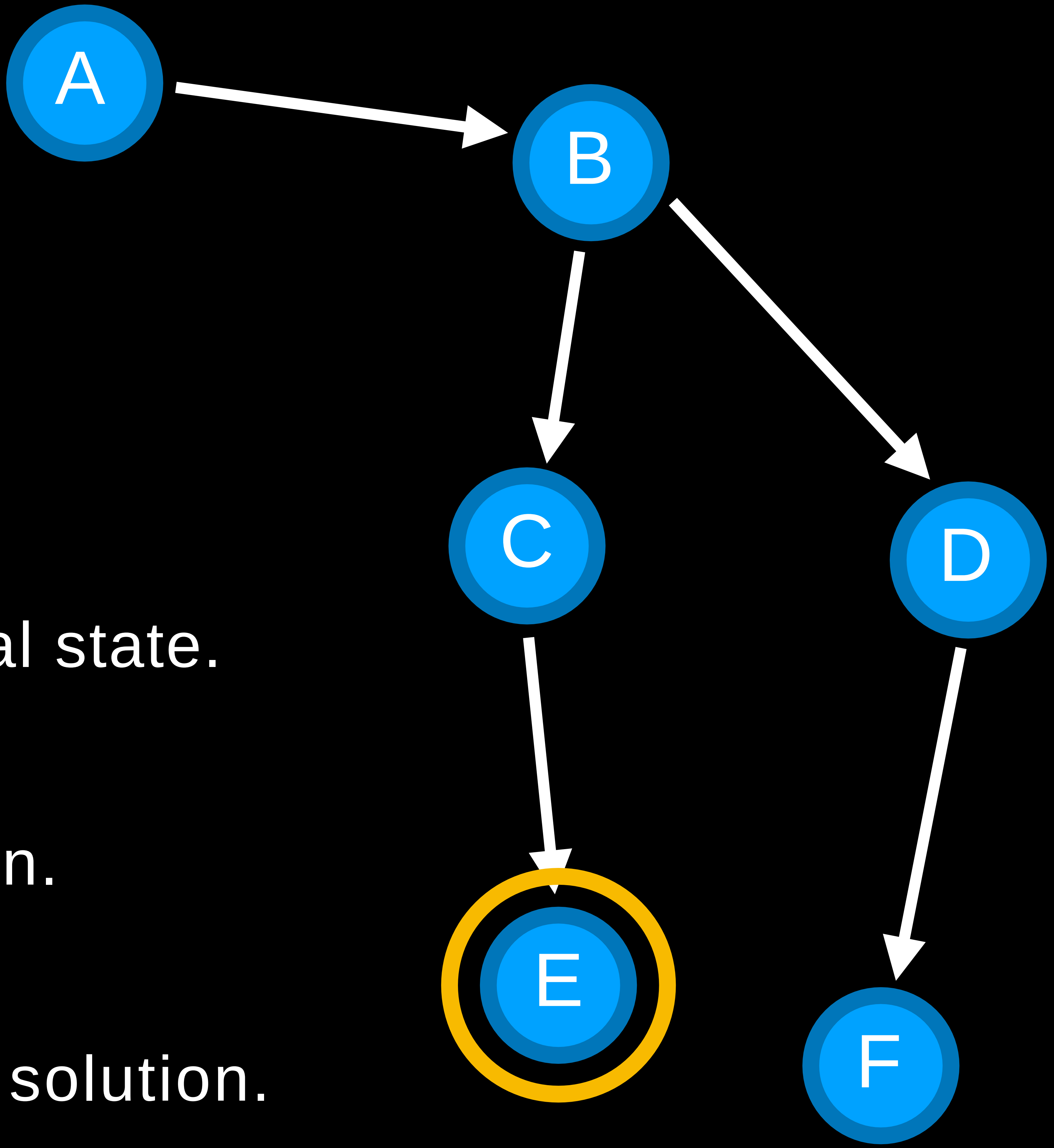

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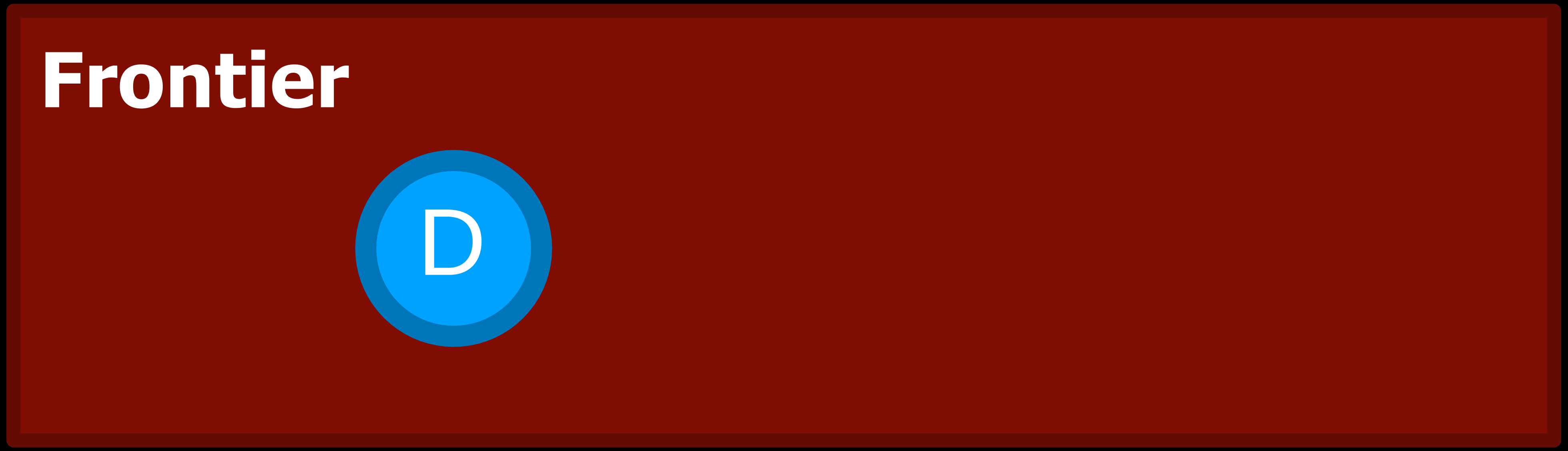

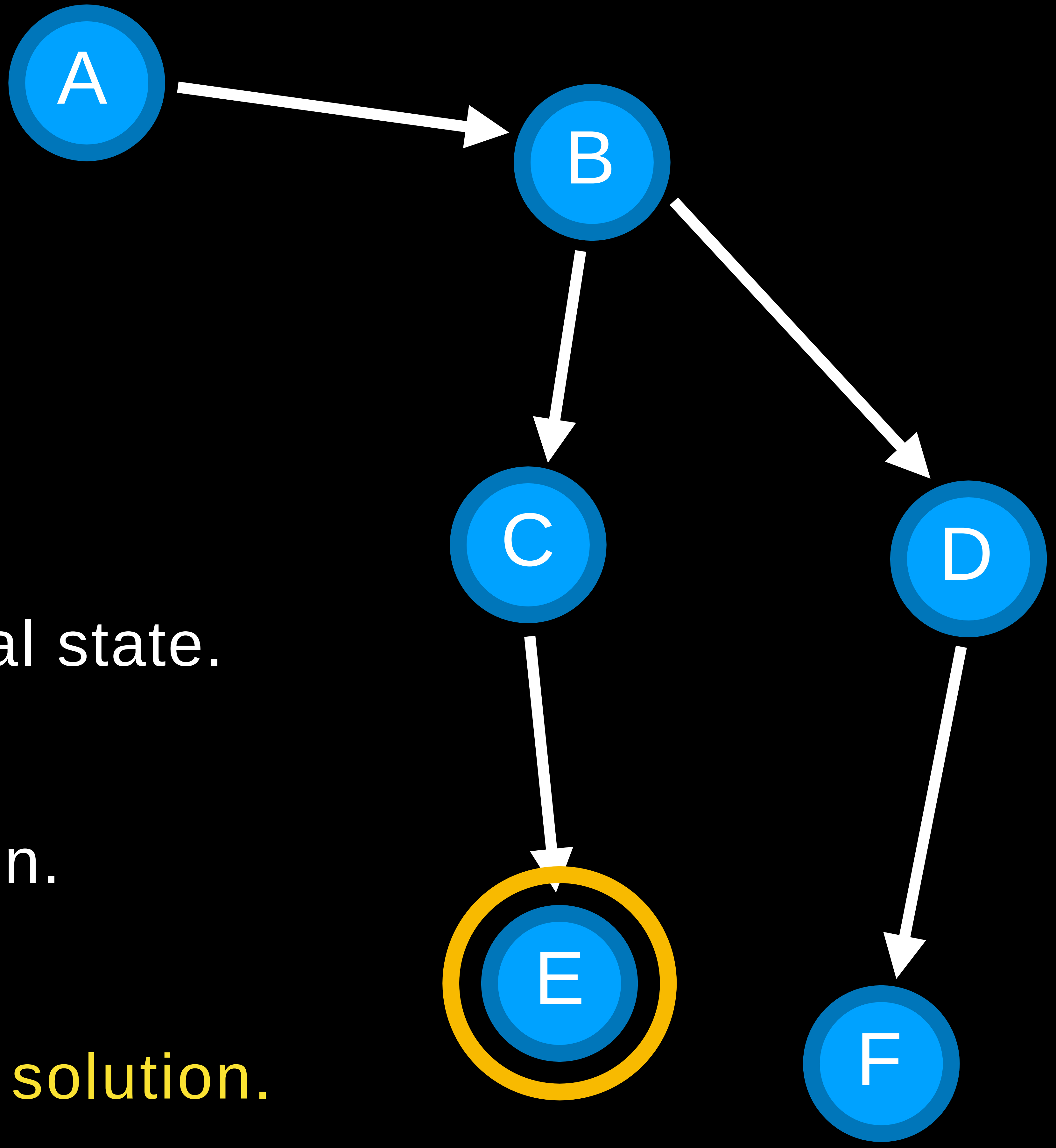

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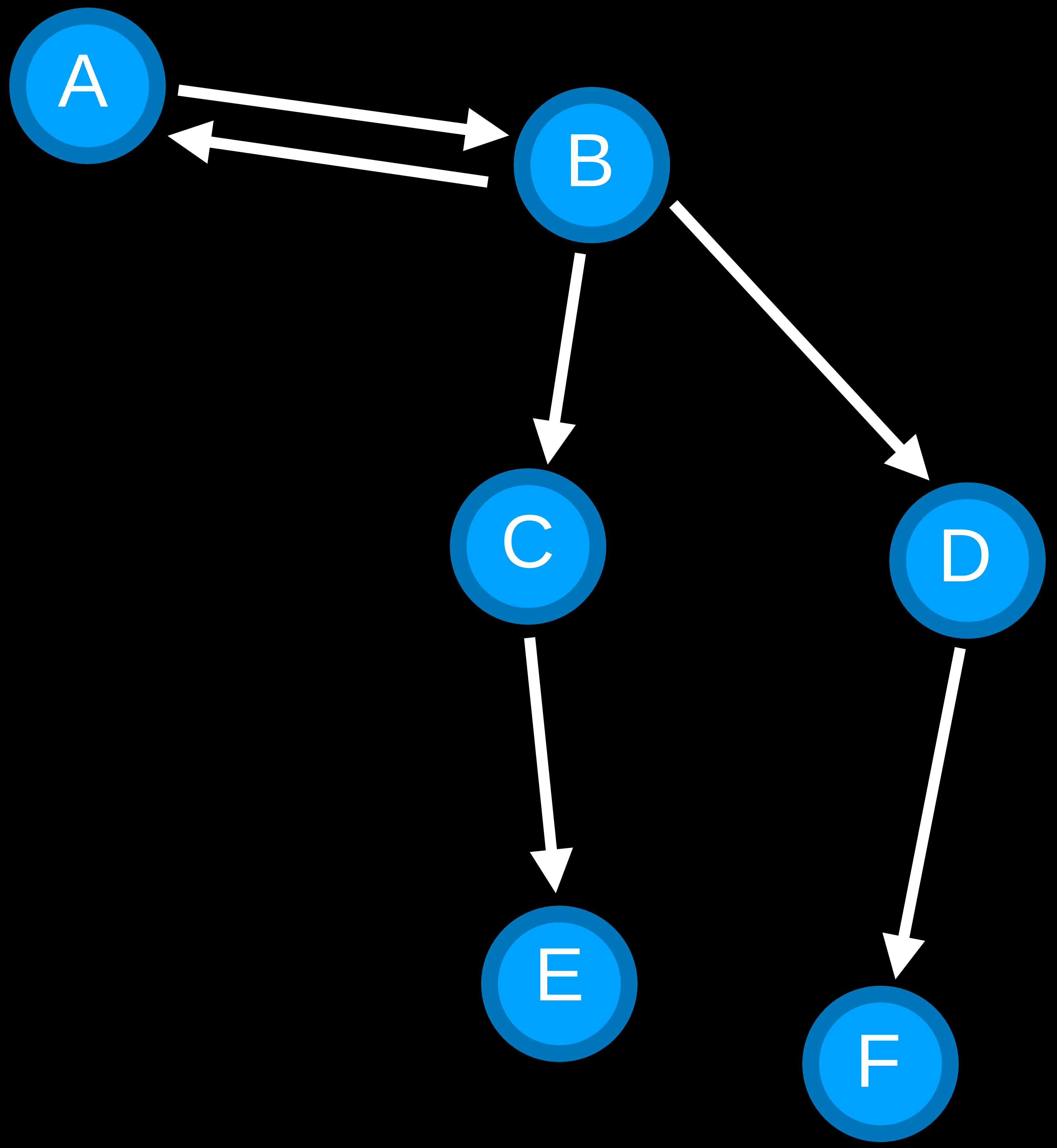
# What could go wrong?

Find a path from A to E.

Frontier



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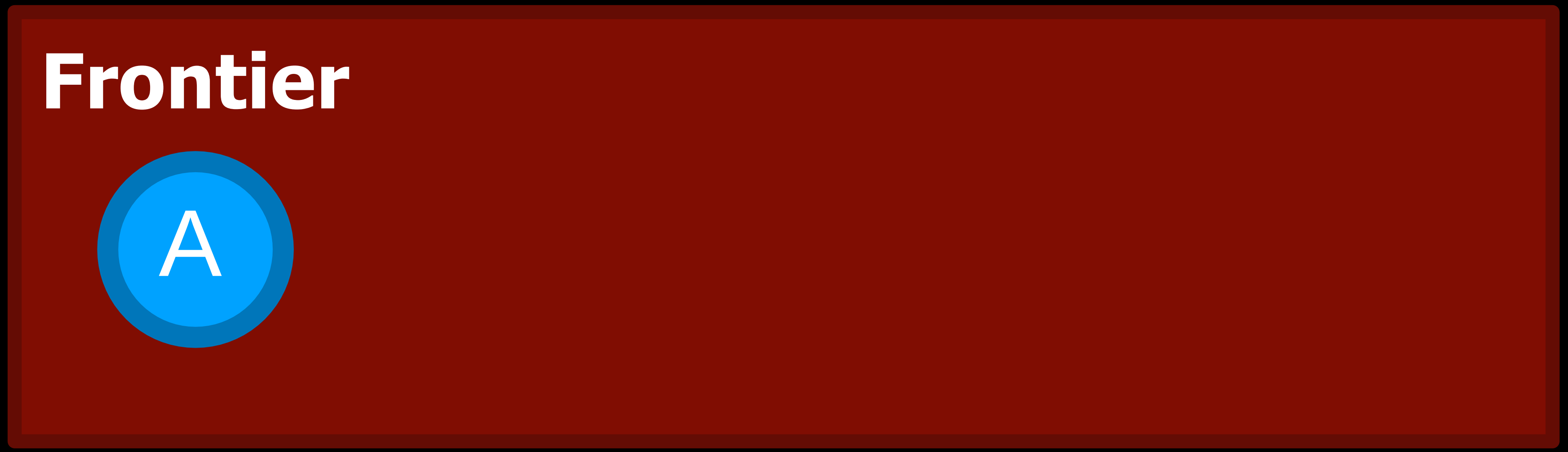
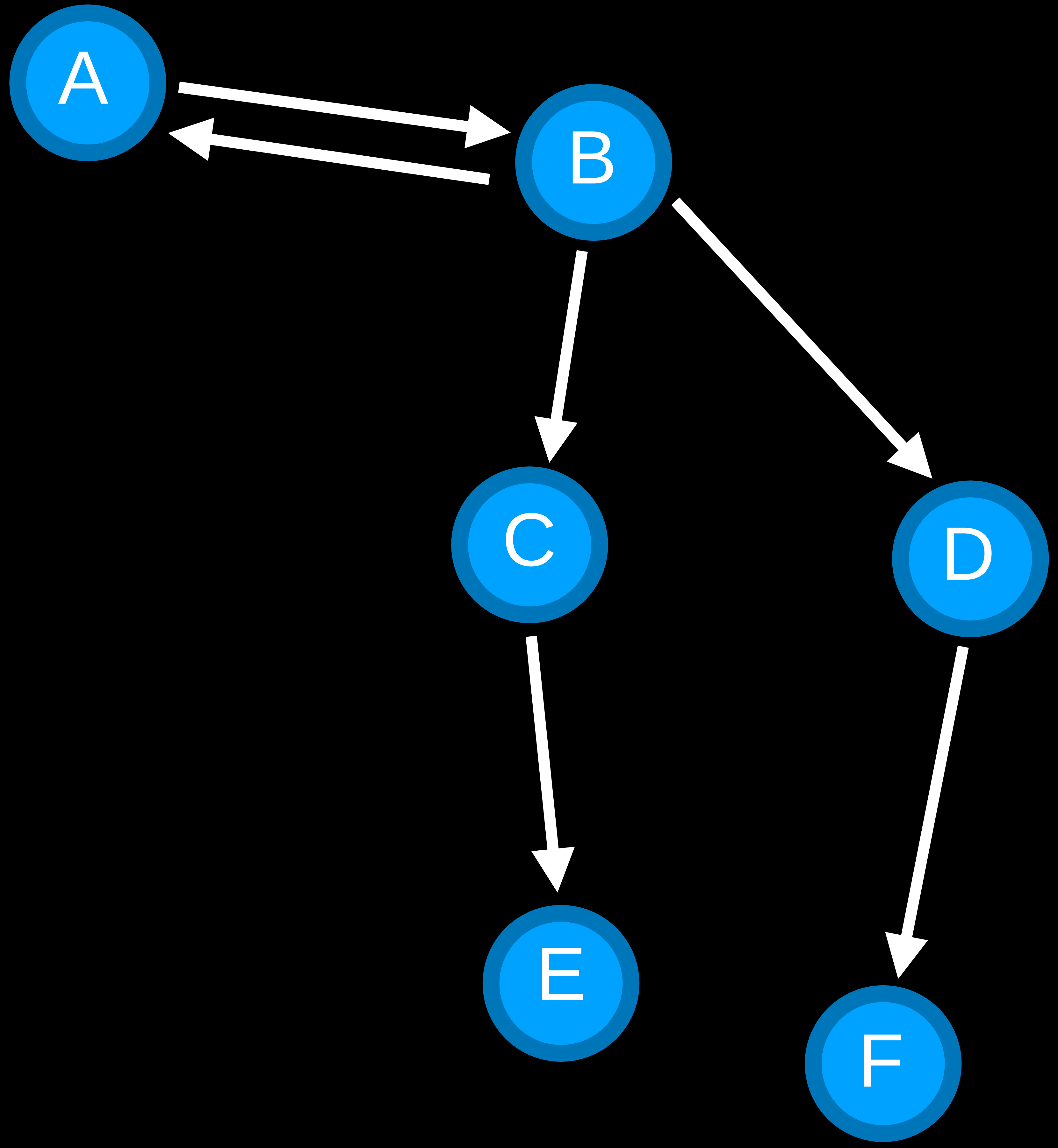
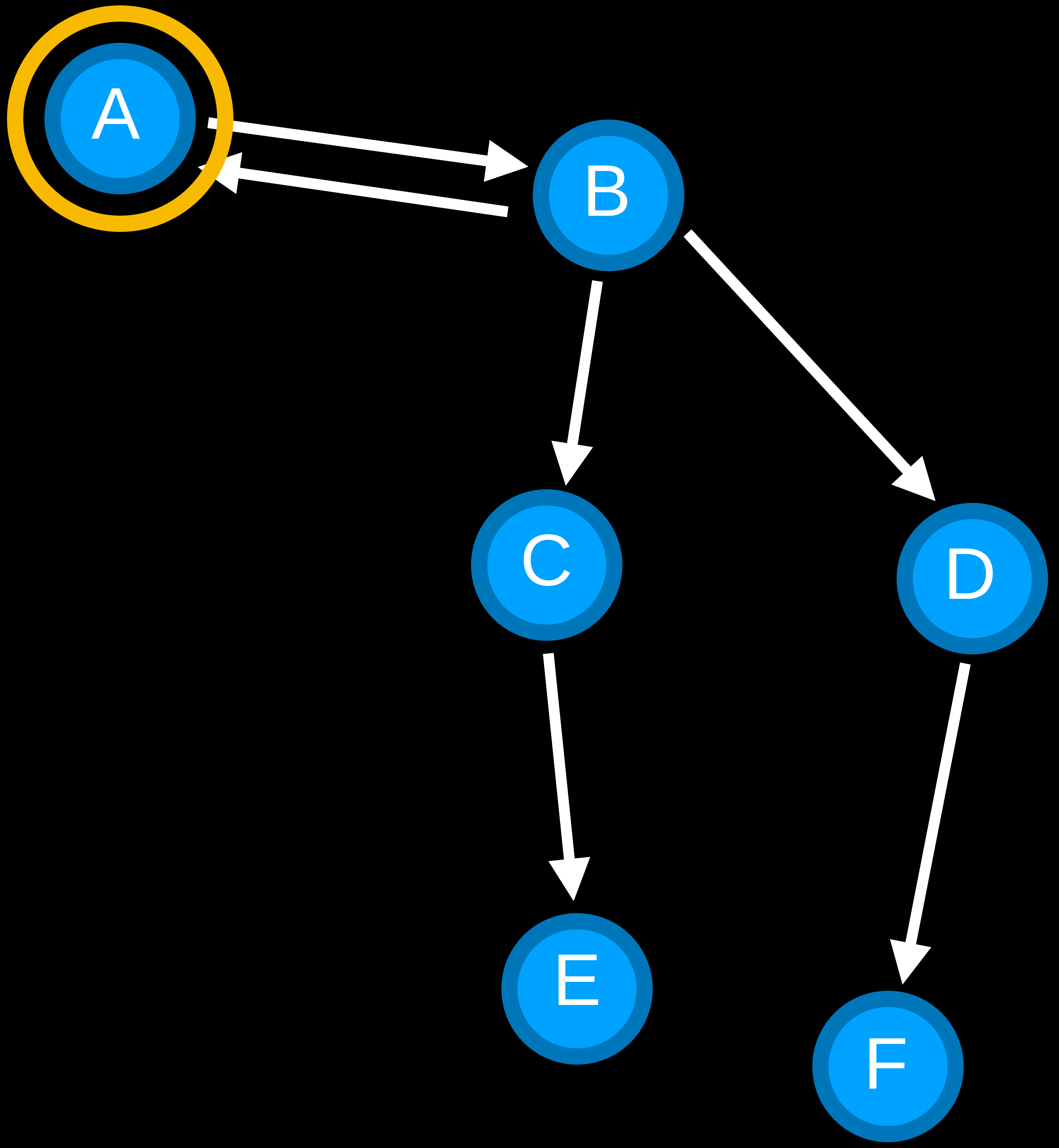




# Find a path from A to E.

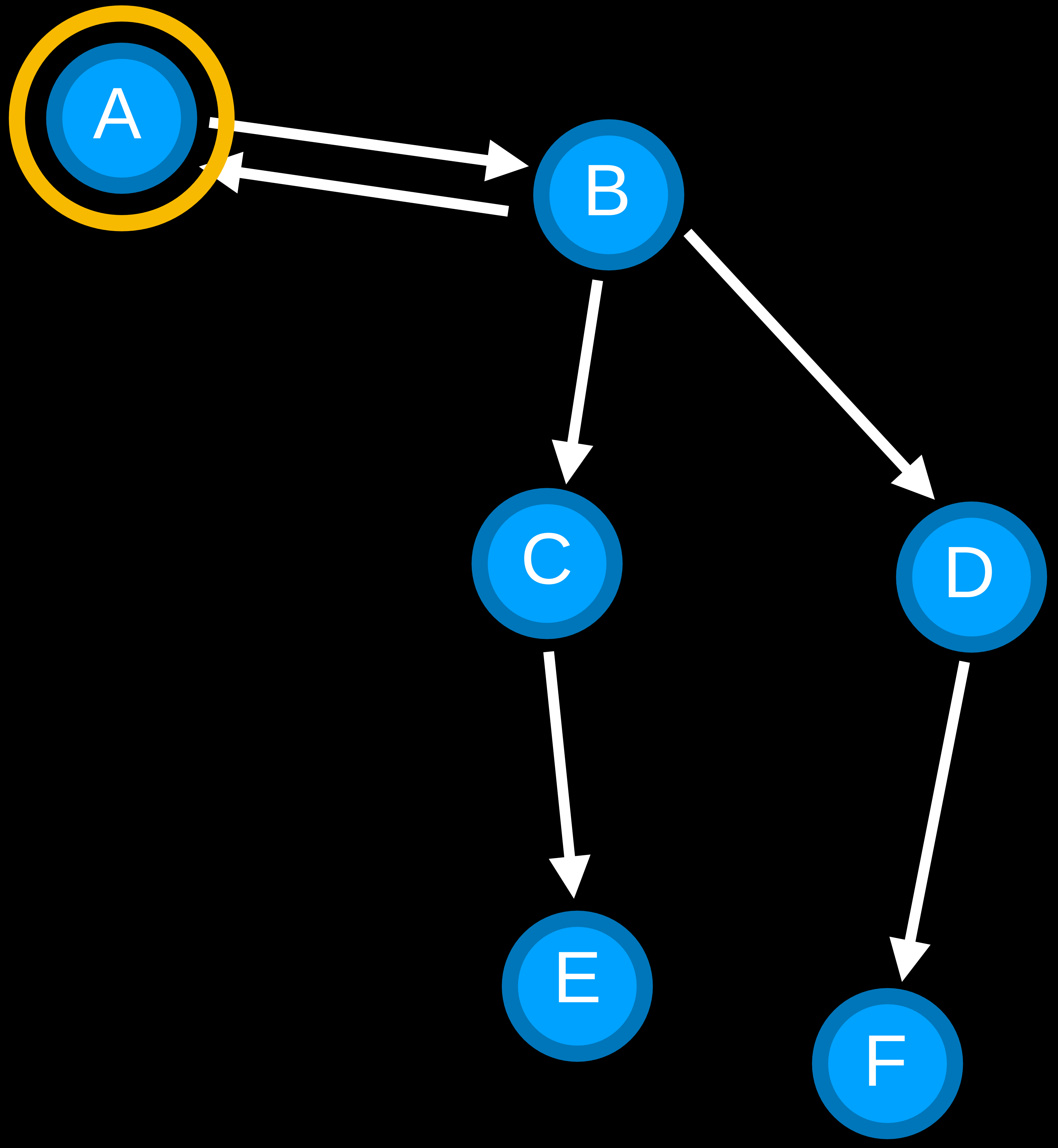
**Frontier**



# Find a path from A to E.

**Frontier**

B



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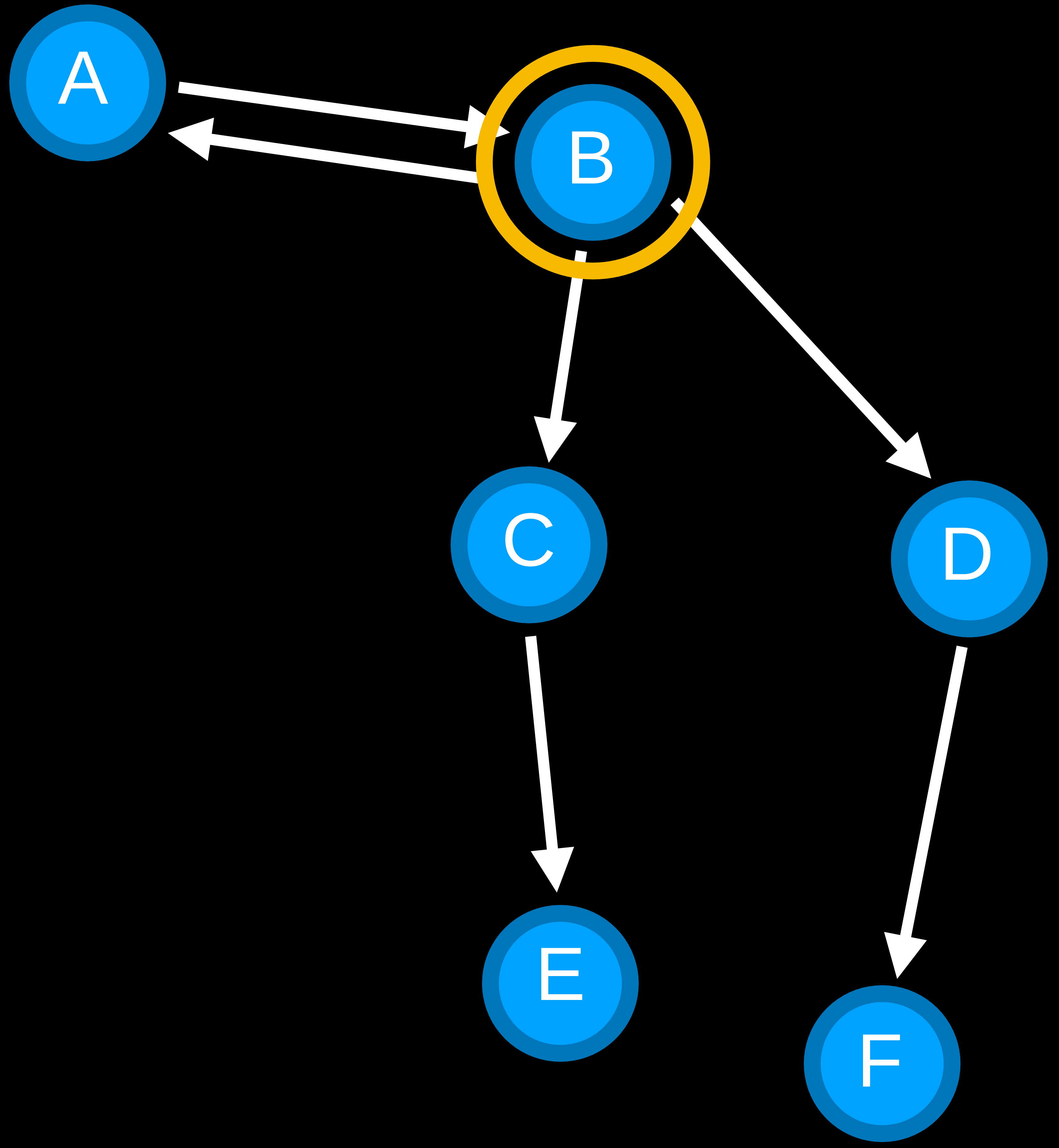

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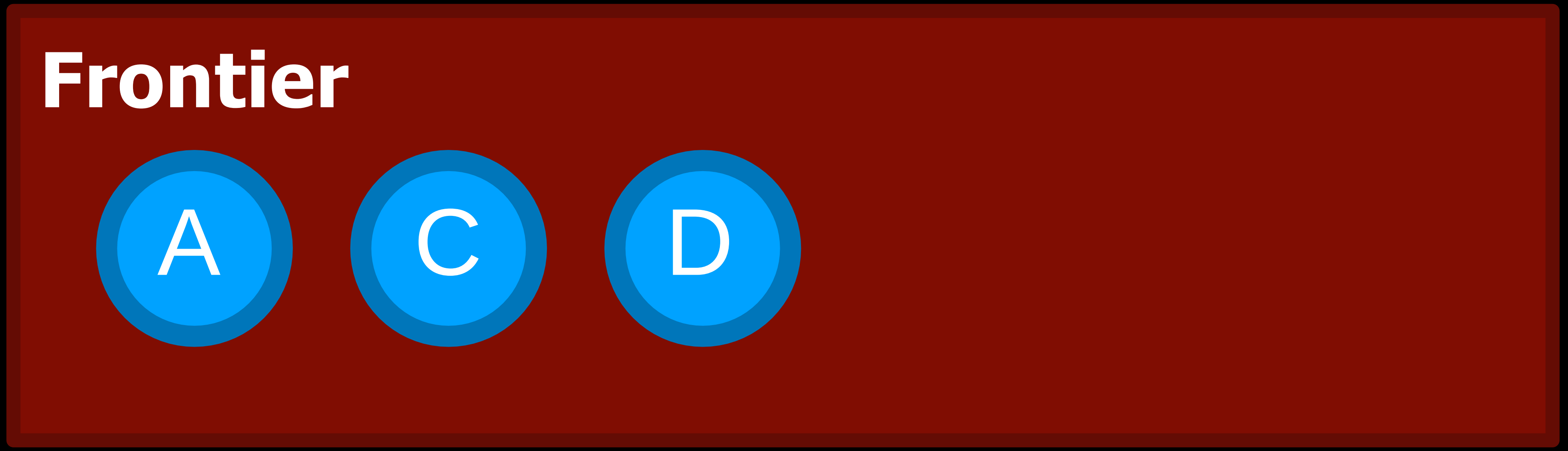
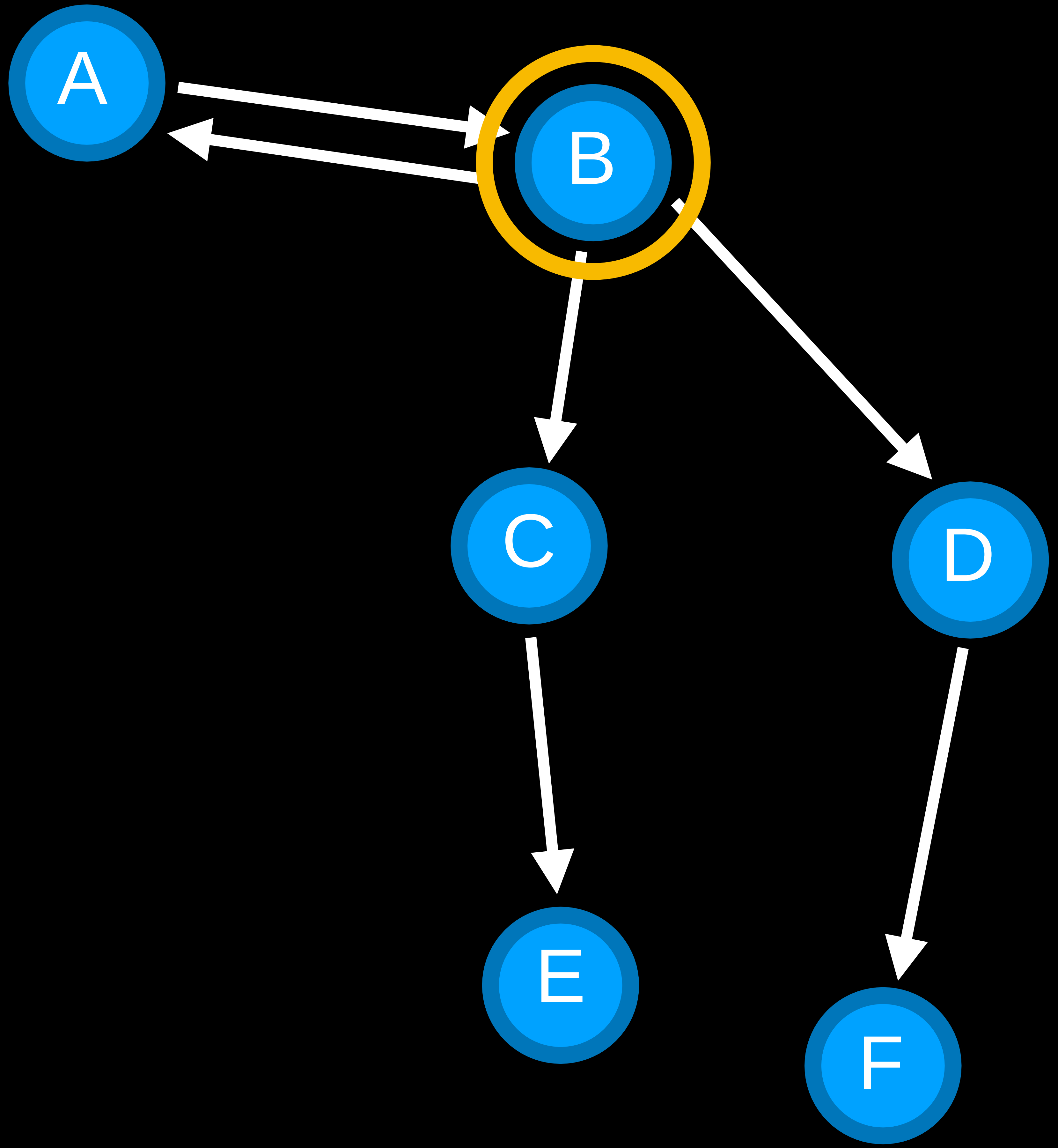


Frontier

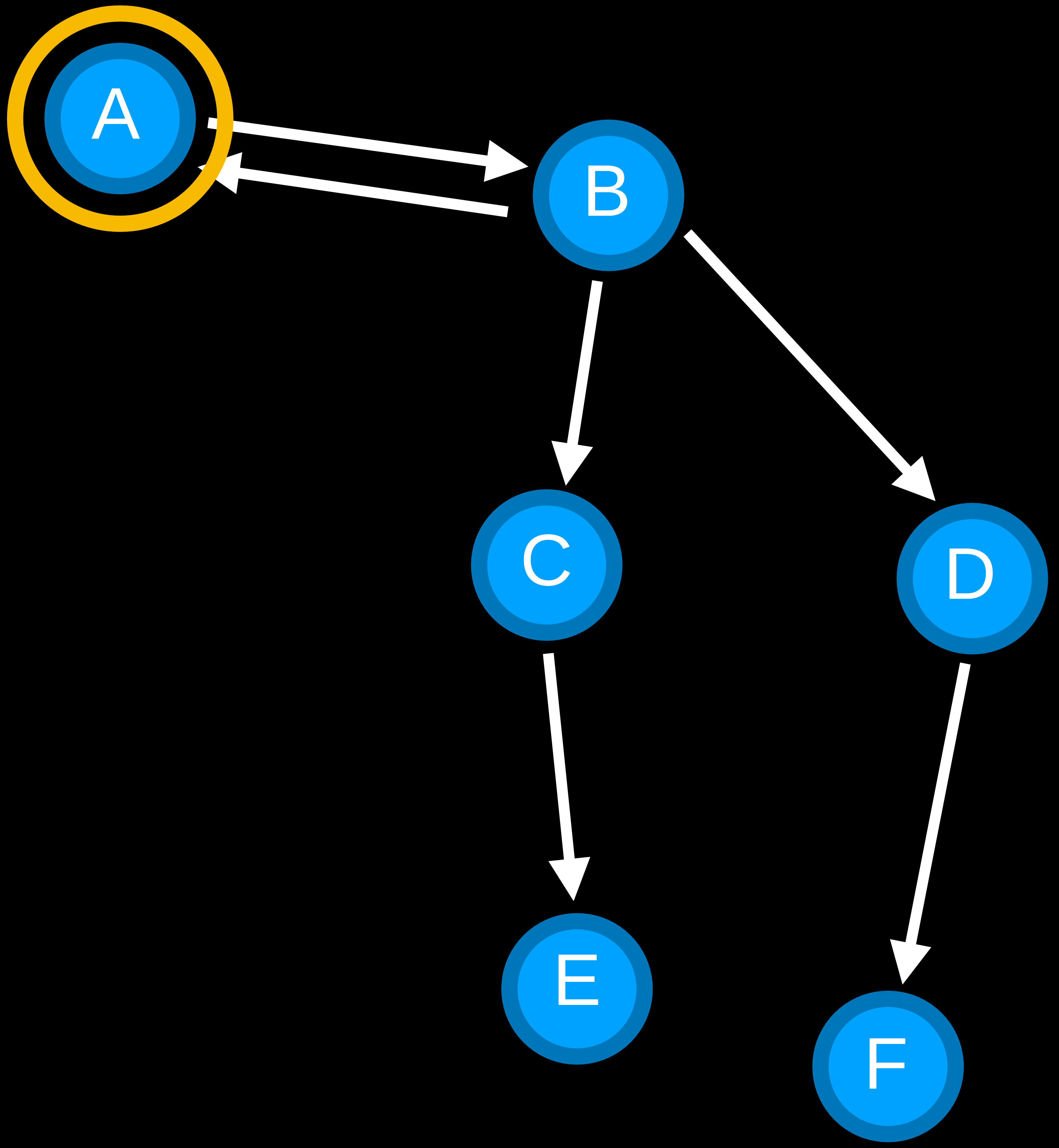
A C D



Find a path from A to E.

**Frontier**

C D



# Revised Approach

- Start with a **frontier** that contains the initial state.
- Start with an empty **explored set**.
- Repeat:
    - If the frontier is empty, then no solution.
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    - If node contains goal state, return the solution.
    - Add the node to the explored set.
    - **Expand** node, add resulting nodes to the frontier if they aren't already in the frontier or the explored set.

# Revised Approach

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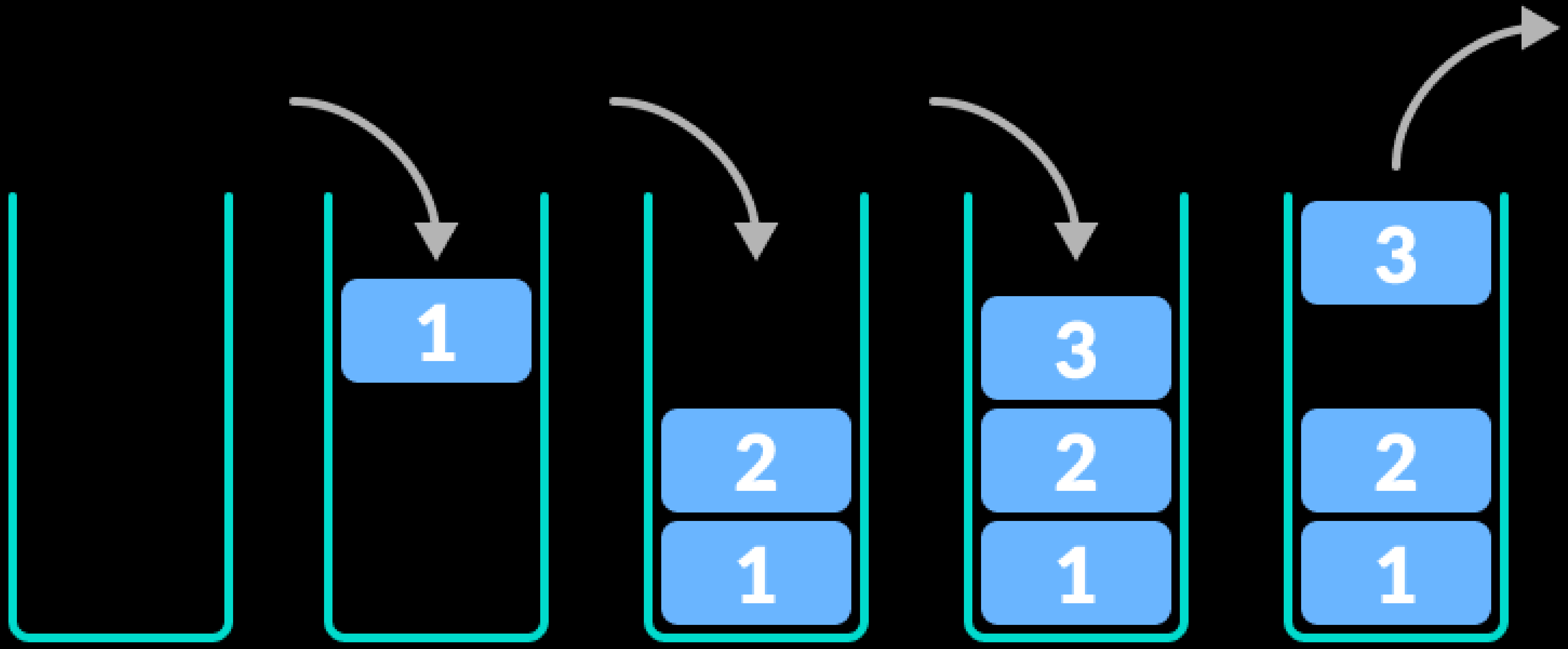
# stack

last-in first-out data type



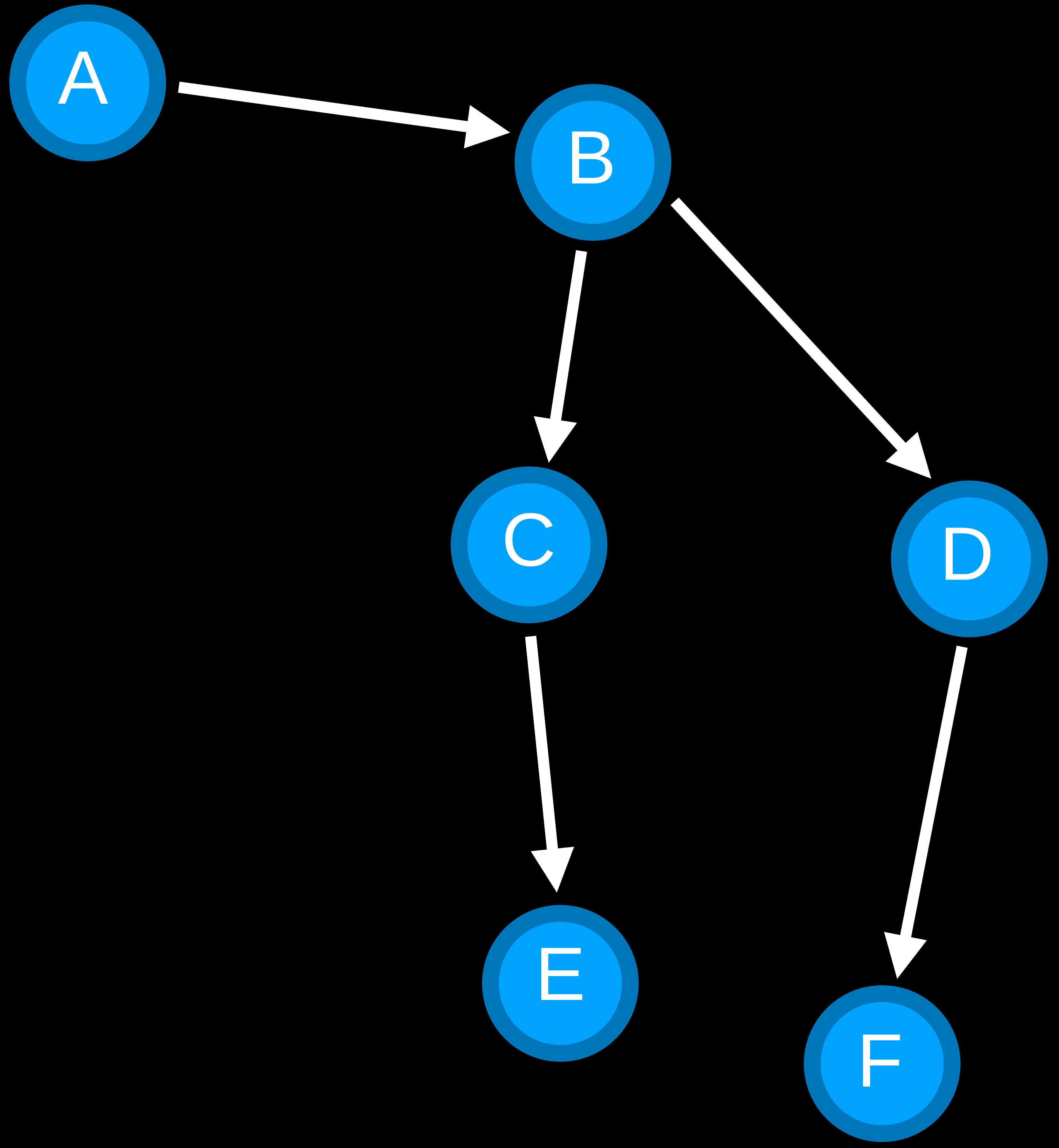
push

pop

Find a path from A to E.

**Frontier**

**Explored Set**

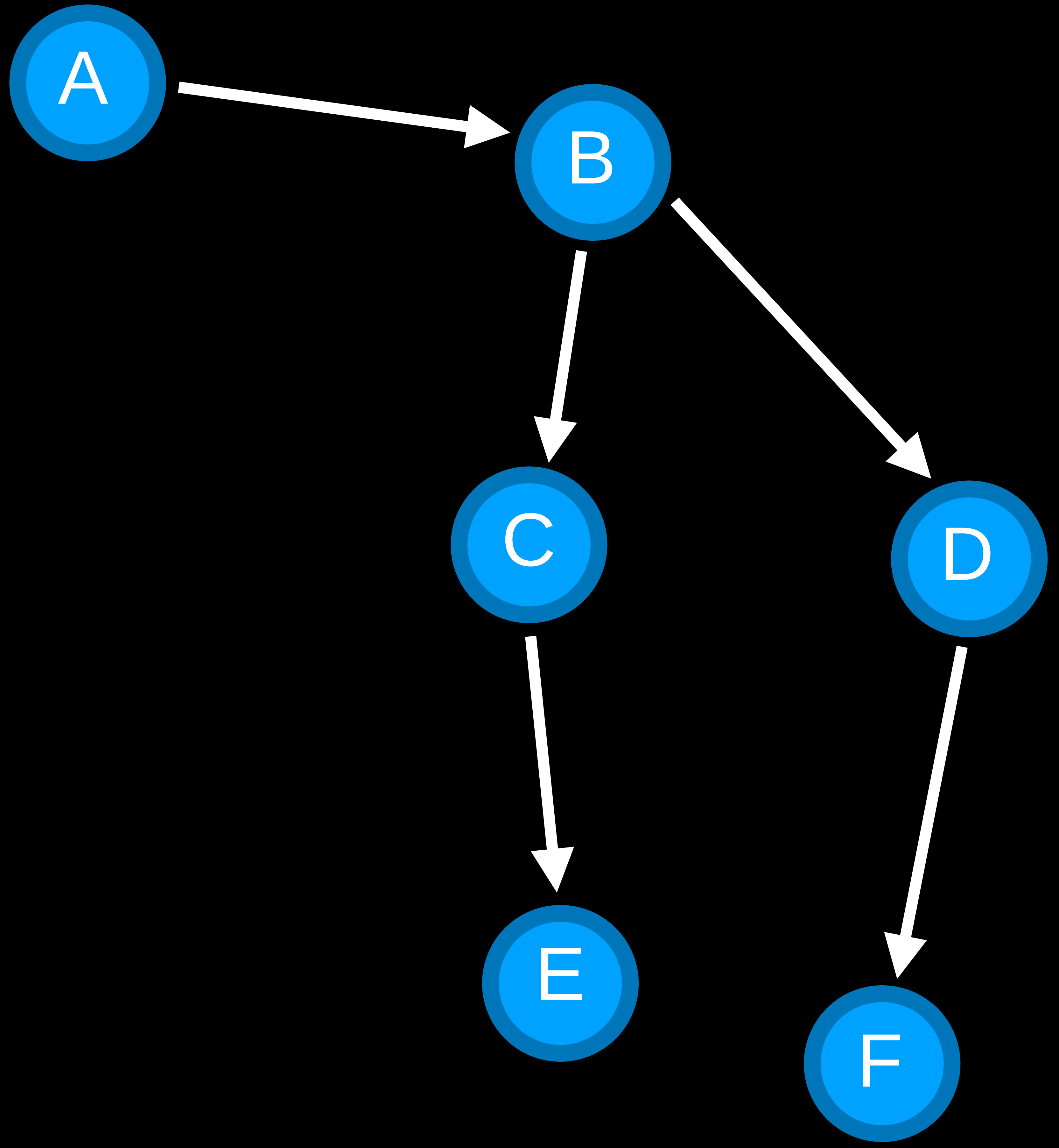


## Find a path from A to E.

**Frontier**

A

**Explored Set**

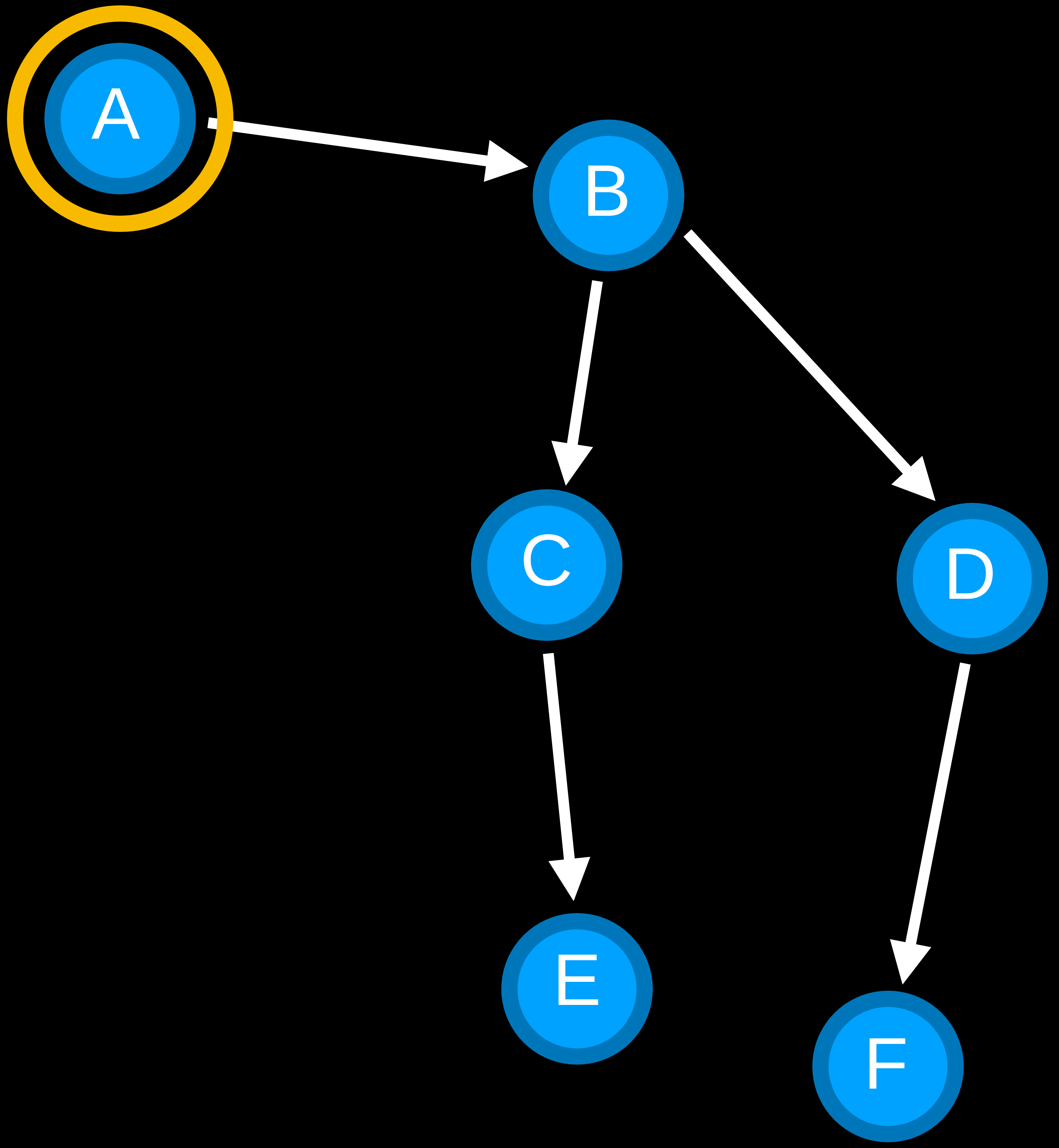


# Find a path from A to E.

**Frontier**

**Explored Set**

A



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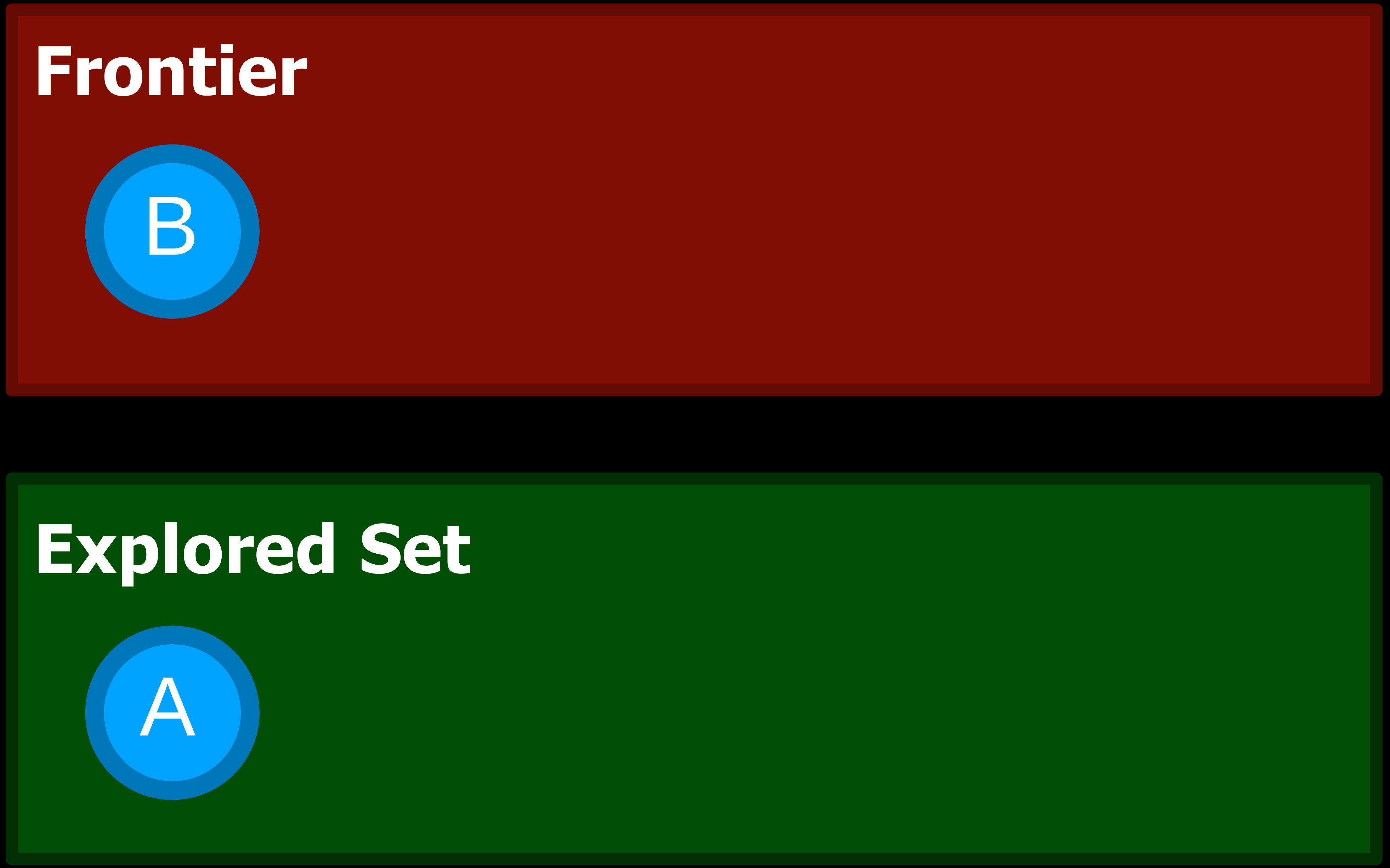
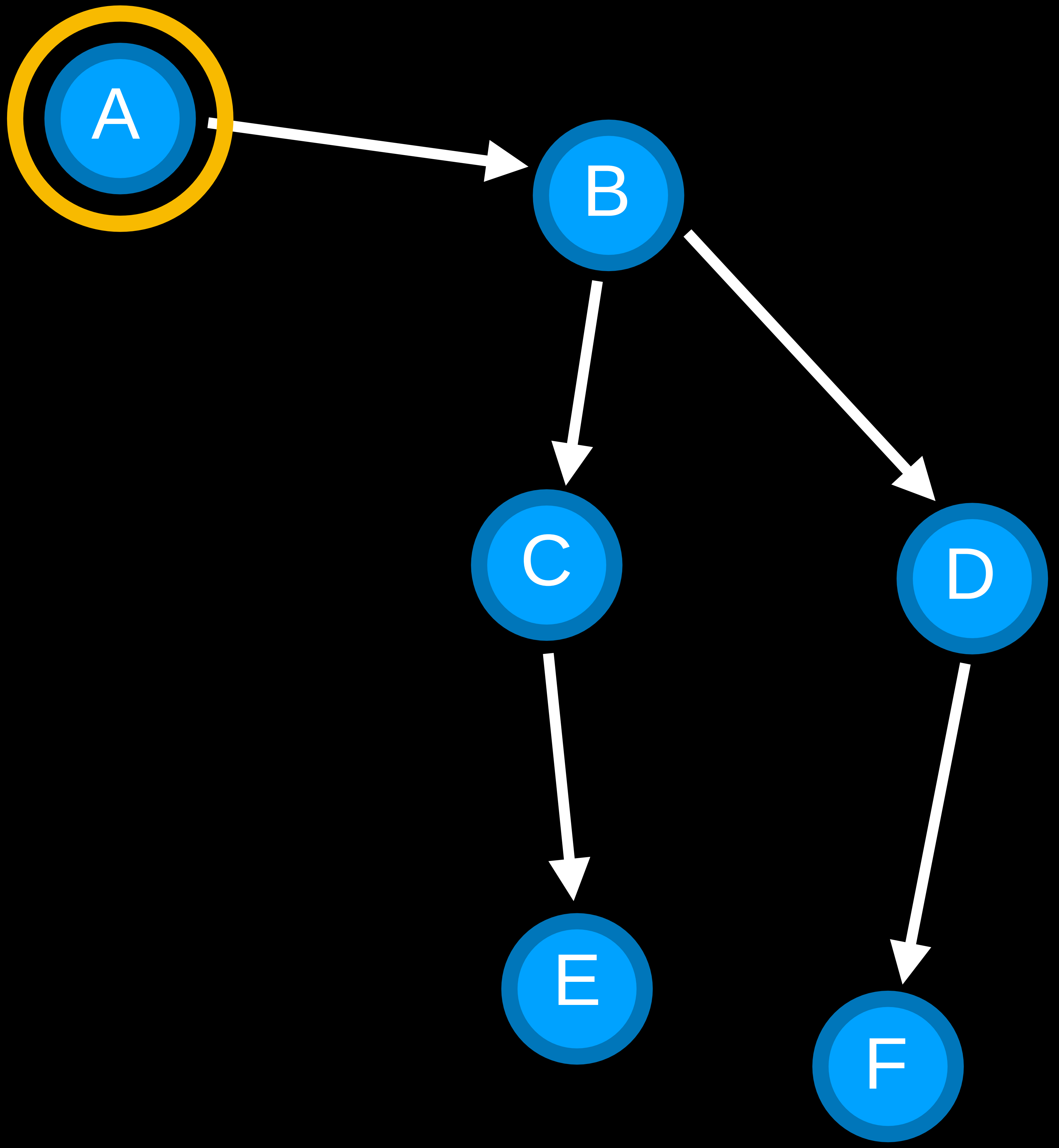


Frontier

Explored Set

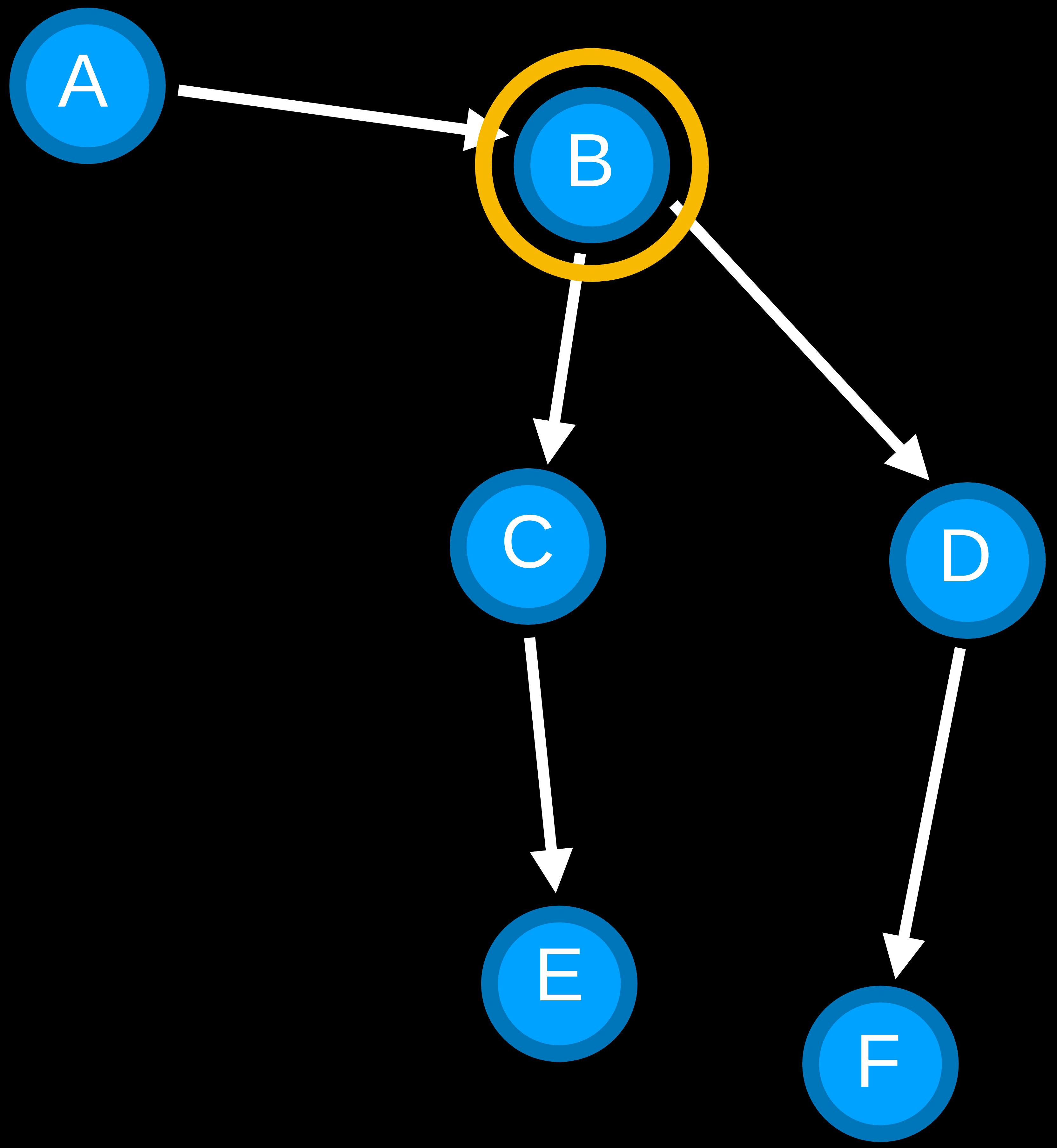


# Find a path from A to E.

## Frontier

## Explored Set

A B



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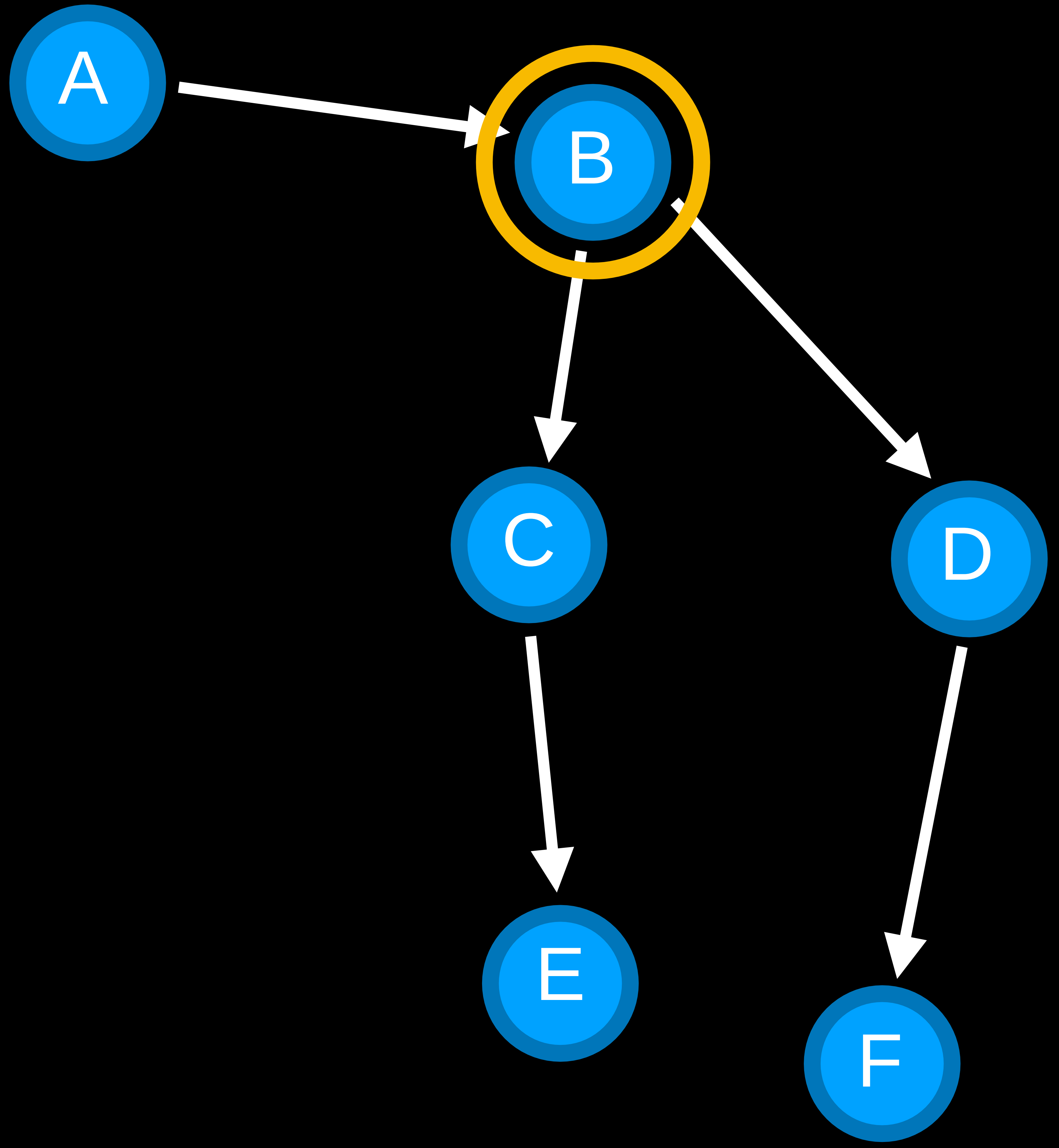
**Frontier**

C D

**Explored Set**

A B



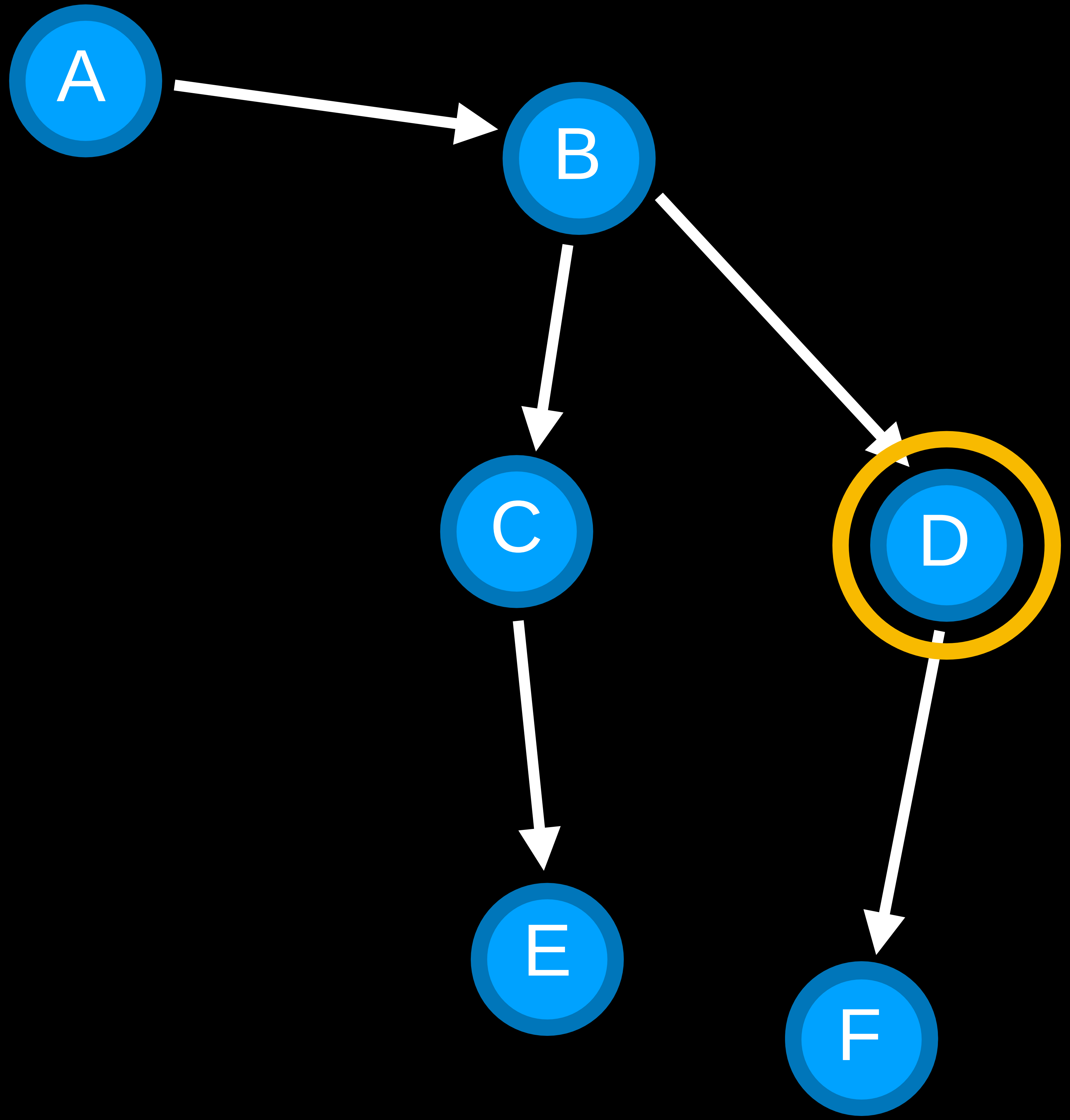
Find a path from A to E.

**Frontier**

C

**Explored Set**

A B D



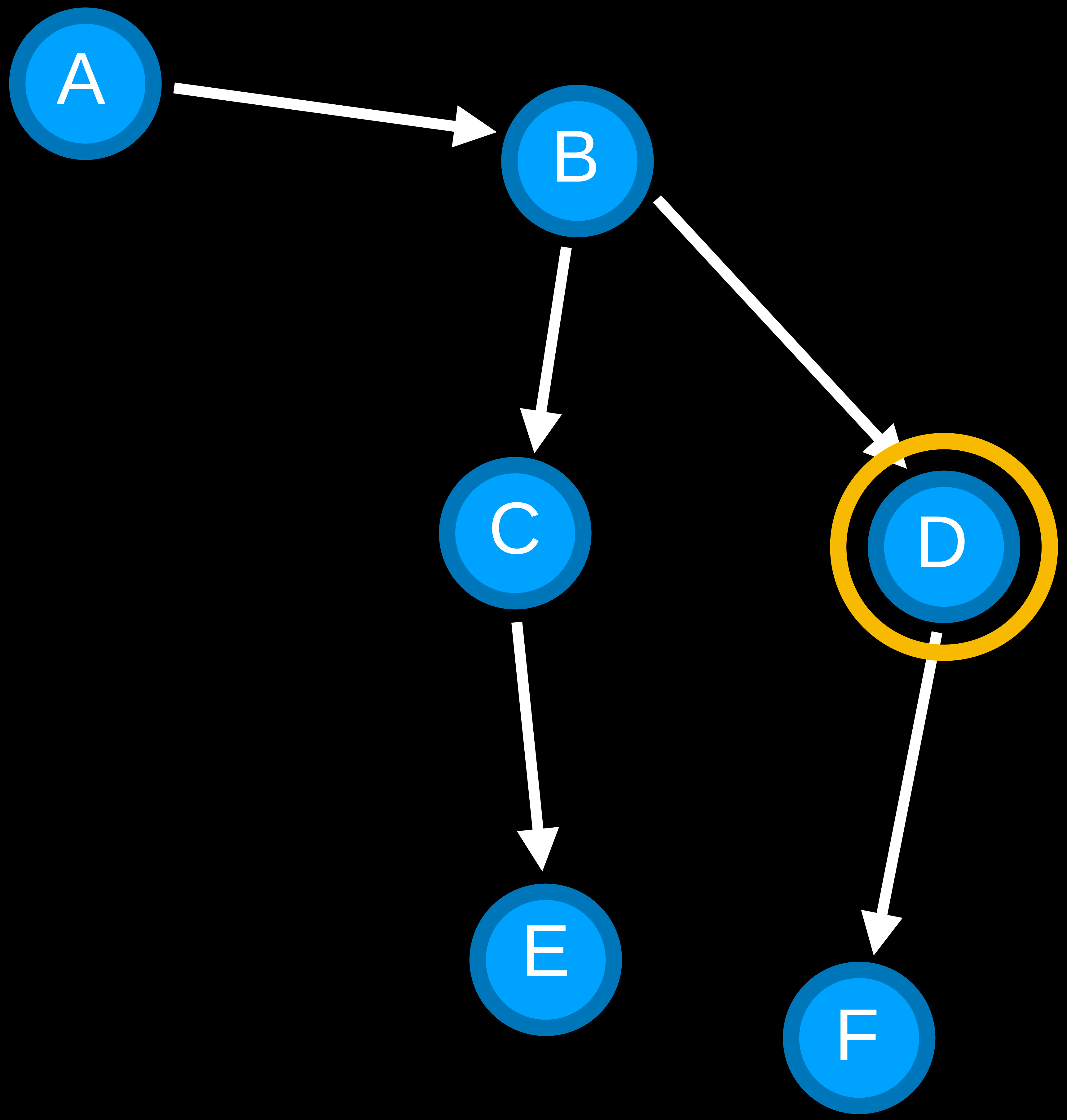
Find a path from A to E.

**Frontier**

C F

**Explored Set**

A B D



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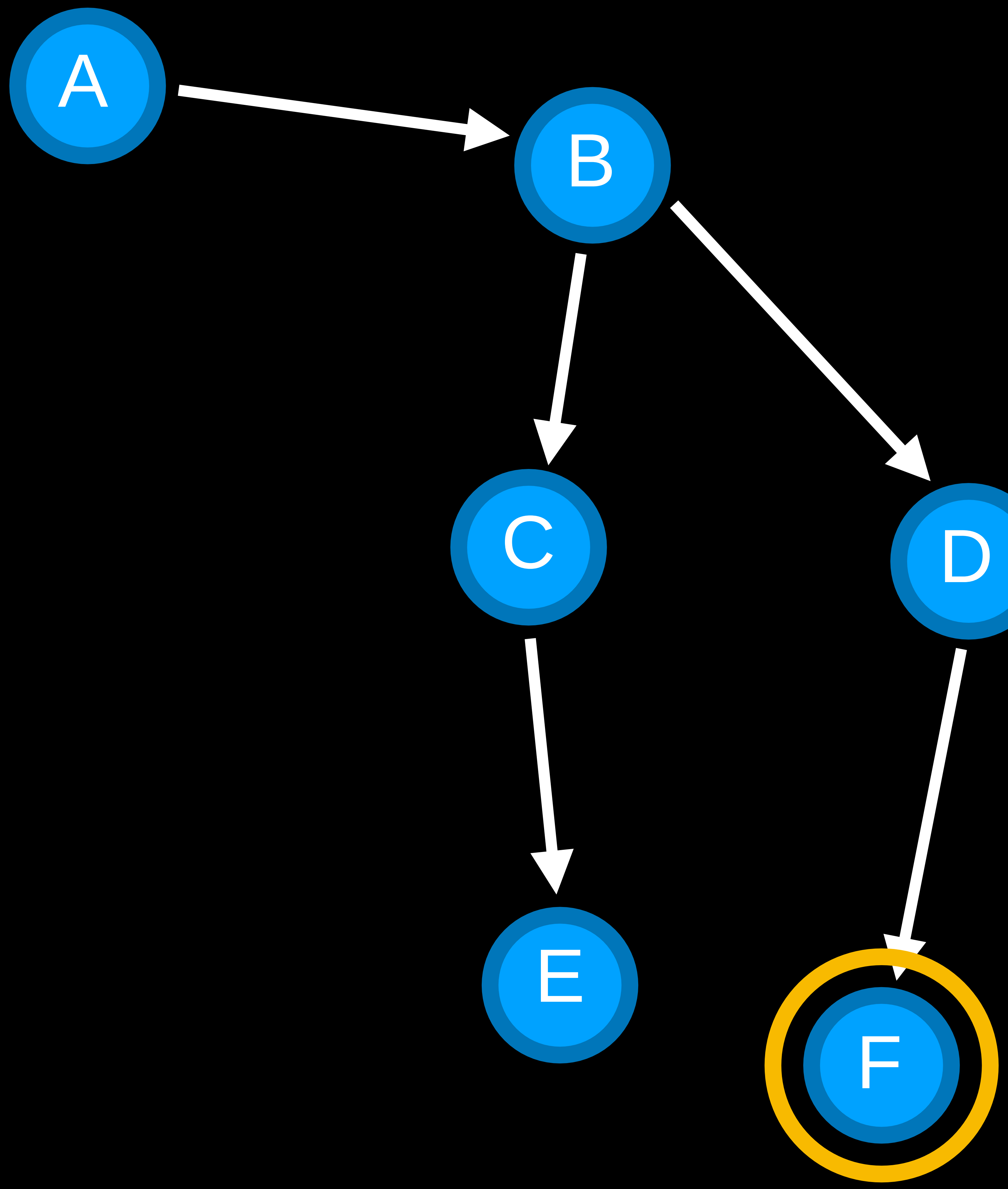
**Frontier**

C

**Explored Set**

A B D F



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## Frontier

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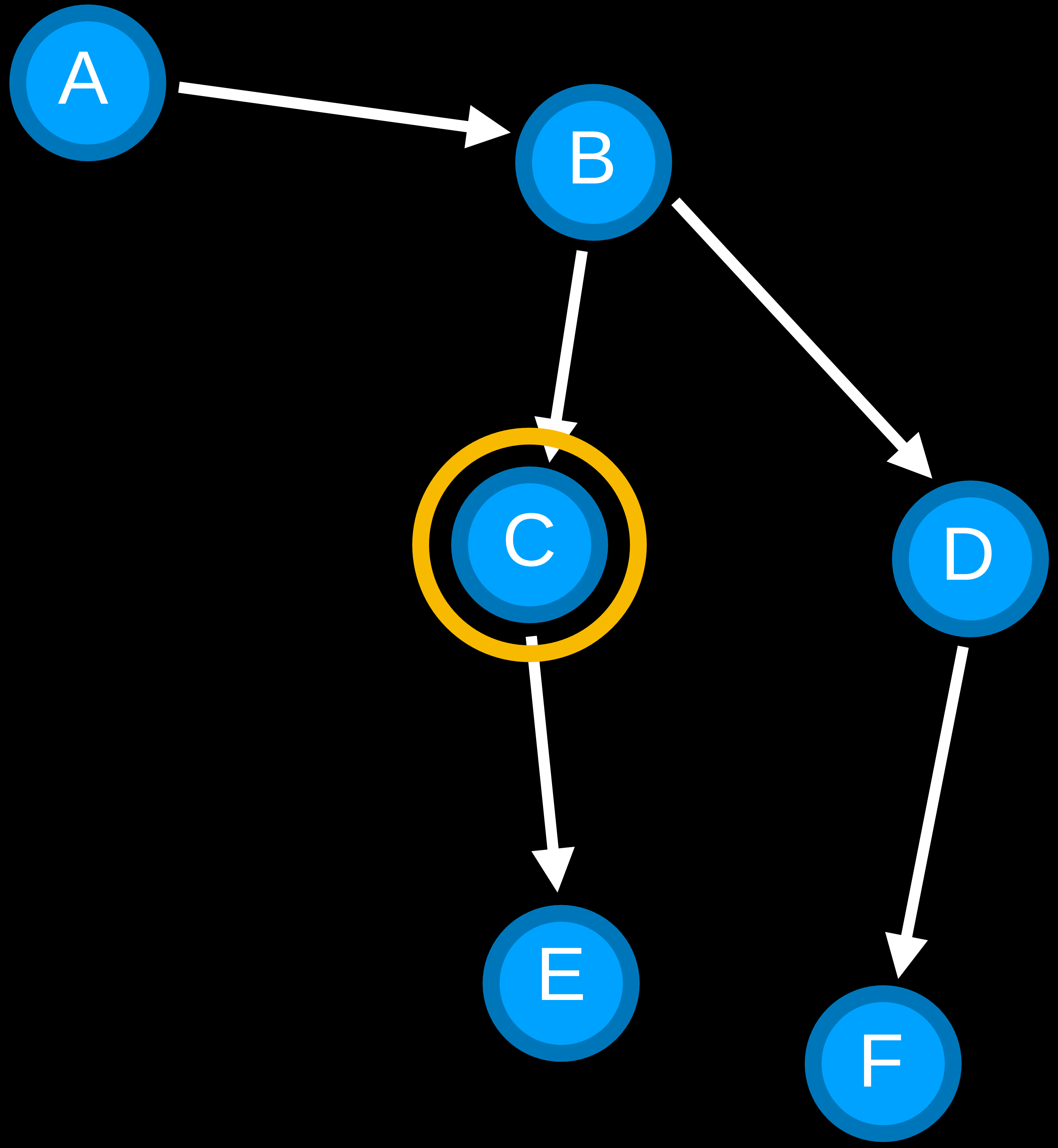


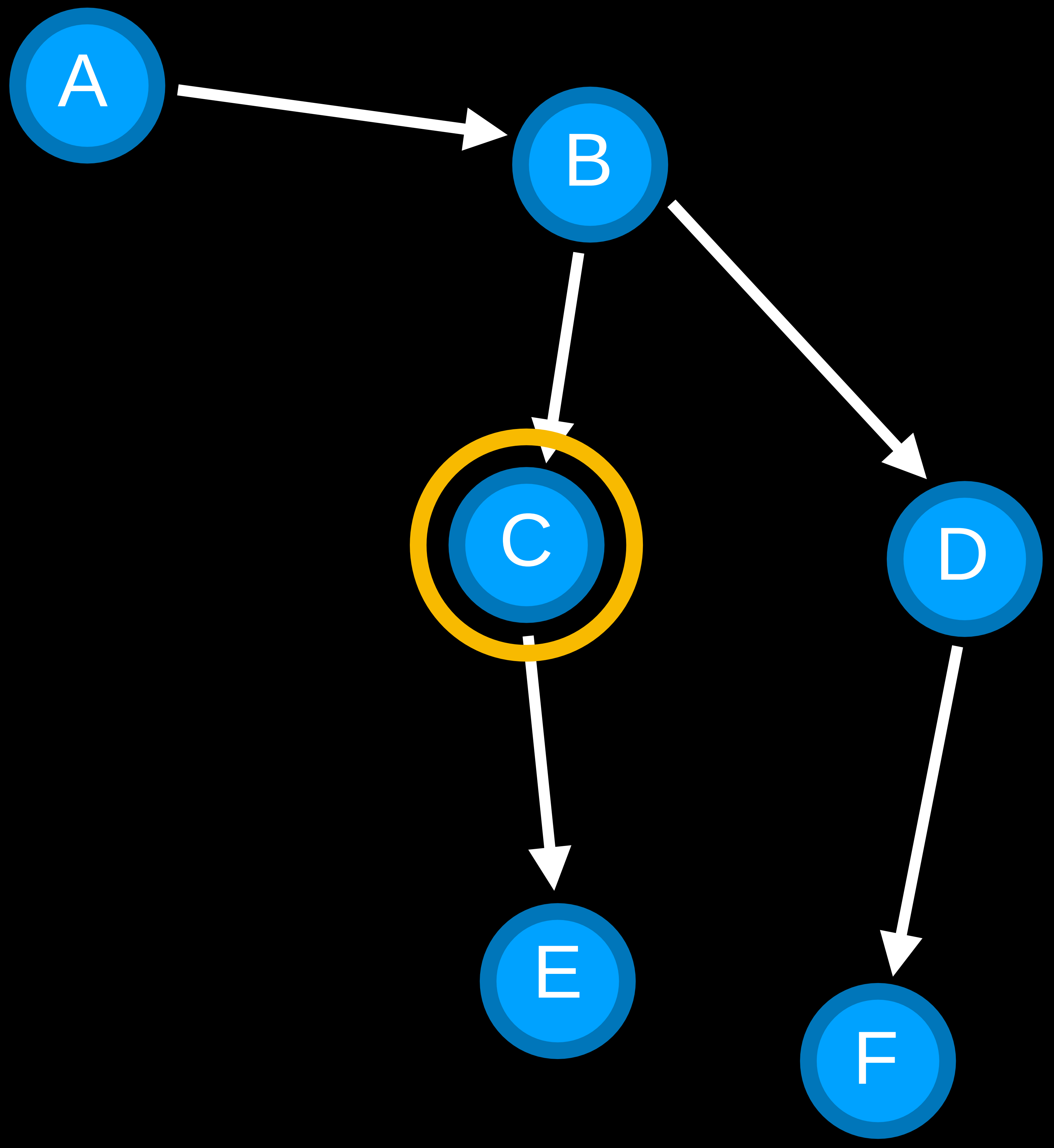
Find a path from A to E.

## Frontier

E

## Explored Set

A B D F C



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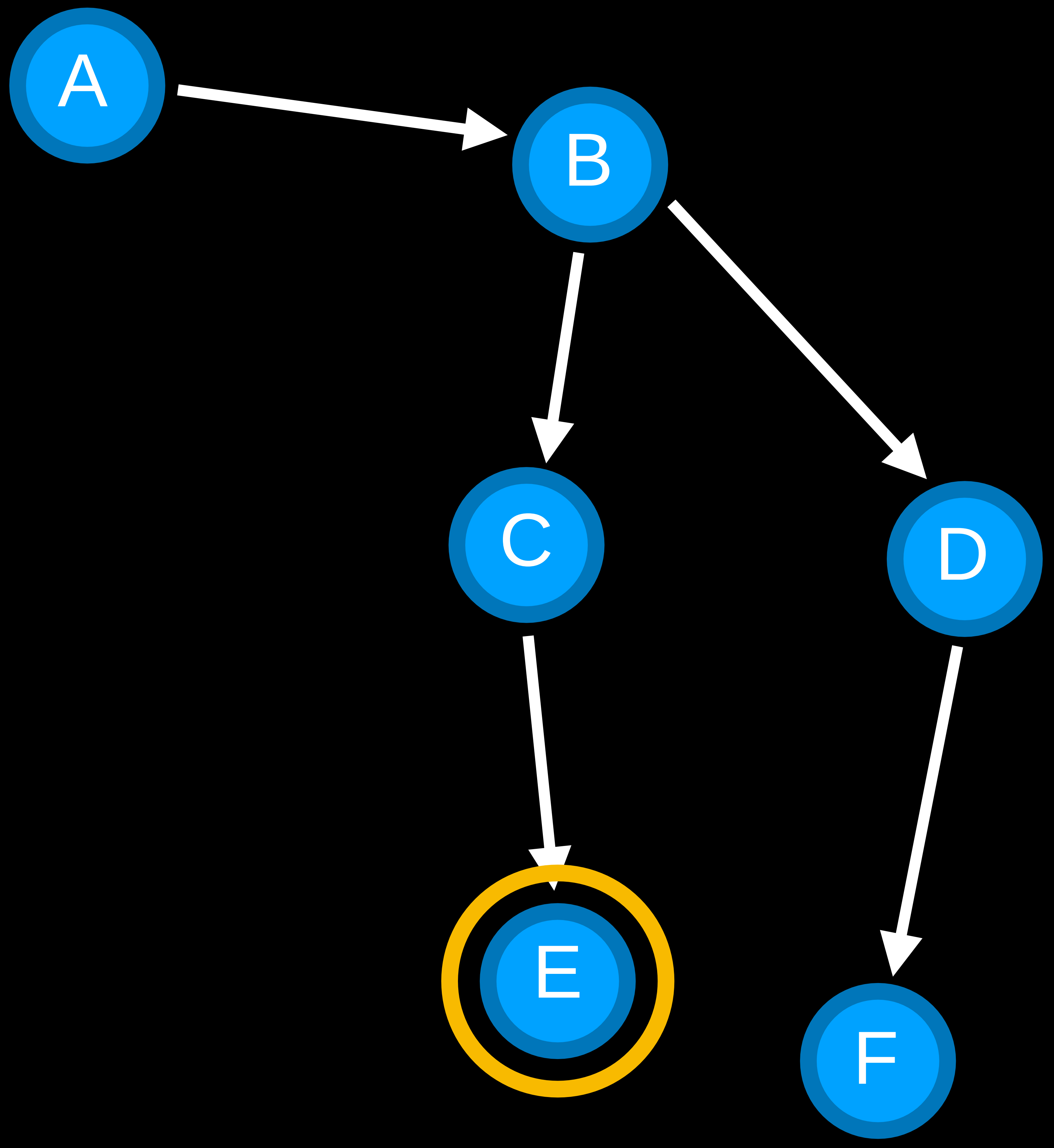
**Frontier**

**Explored Set**

A B D F C



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