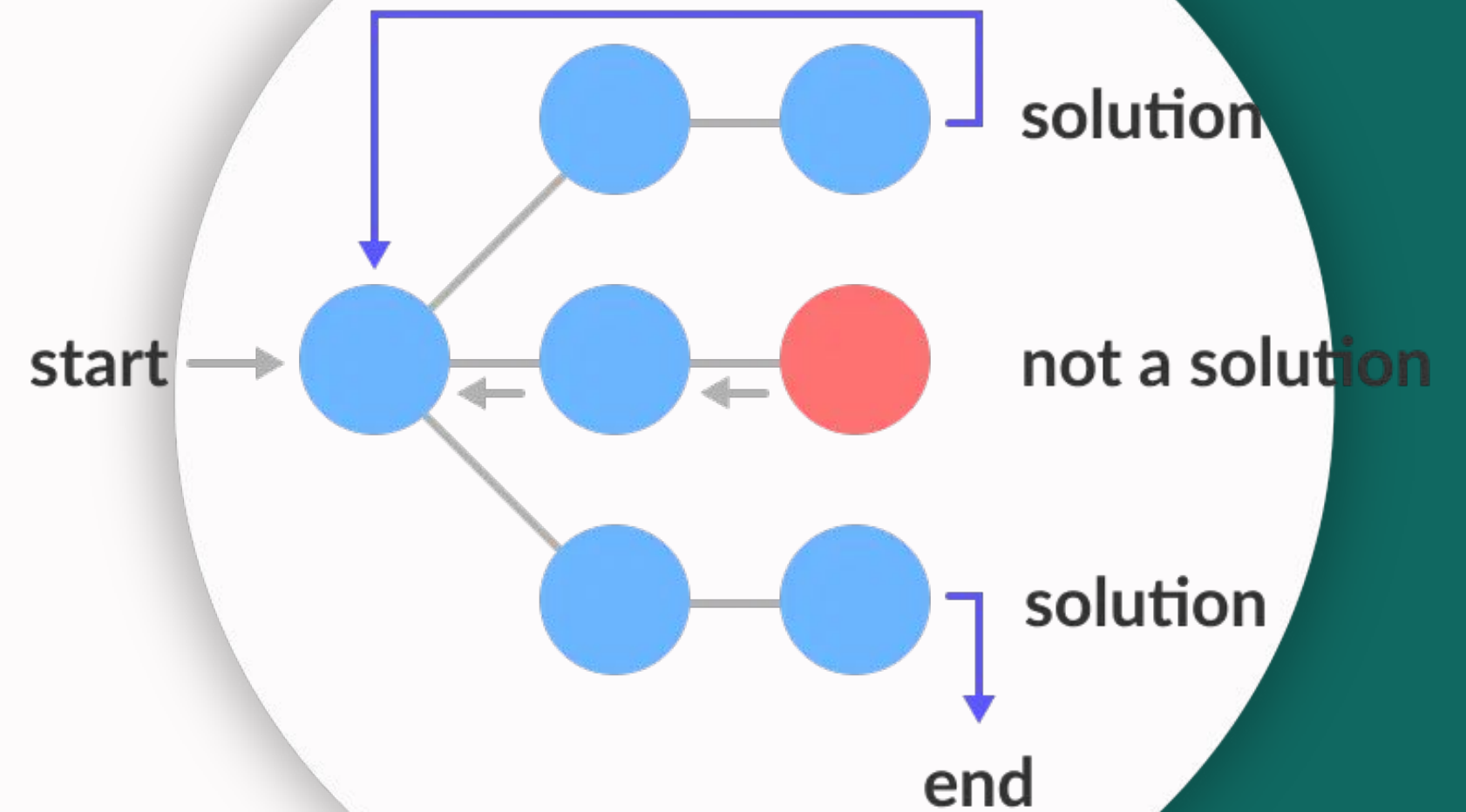




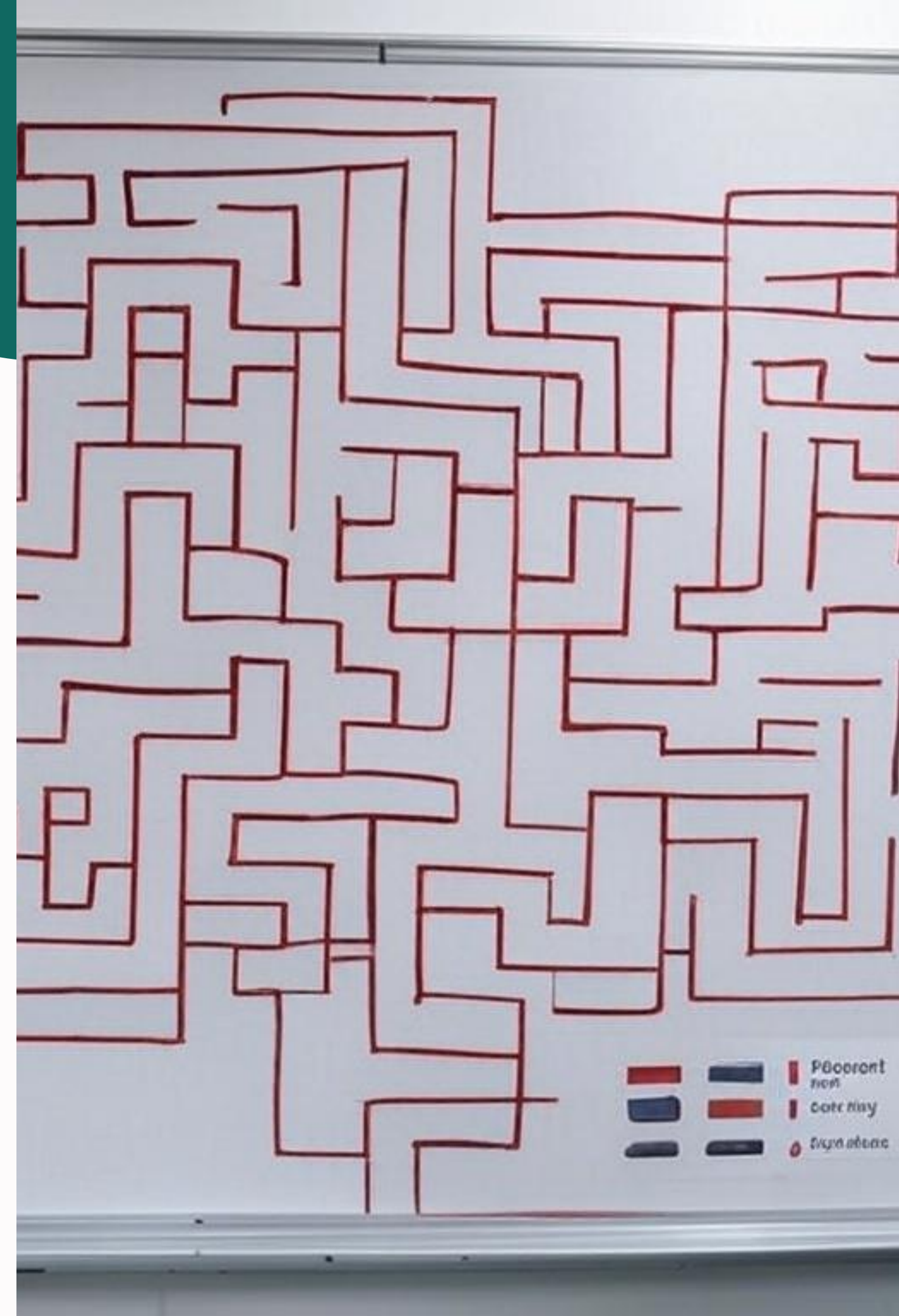
GROUP B6

IMPROVMENT OF BACKTRACKING



Improving Backtracking with Arc Consistency (AC-3)

- A More Efficient Approach to
Constraint Satisfaction
Problems (CSPs)





Why Improve Backtracking?

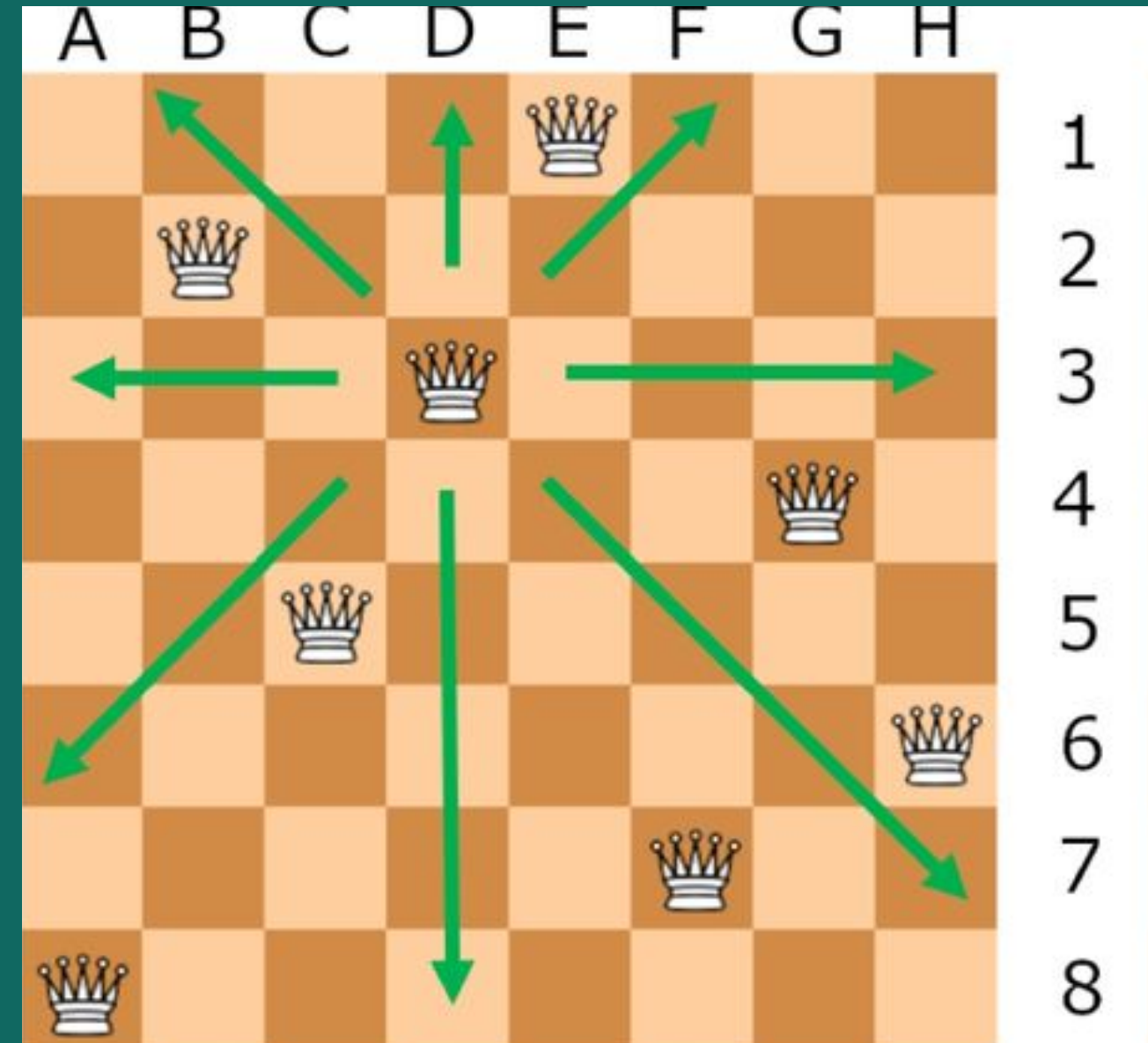
- – Backtracking alone is inefficient in CSPs with large search spaces.
 - – It often leads to unnecessary re-exploration of inconsistent paths.
- – Solution? Arc Consistency (AC-3) helps reduce the



search space before backtracking begins

What is Arc Consistency?

- – AC-3 is a constraint propagation algorithm.
- – It removes values that cannot be part of a consistent solution before search begins.
- – Works with binary constraints (relations between two



How AC-3 Works?

- 1 Convert each binary constraint into two arcs.
- 2 Add all arcs to an agenda (queue).
- 3 While the agenda is not empty:
 - – Take an arc (X_i, X_j) and check for consistency.
- 4 Remove values from X_i that don't satisfy the constraint with any value of X

- 5 – If X_i is modified, add arcs (X_k, X_i) back to the agenda.

AC-3 in Action

(Example)

Given variables and constraints:

- – Domains: $\{1,2,3,4\}$ for A, B, and C
- – Constraints:

$$A \succ B$$

$$B = C$$

01



Start with the full domains.

02



Apply constraints iteratively.

03



Prune inconsistent values

04



Reduced domains after AC-3.

Solution

Problem Statement

- $A = \{1,2,3,4\}$
- $B = \{1,2,3,4\}$
- $C = \{1,2,3,4\}$
-
- Constraints:
 - 1. $A > B$ (A should be a proper superset of B)
 - 2. $B = C$ (B and C are equal sets)

Initial Domains and Constraints

- 1. Initial Domains and Constraints:
 - $A = \{1,2,3,4\}, B = \{1,2,3,4\}, C = \{1,2,3,4\}$
- 2. Apply constraints:
 - - $B = C \rightarrow$ No change in values.
 - - $A > B \rightarrow$ A must only contain values strictly greater than B.

Removing Inconsistent Values

- 1. Removing Inconsistent Values:
 - value exists in B).
 - $\rightarrow A = \{2,3,4\}$
- 2. $B = C$ remains unchanged for now.
- 3. Adjust B and C to maintain consistency:
 - - Since $A > B$, the largest B can have is 3 (to ensure at least one element in A is greater than B).

Final Domain after arc Consistency

- Final Domains:
 - $A = \{2,3,4\}$
 - $B = \{1,2,3\}$
 - $C = \{1,2,3\}$

AC-3 vs.

Backtracking



.....● – Backtracking: Blindly searches all possibilities → inefficient.



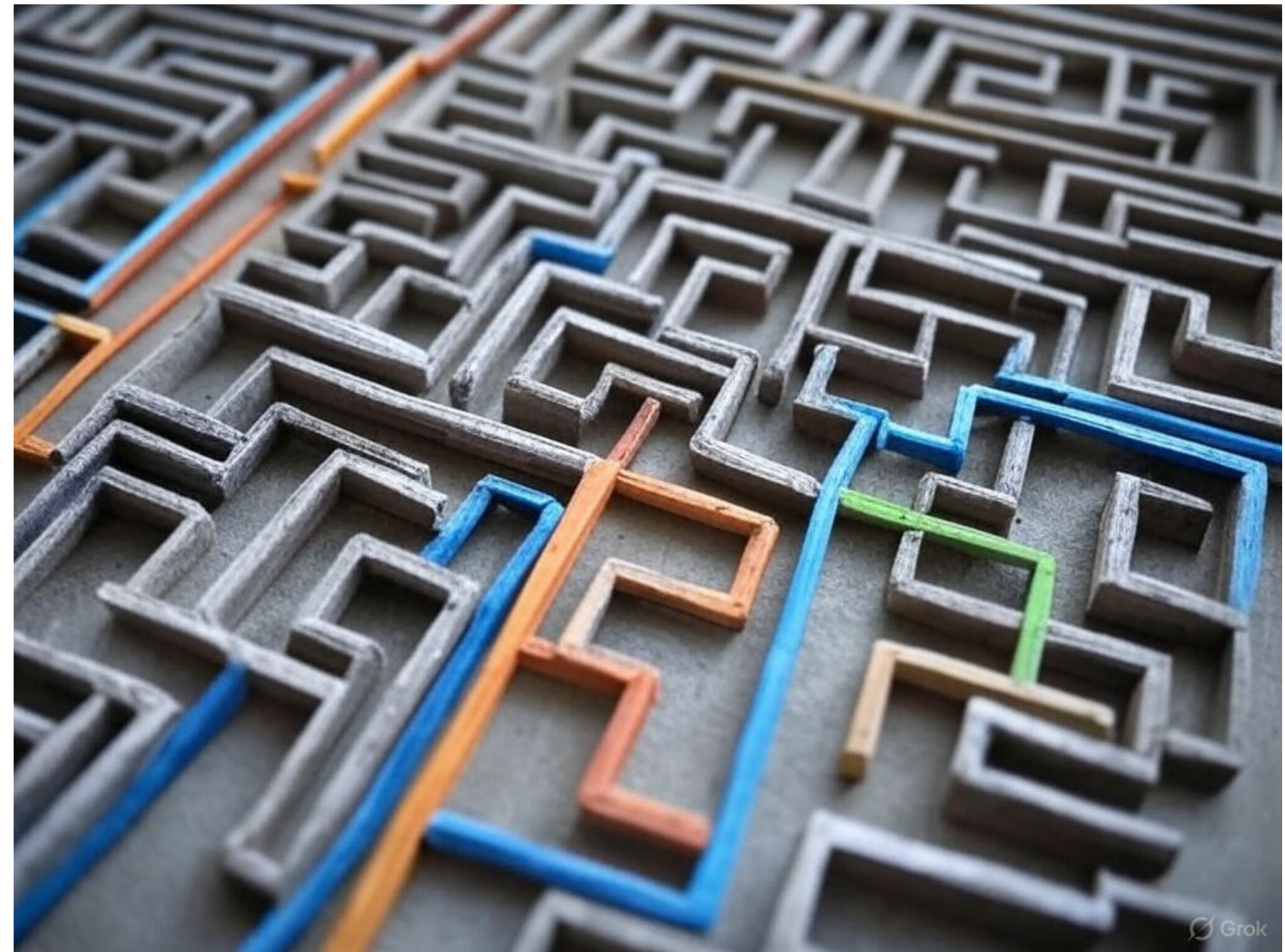
.....● – AC-3: Reduces search space before solving → faster solutions.

Summary

AC-3 makes backtracking faster by eliminating inconsistent values before searching.

- Works best for binary constraints in CSPs.

Reduces unnecessary search space, leading to more efficient problem-solving.





THANK YOU

For watching this
presentation