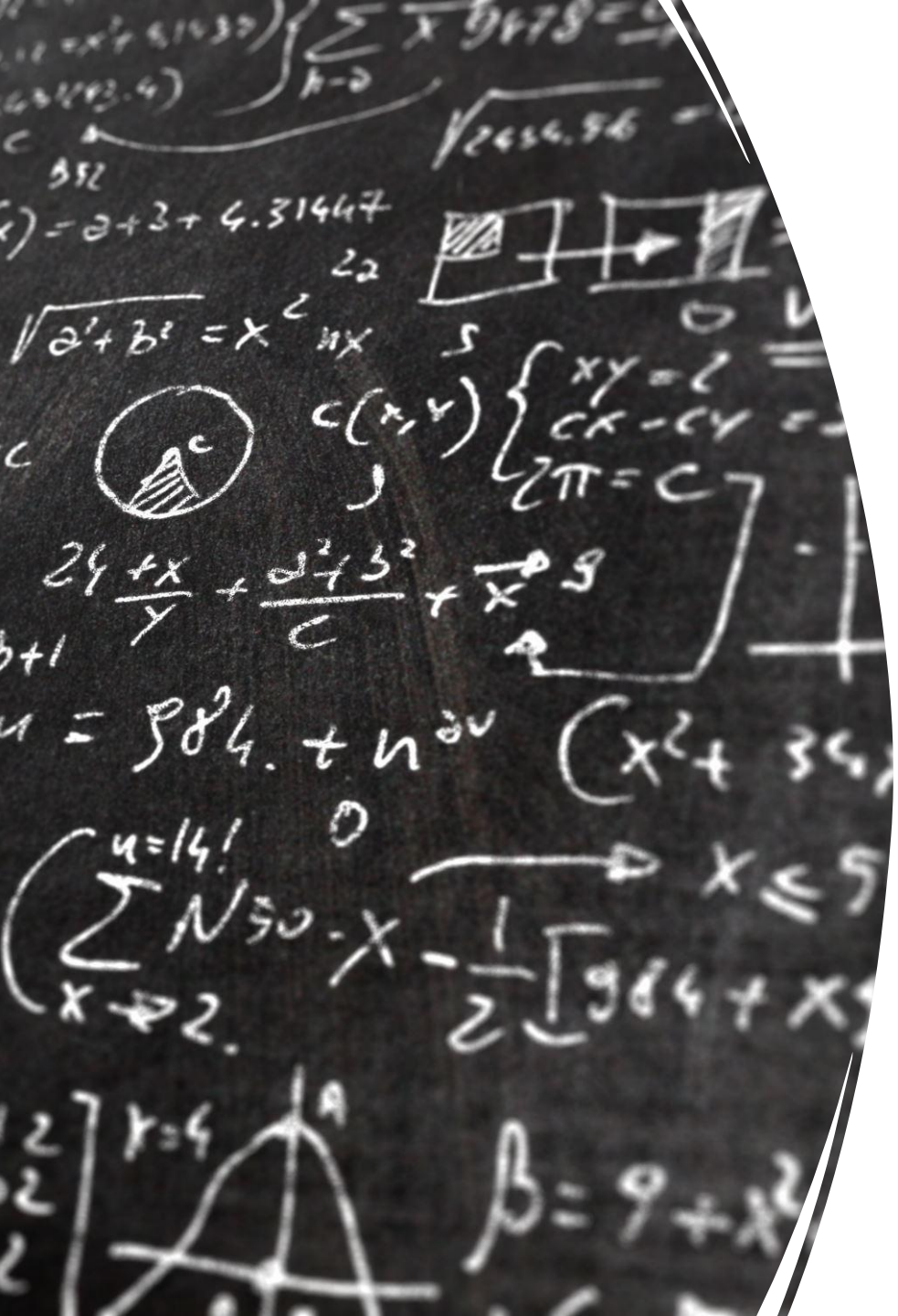


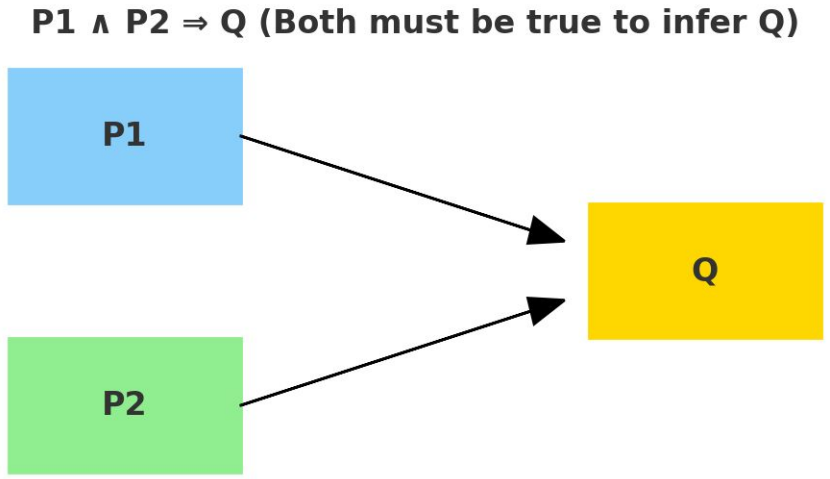
Inference in First-Order Logic (FL)

Forward & Backward Chaining

What is Inference in FL?

- Inference = drawing new conclusions from known facts + rules.
- FL rules look like: P1 ∧ P2 ⇒ Q

- Example:
  - Rule: If a student studies ⟶ the student passes.
  - Fact: Ali studies.
  - Inference: Ali passes.



Forward Chaining (Data-driven)

Starts from facts and applies rules step by step.

Expands knowledge until goal is reached.

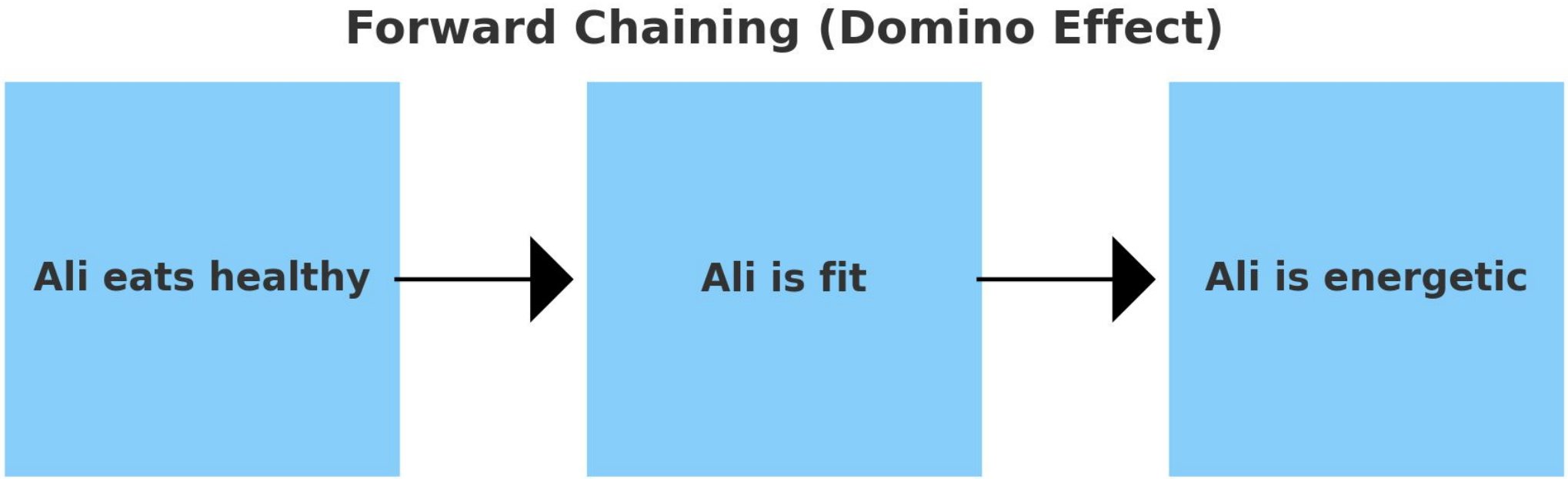
Analogy:

- Domino effect – facts trigger new facts.

Example:

- 1. Ali eats healthy food.
- 2. If someone eats healthy → they stay fit.
- 3. If someone stays fit → they are energetic.
- Inference: Ali is energetic.

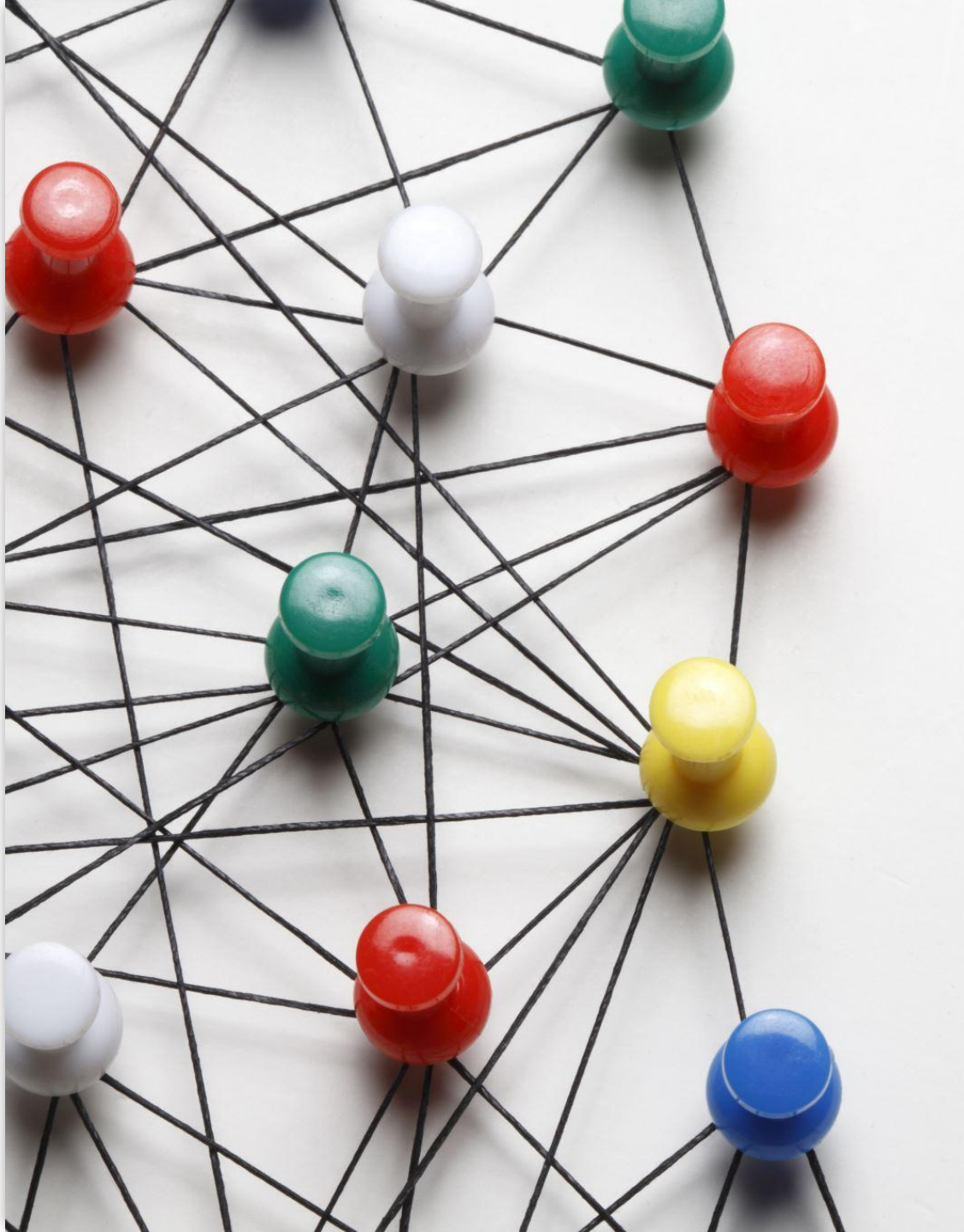
Forward Chaining (Domino Effect)



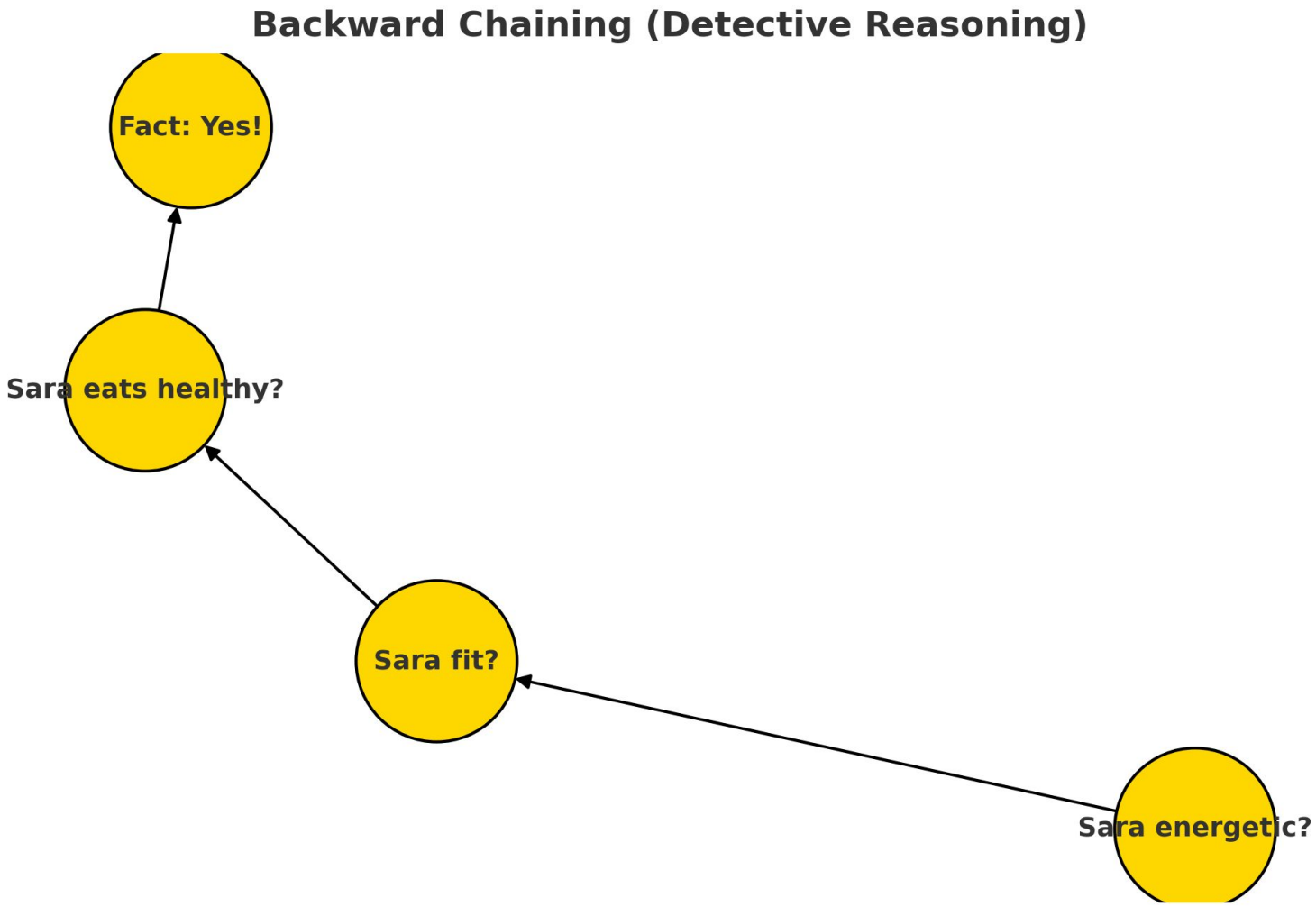
Backward Chaining (Goal-driven)

- Starts with goal (query) and checks if it can be proven.
- Works backward from goal to facts.
- Analogy: Detective reasoning – start with mystery and trace back clues.

- Example:
  - Query: Is Sara energetic?
  - Rule: If someone is fit → they are energetic.
  - Rule: If someone eats healthy → they are fit.
  - Fact: Sara eats healthy.
  - Inference: Yes, Sara is energetic.



Backward Chaining (Detective Reasoning)



Forward vs Backward Chaining

Forward Chaining:

Data-driven

Starts with facts

Domino effect

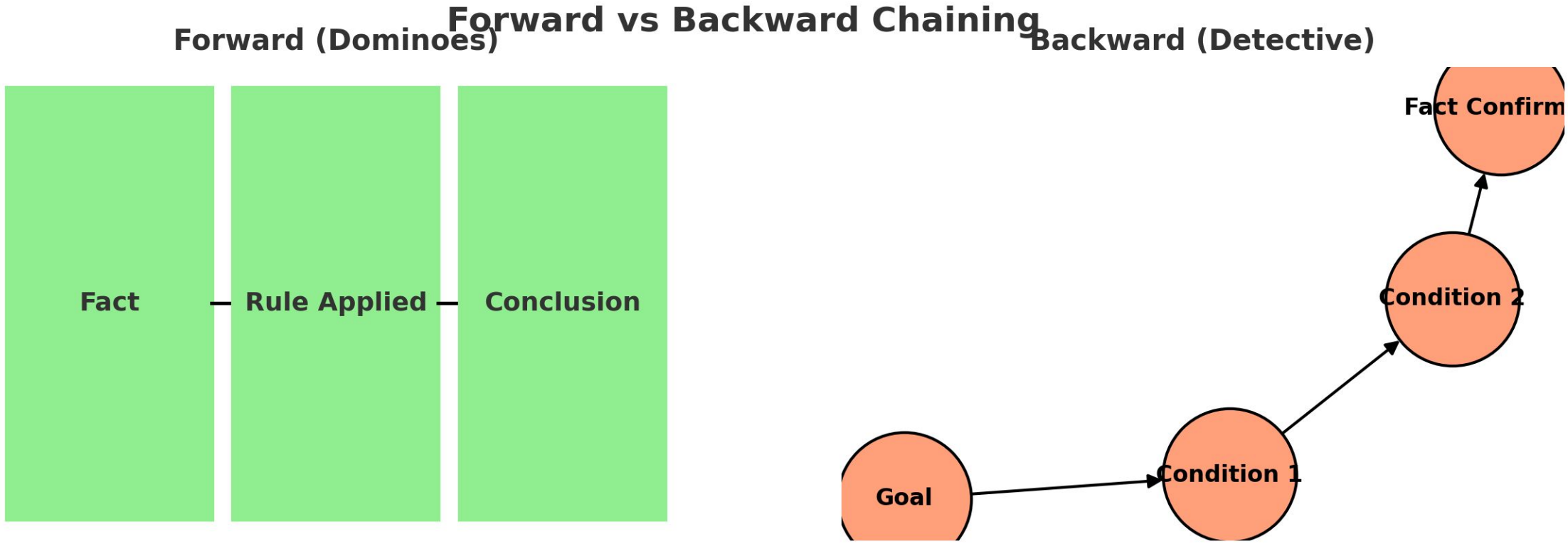
Backward Chaining:

Goal-driven

Starts with query

Detective reasoning

Forward vs Backward Comparison



Class Participation Activity

Activity 1 (Forward):

- Rule: If a student works hard ⟶ they get good grades.
- Rule: If they get good grades ⟶ they get a scholarship.
- Fact: Ahmed works hard.
- ⟶ What can we infer?

Activity 2 (Backward):

- Query: Does Ahmed get a scholarship?
- Work backward with rules & facts.

Summary

- Forward Chaining = facts → conclusions (domino effect).
- Backward Chaining = goal → facts (detective reasoning).
- Both are powerful, used in AI systems like expert systems, Prolog, and medical diagnosis.

Memory Trick: Domino = Forward, Detective = Backward.