



Anatomy of a Fallacy: The $P = NP$ Mirage

Deconstructing the exponential trap hidden inside the 3-SAT to DNF-SAT reduction.

Premise A: DNF-SAT can be solved in Polynomial Time (P).



Premise B: Any 3-SAT problem (which is NP-Complete) can be converted to DNF-SAT using boolean distributive laws.

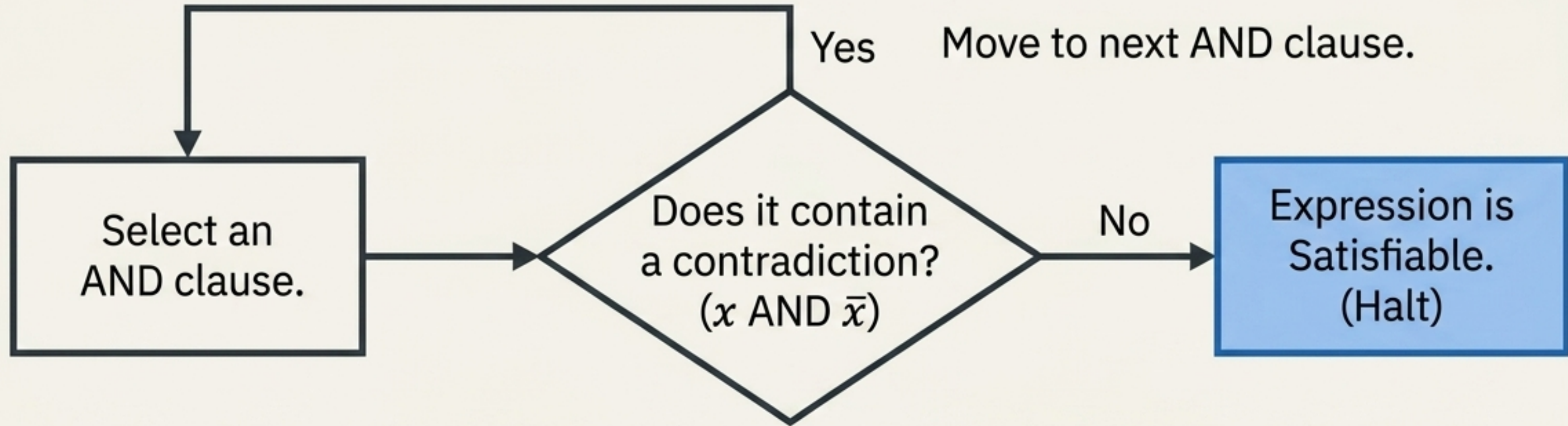


The Claim: Therefore, 3-SAT can be solved in Polynomial Time. $P = NP$.

The Boolean Architecture: DNF vs. CNF

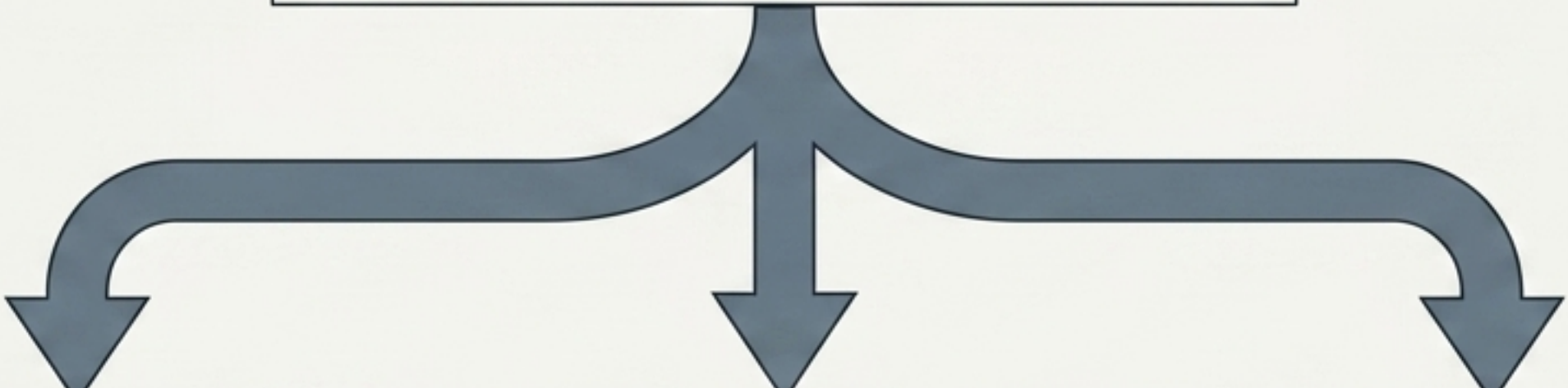
	DNF (Disjunctive Normal Form)	CNF (Conjunctive Normal Form)
Core Structure	OR of ANDs $(A \wedge B) \vee (C \wedge D)$	AND of ORs $(A \vee B) \wedge (C \vee D)$
Satisfiability Rule	Only ONE clause needs to be True to satisfy the entire expression.	ALL clauses must be True simultaneously.
Satisfiability Complexity	Solvable in Polynomial Time (P).	NP-Complete (for 3-SAT).

Premise A: Solving DNF-SAT in Polynomial Time



For n variables and m clauses, maximum time = $O(n \times m)$
Because $O(n \times m)$ is a polynomial time bound, Premise A is mathematically sound.

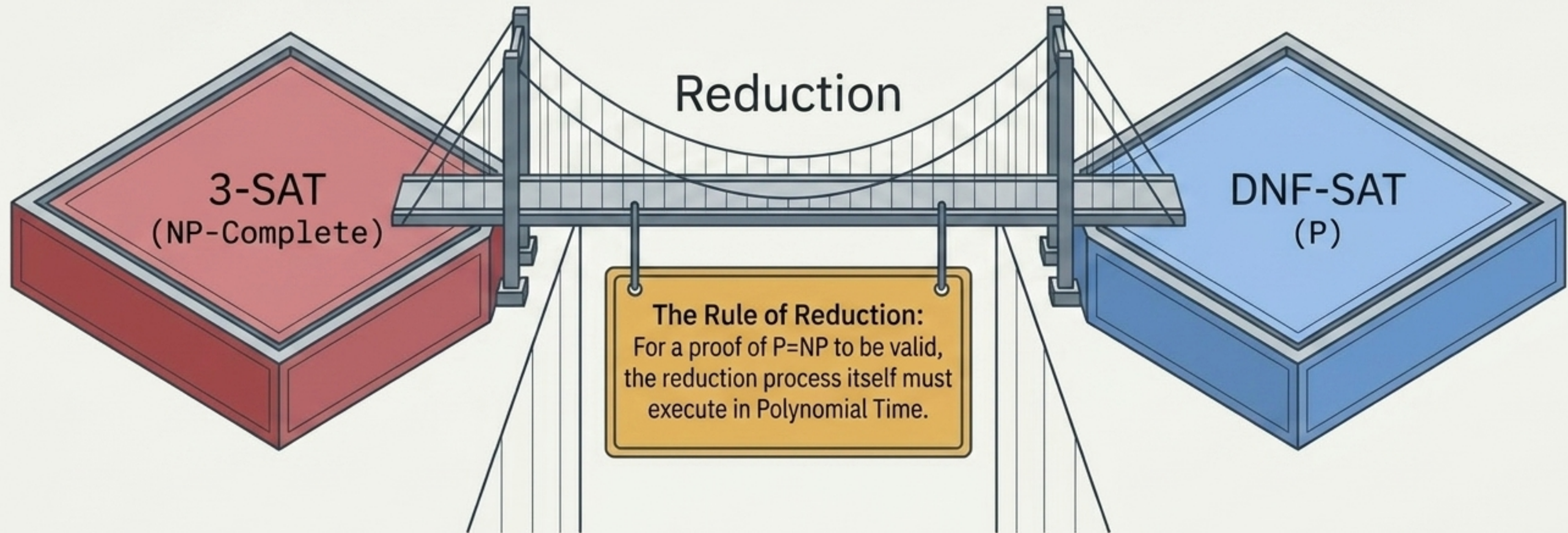
Premise B: The Distributive Bridge

$$(a \vee b \vee \bar{c}) \wedge (\bar{a} \vee \bar{b})$$


A diagram showing three arrows originating from the bottom of the top box and pointing to the three main groups of terms in the bottom box. The first arrow points to $(a \wedge \bar{a})$, the second to $(b \wedge \bar{a})$, and the third to $(\bar{c} \wedge \bar{a})$. Another set of three arrows originates from the bottom of the top box and points to the three main groups of terms in the bottom box. The first arrow points to $(a \wedge \bar{b})$, the second to $(b \wedge \bar{b})$, and the third to $(\bar{c} \wedge \bar{b})$.

$$(a \wedge \bar{a}) \vee (b \wedge \bar{a}) \vee (\bar{c} \wedge \bar{a}) \vee (a \wedge \bar{b}) \vee (b \wedge \bar{b}) \vee (\bar{c} \wedge \bar{b})$$

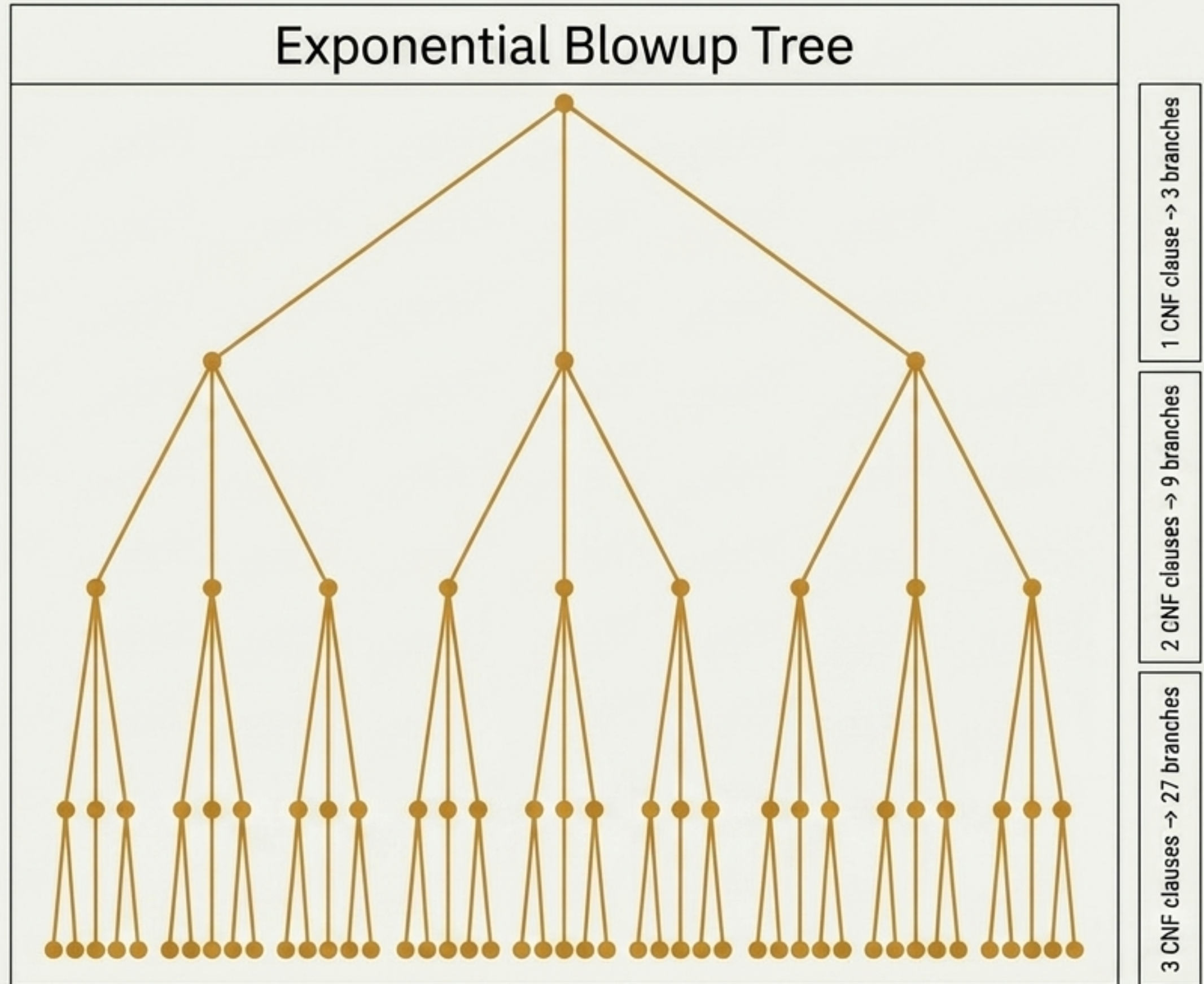
Algebraically, 3-CNF can be perfectly converted to DNF by distributing ANDs ($\wedge$) over ORs ($\vee$). Premise B is theonecratically true.



Does the distributive law cross this bridge safely?

The Trap of Distribution

To generate the equivalent DNF expression, the algorithm must select one of up to 3 literals from **EVERY** CNF clause. Every possible combination must be generated.



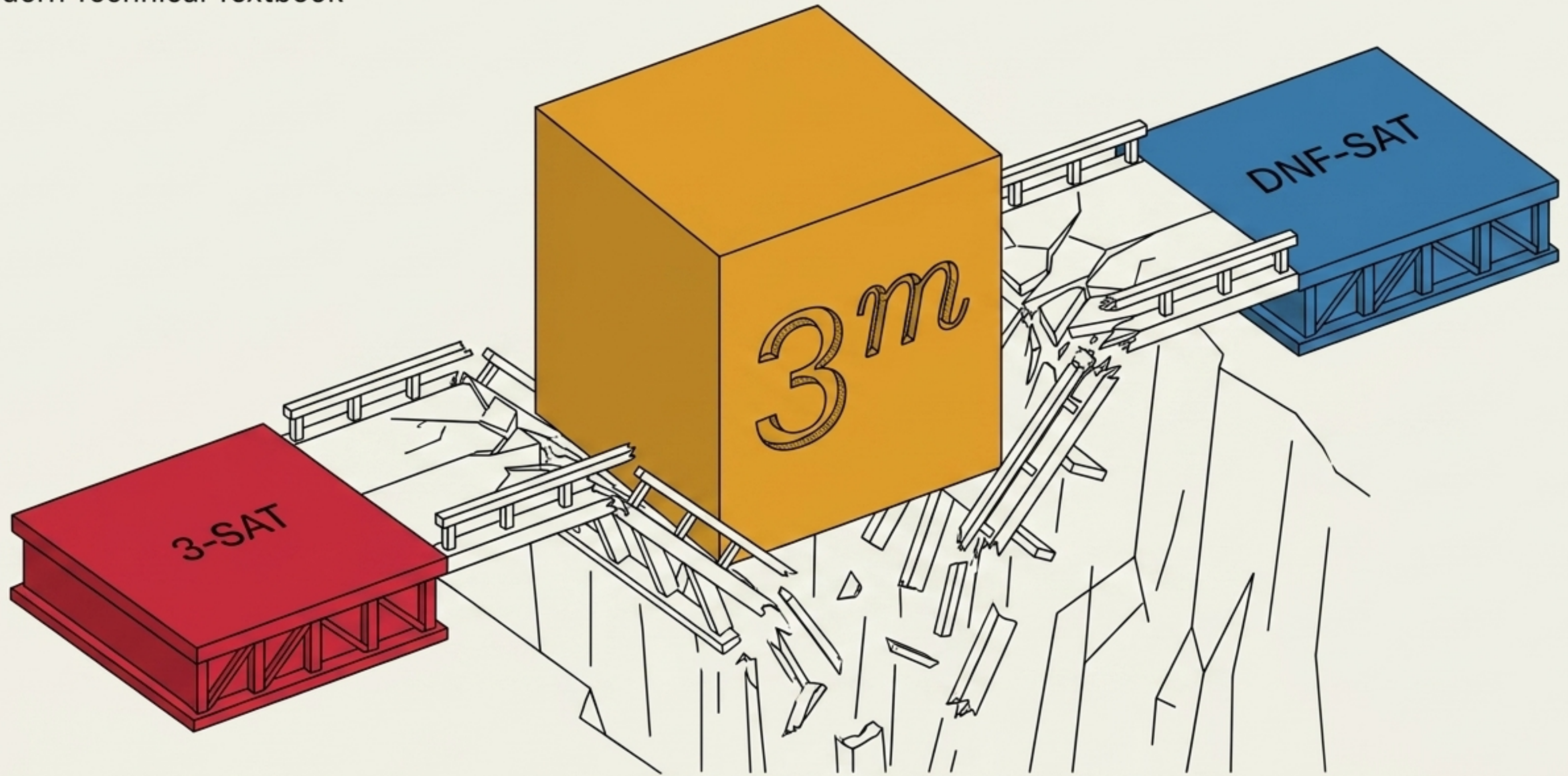
The Mathematical Reality

$$O(3^m)$$

m represents the number of clauses in the original 3-CNF expression.

In the worst-case scenario, this creates a DNF expression with 3^m AND clauses.

$O(3^m)$ dictates an exponential growth rate in both time and space. The conversion process is not polynomial. The reduction is invalid.



The Collapsing Bridge. The logical premises are true in a vacuum, but the mechanism connecting them carries infinite weight. An exponential conversion cannot act as a bridge to polynomial time.

Post-Mortem of a Fallacy

Theoretical equivalence does not equal computational equivalence.

Time and space complexities are inescapable physical realities of logic.

The $P = NP$ problem cannot be solved by simply rearranging boolean formats; the intrinsic complexity of the problem always persists.

