

The Immaterial Paradise, Motivating Paradoxes, Puzzles, and R,

Part I

Selmer Bringsjord

Intro to (Formal) Logic (and AI) = IFLAI I

I/28/21



Logistics ...

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See Sergei's FAQ.

(Reading the syllabus is helpful.)

What *is* Logic?

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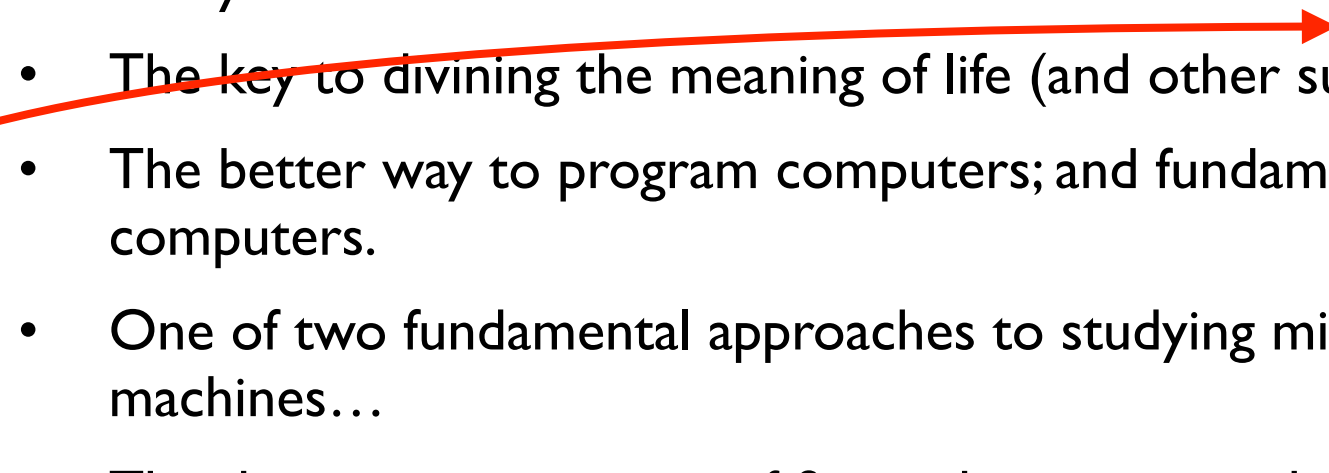
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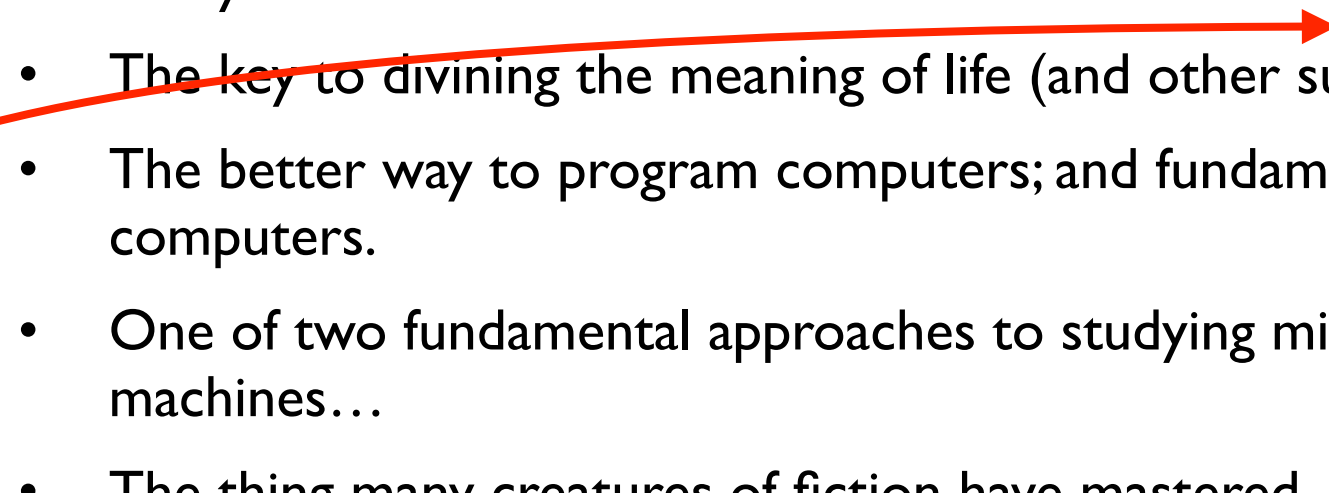
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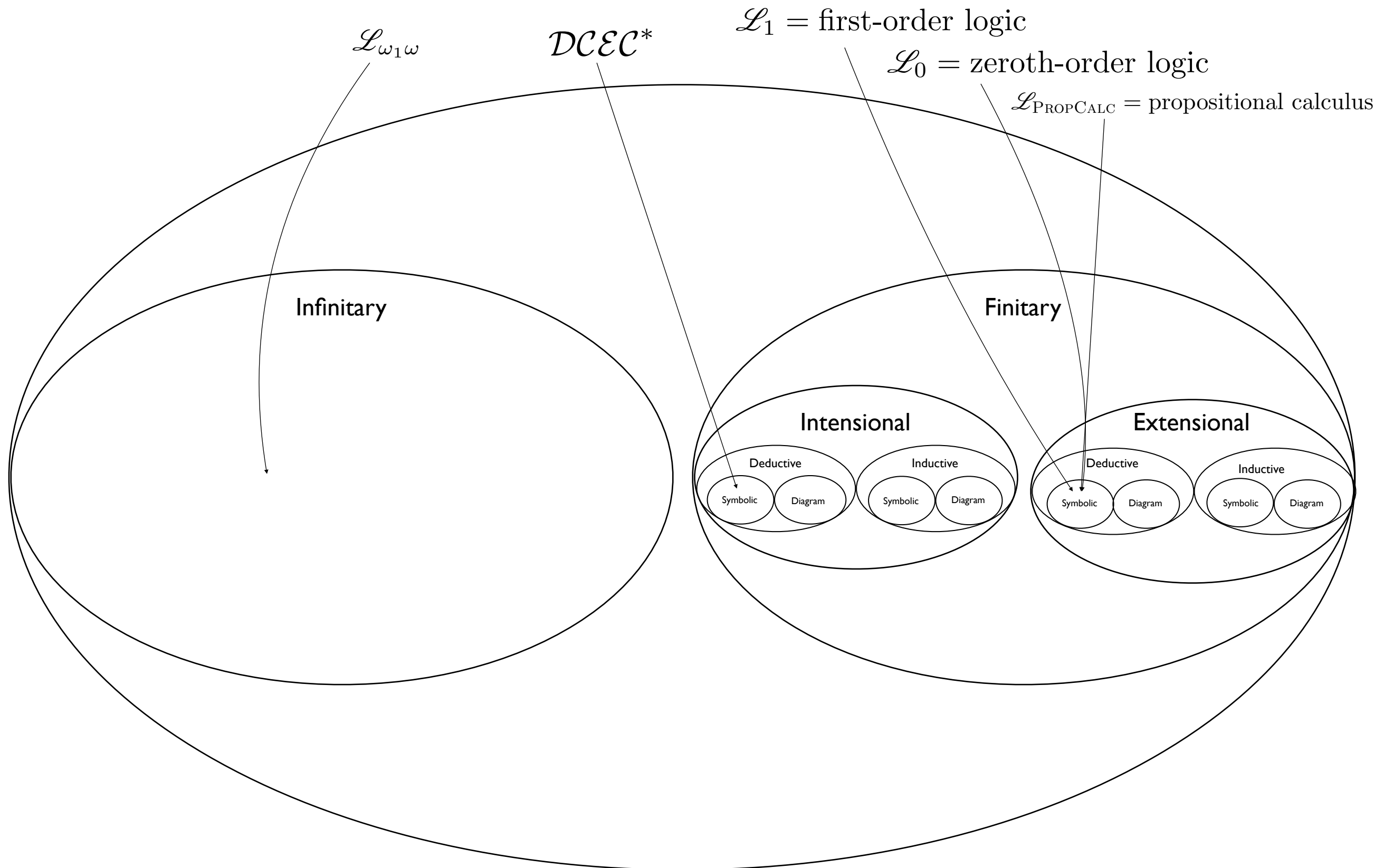


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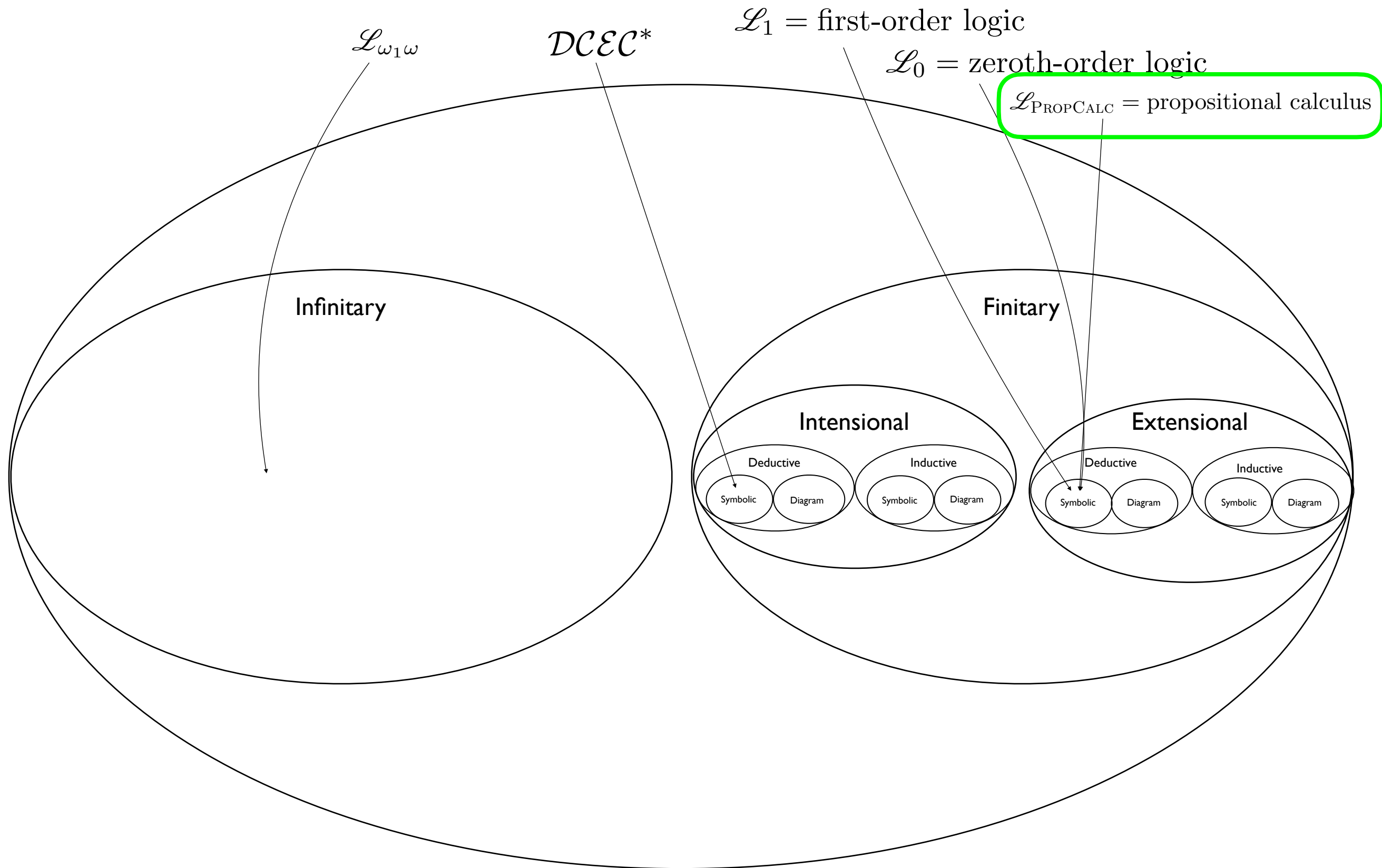
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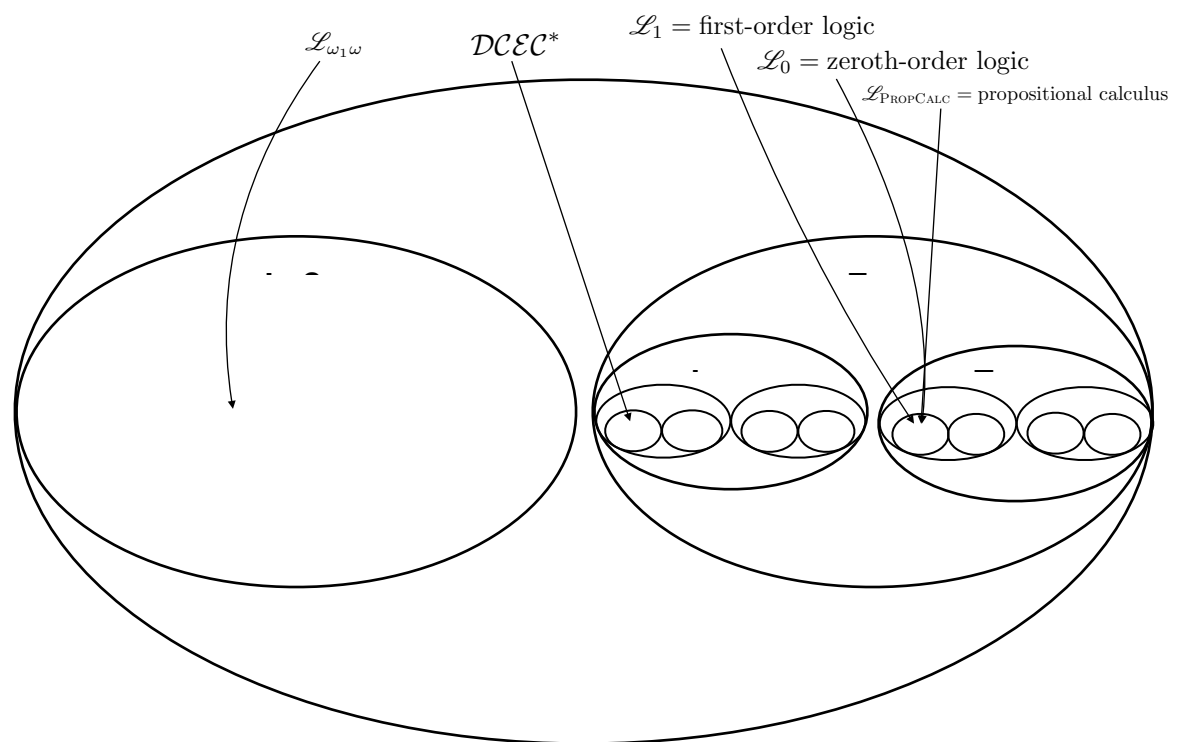
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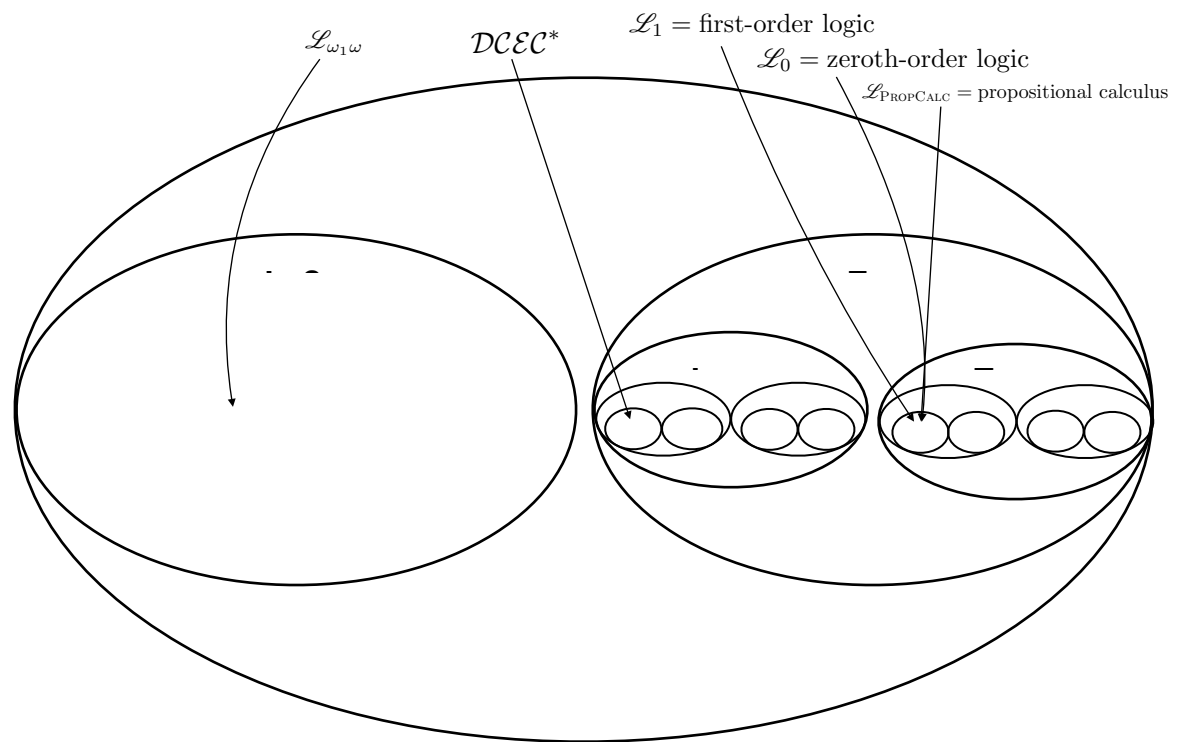


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Non-Physical

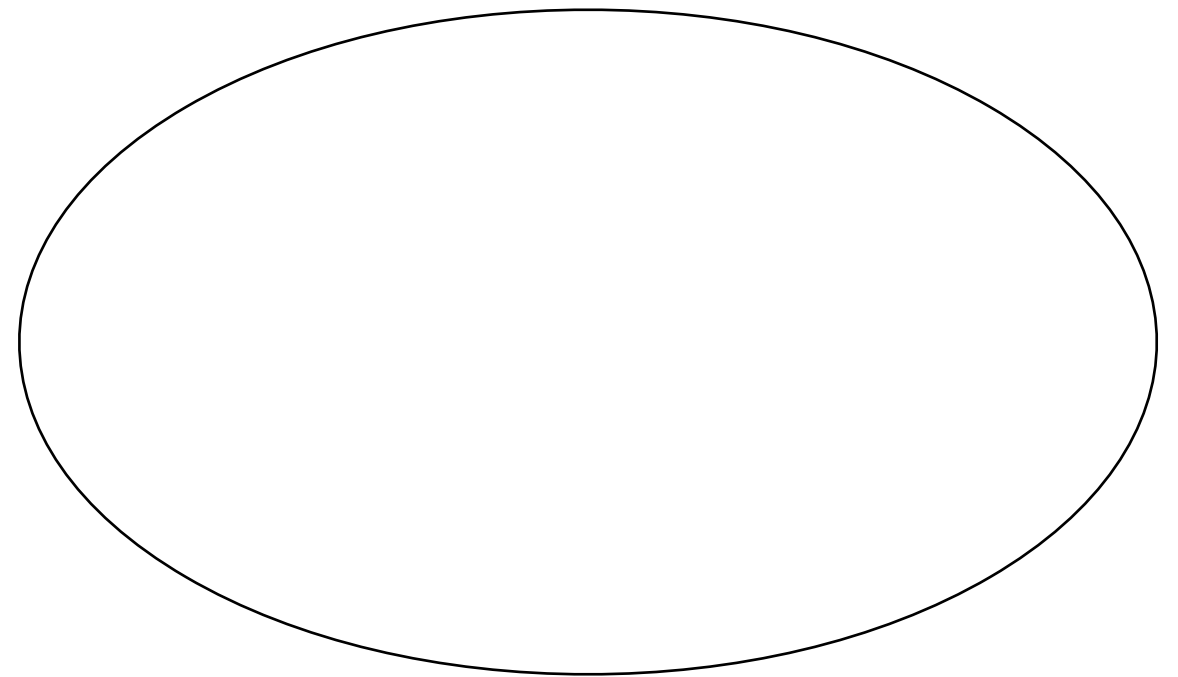
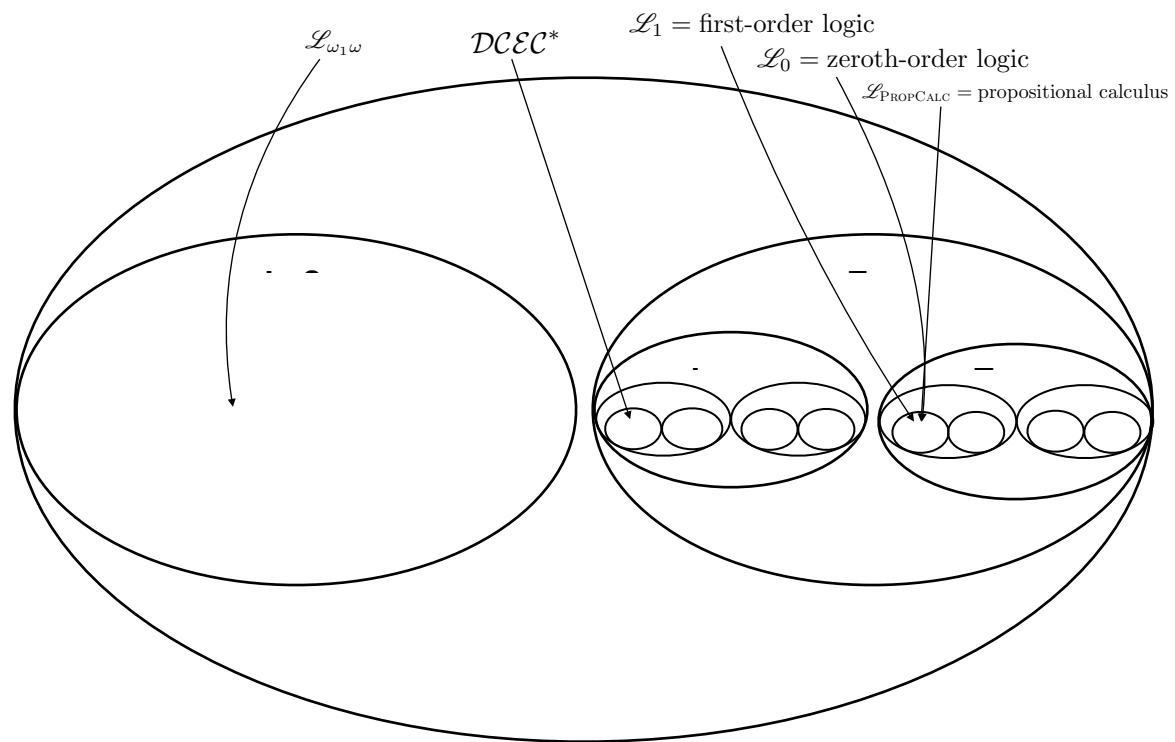
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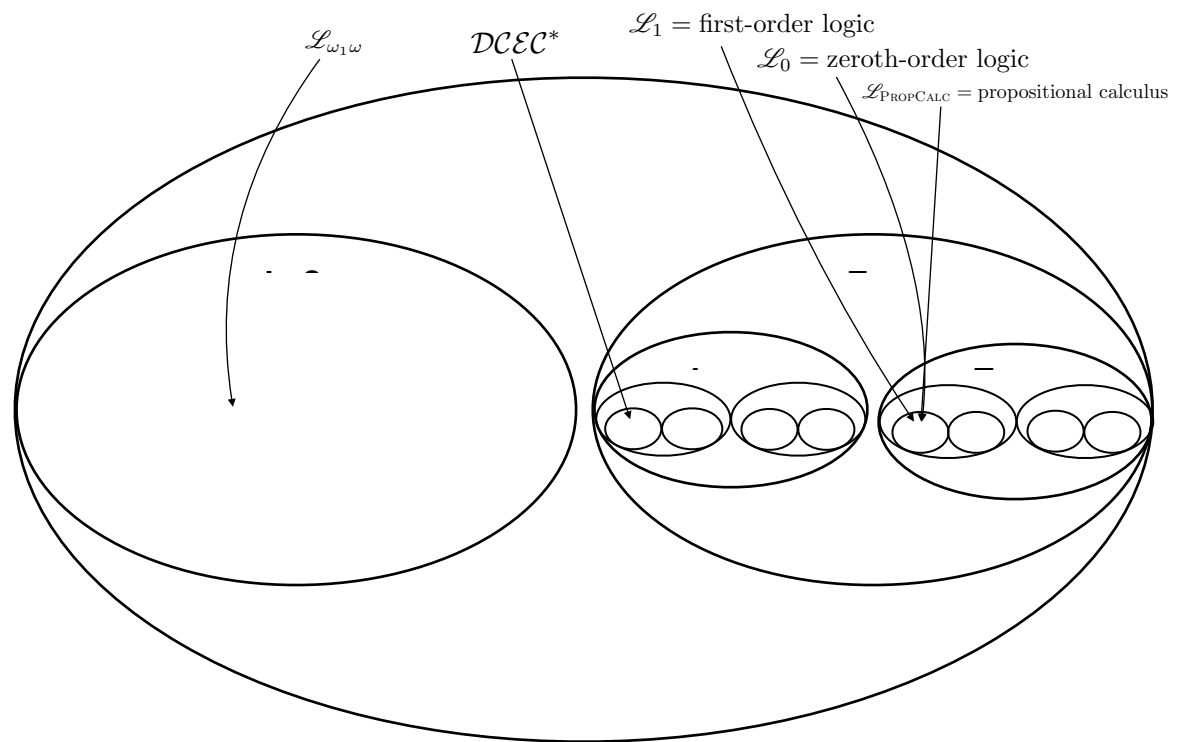
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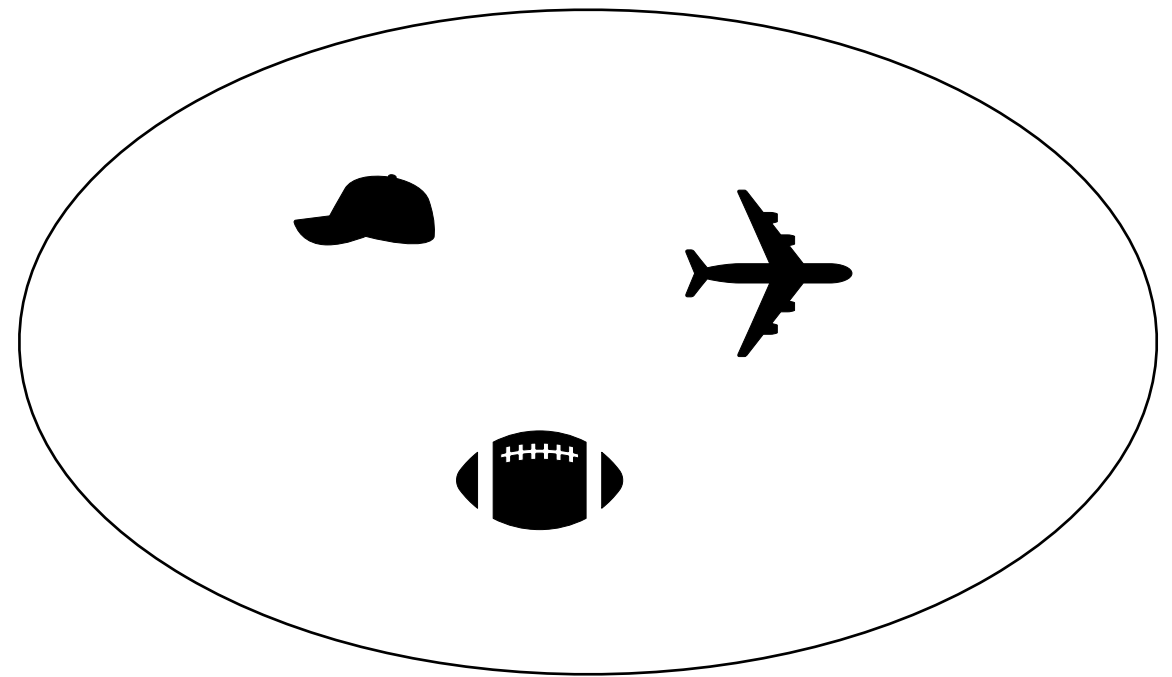


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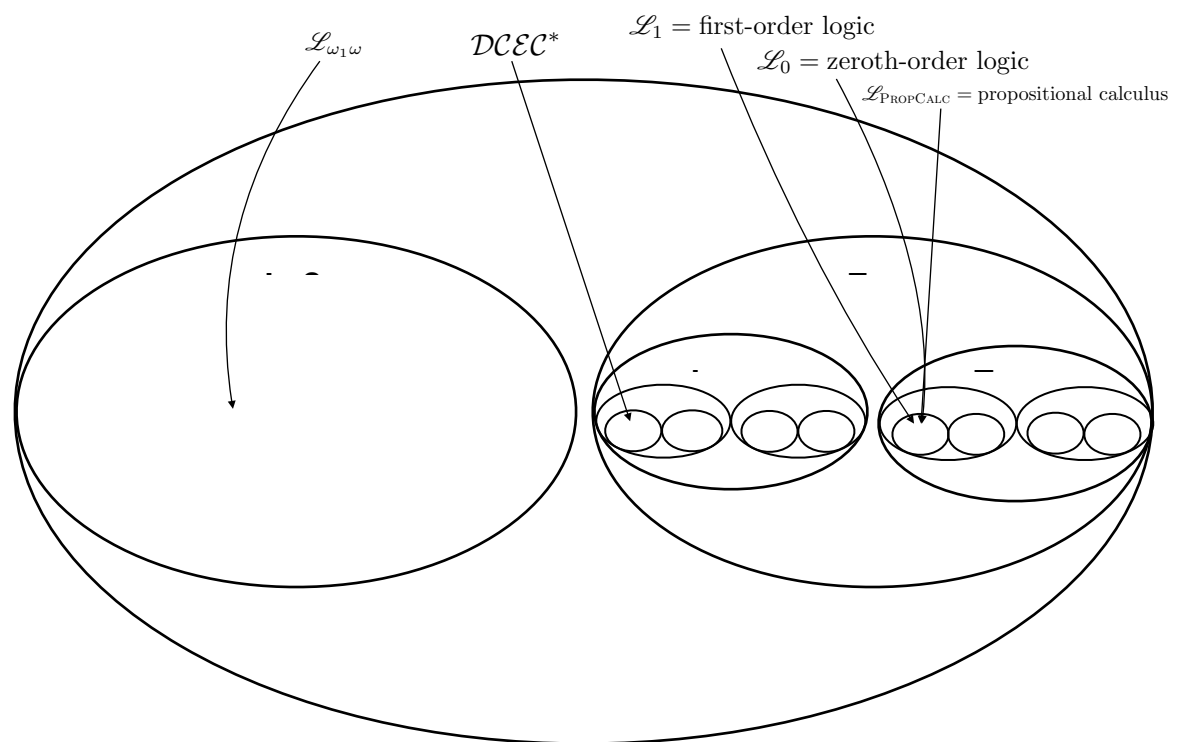


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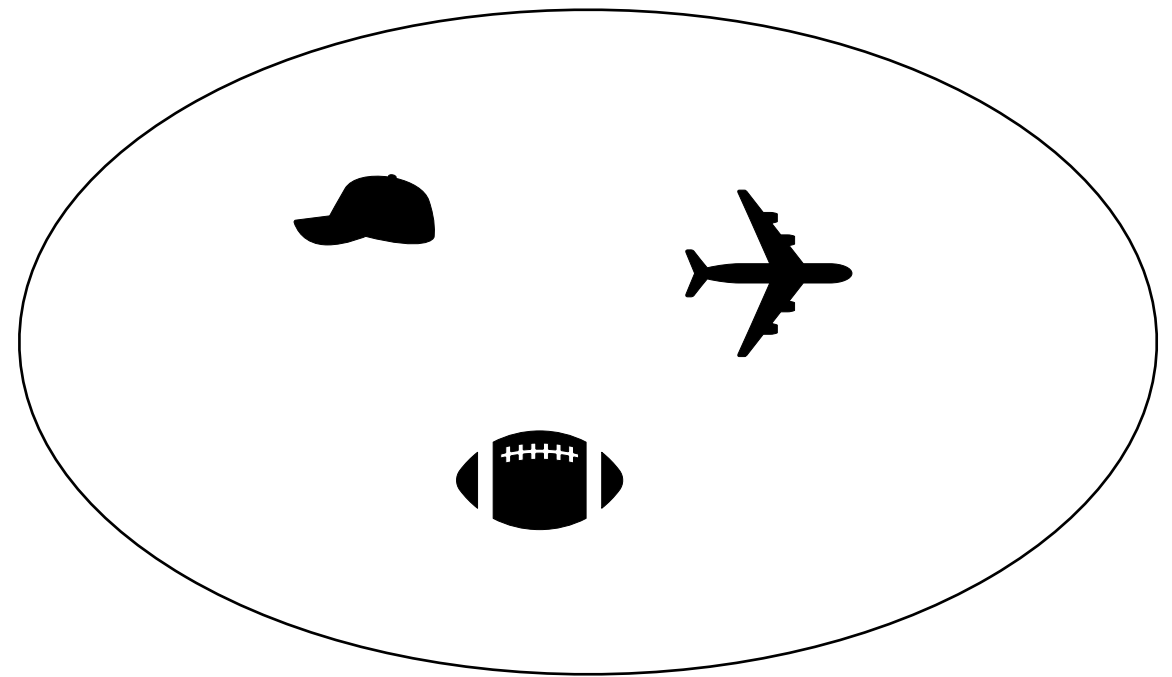


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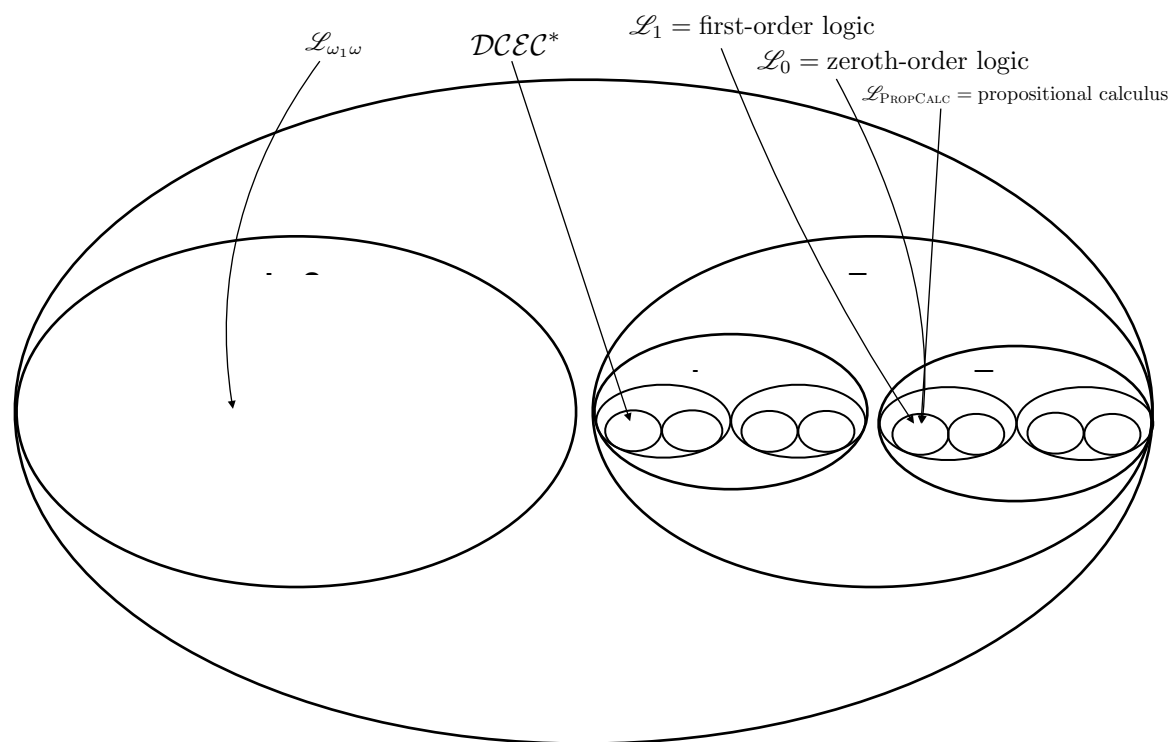


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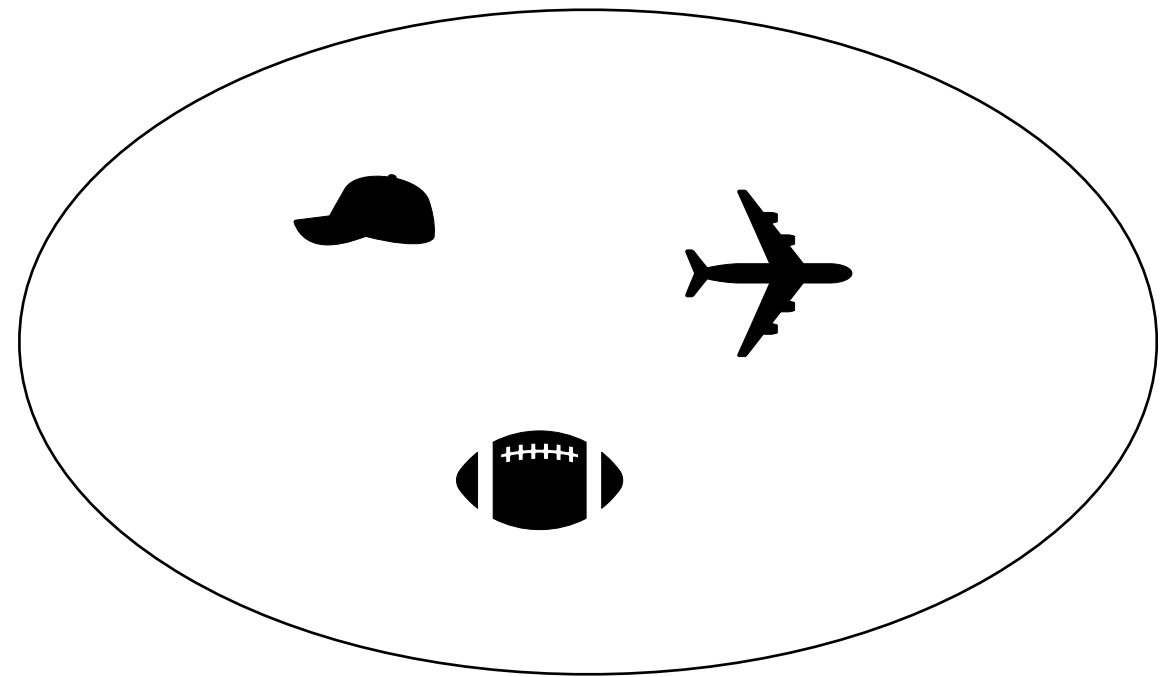


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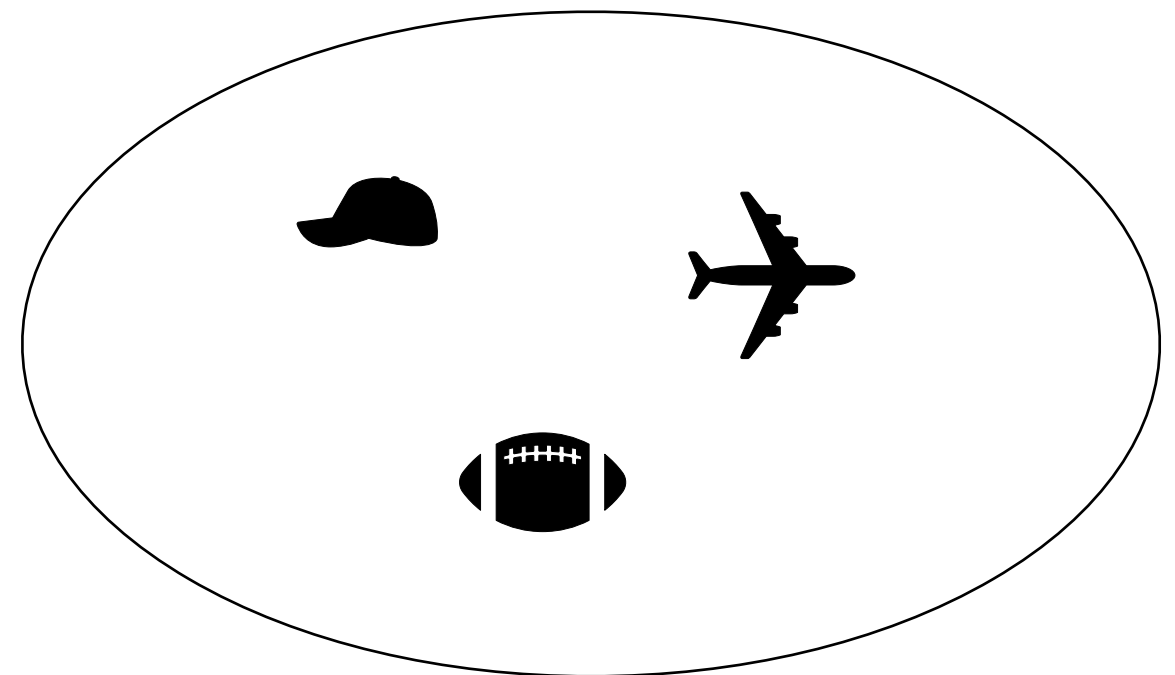
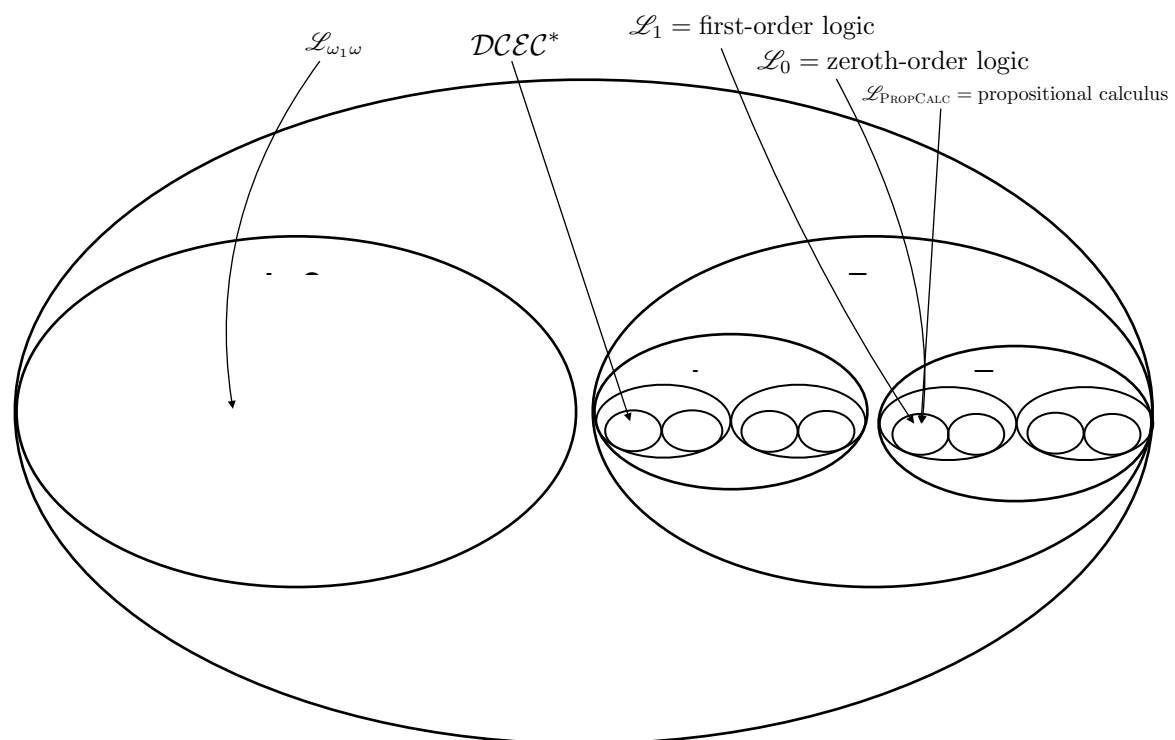
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modus ponens

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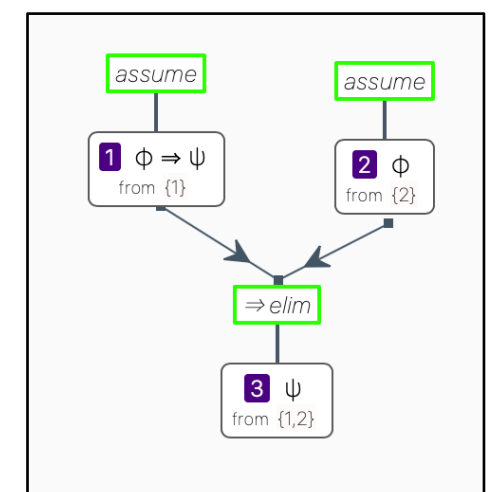
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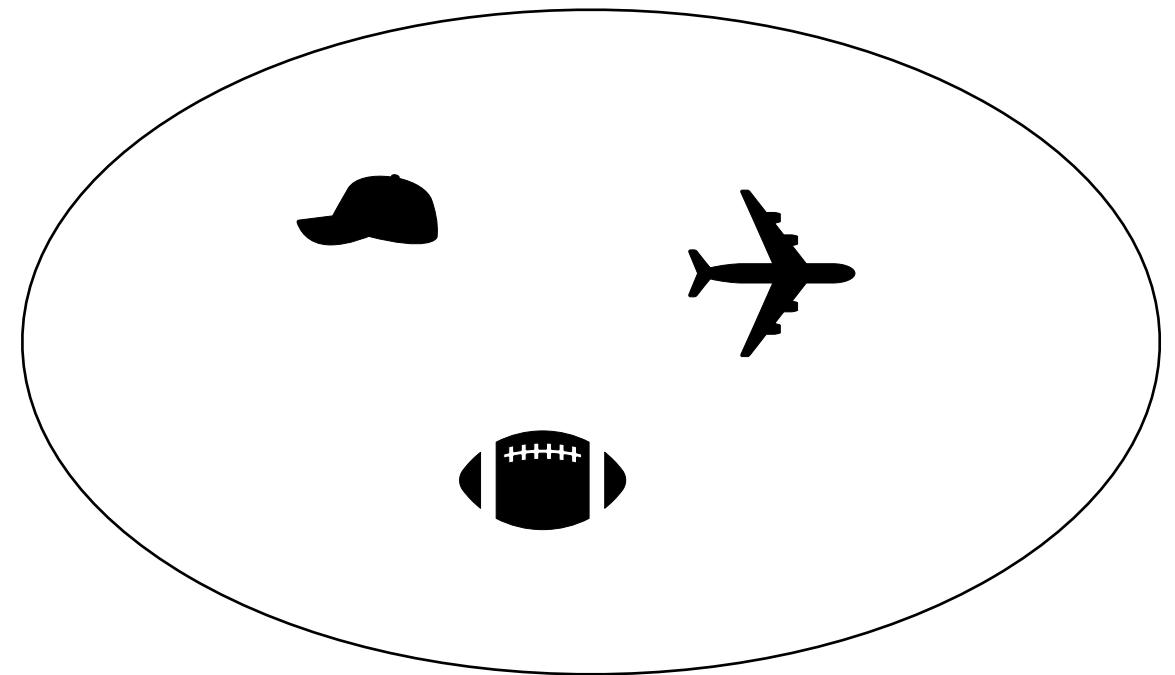
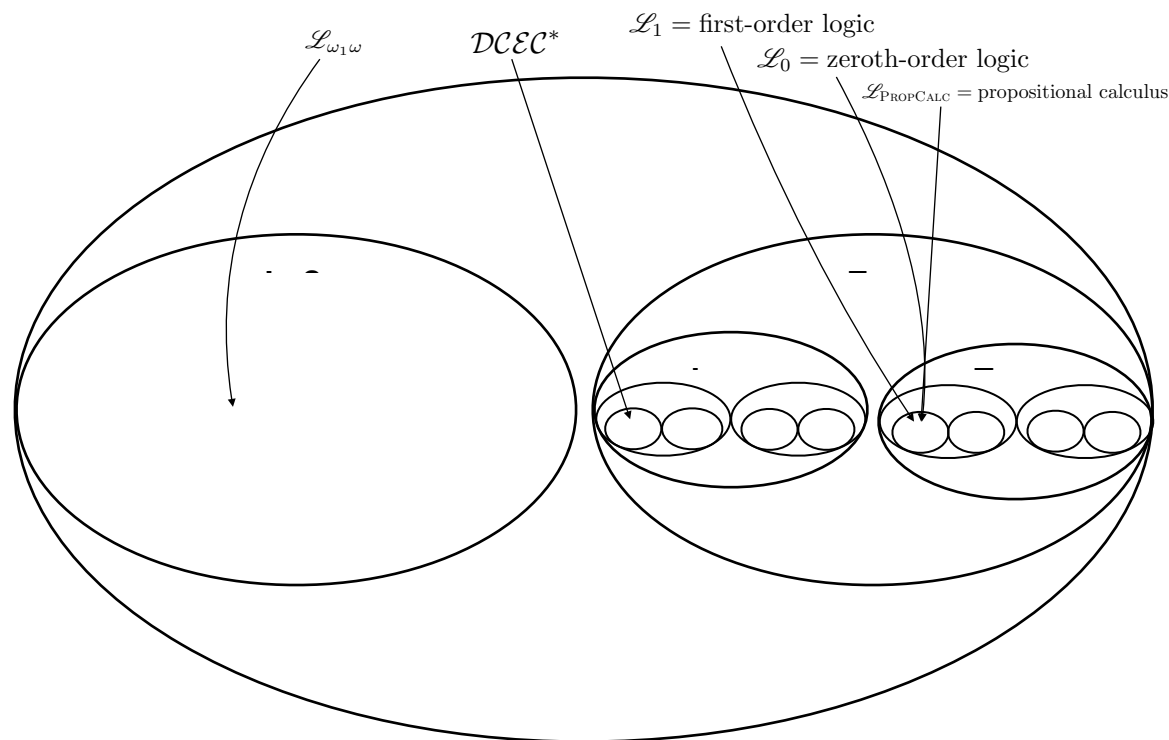
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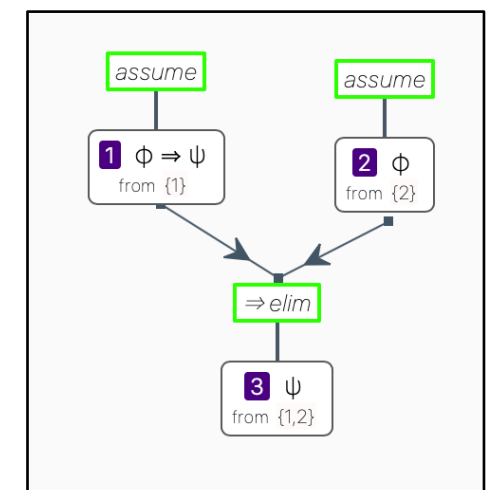
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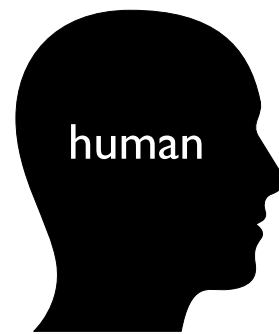


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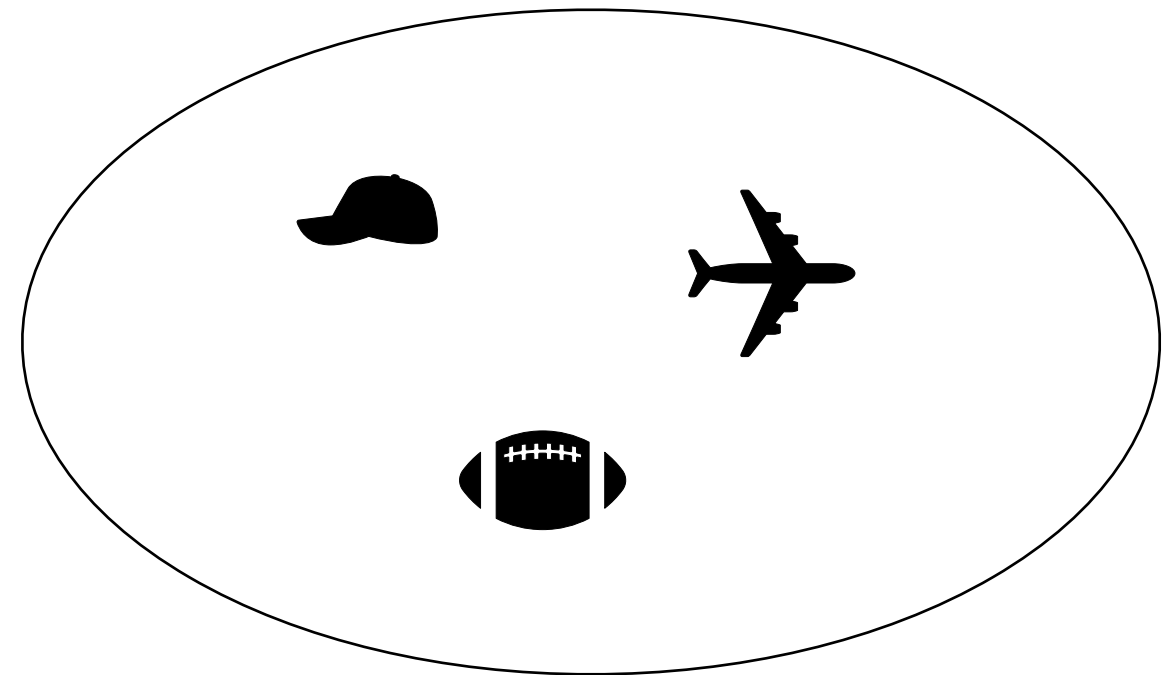
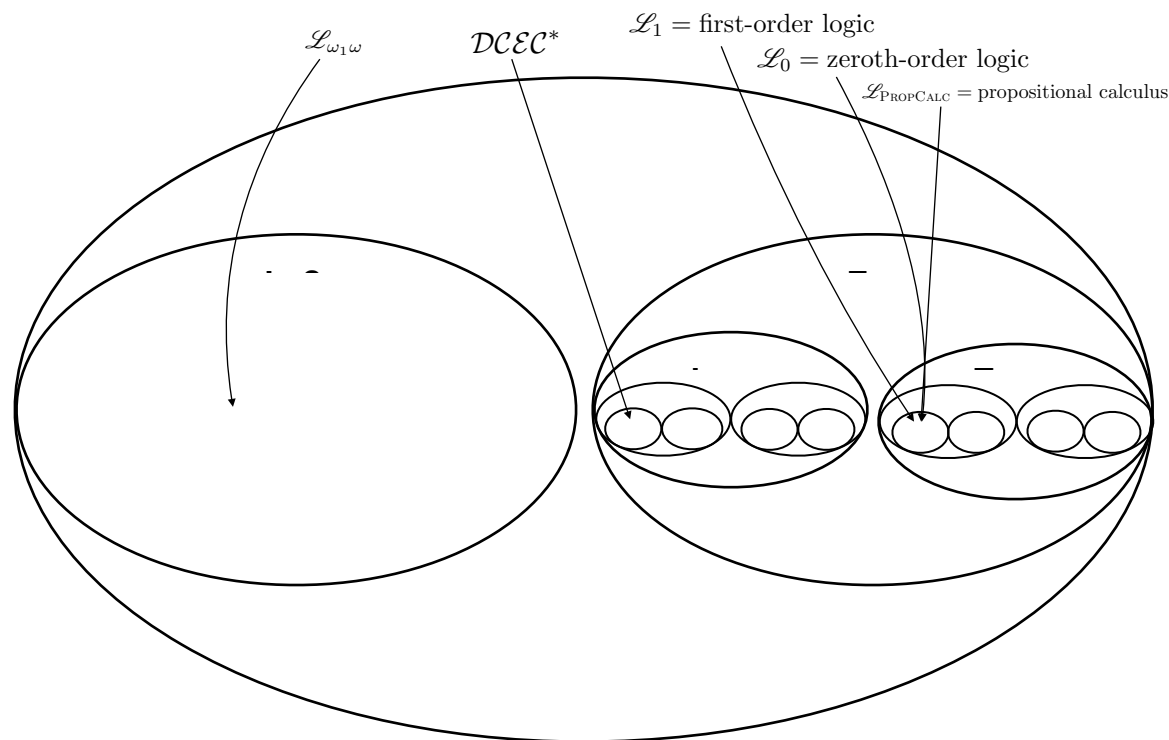


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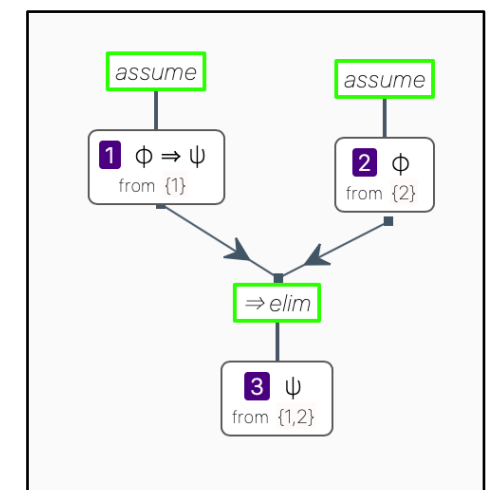
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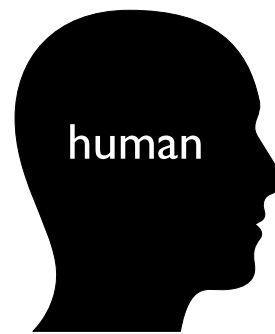


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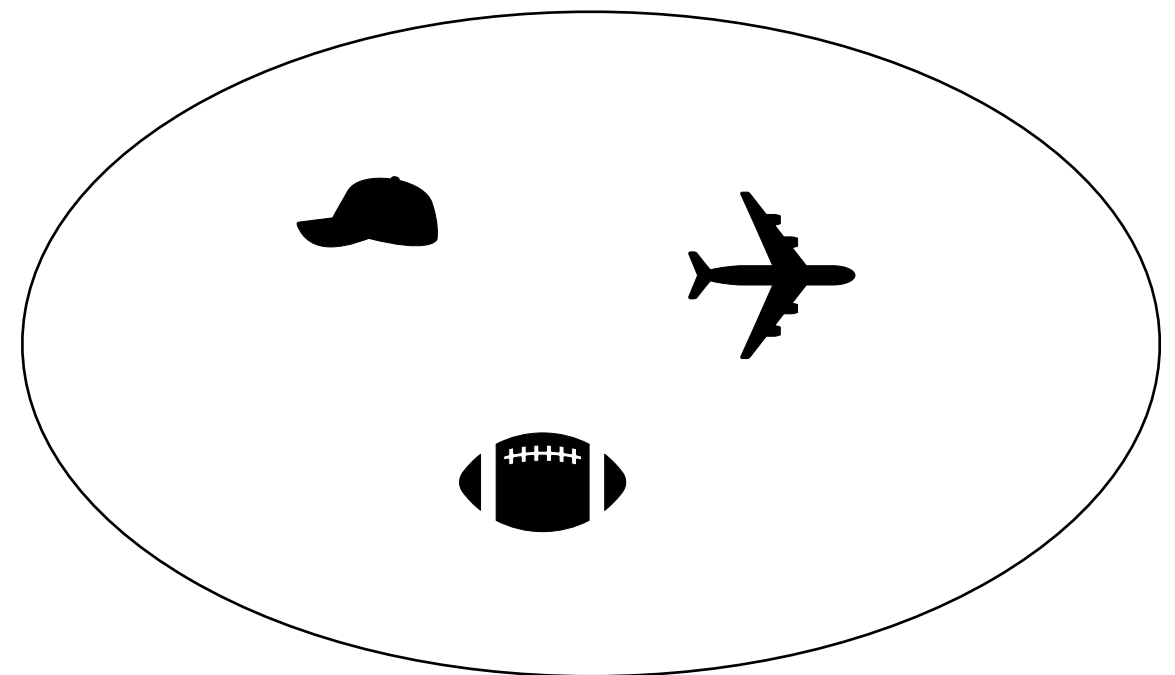
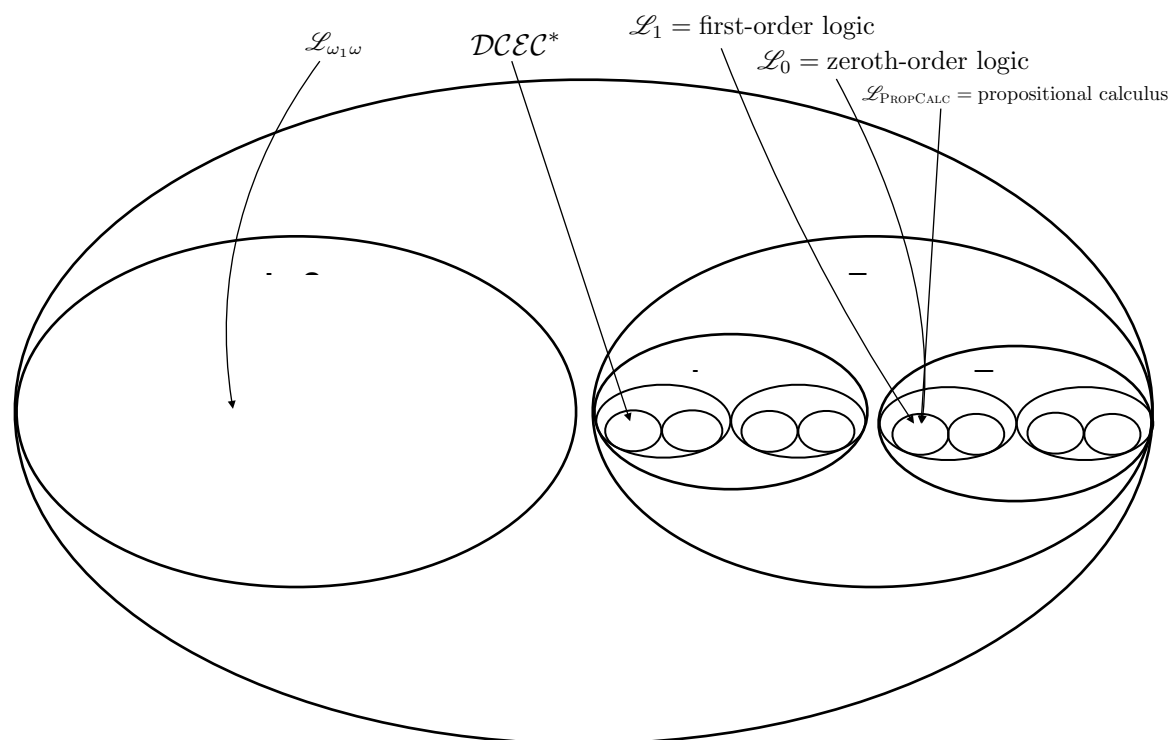


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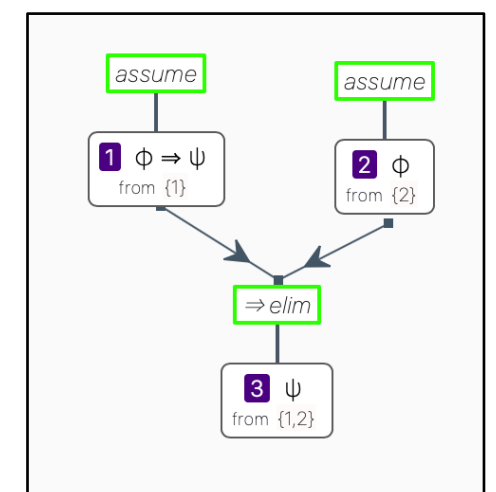
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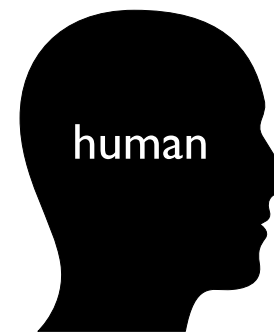
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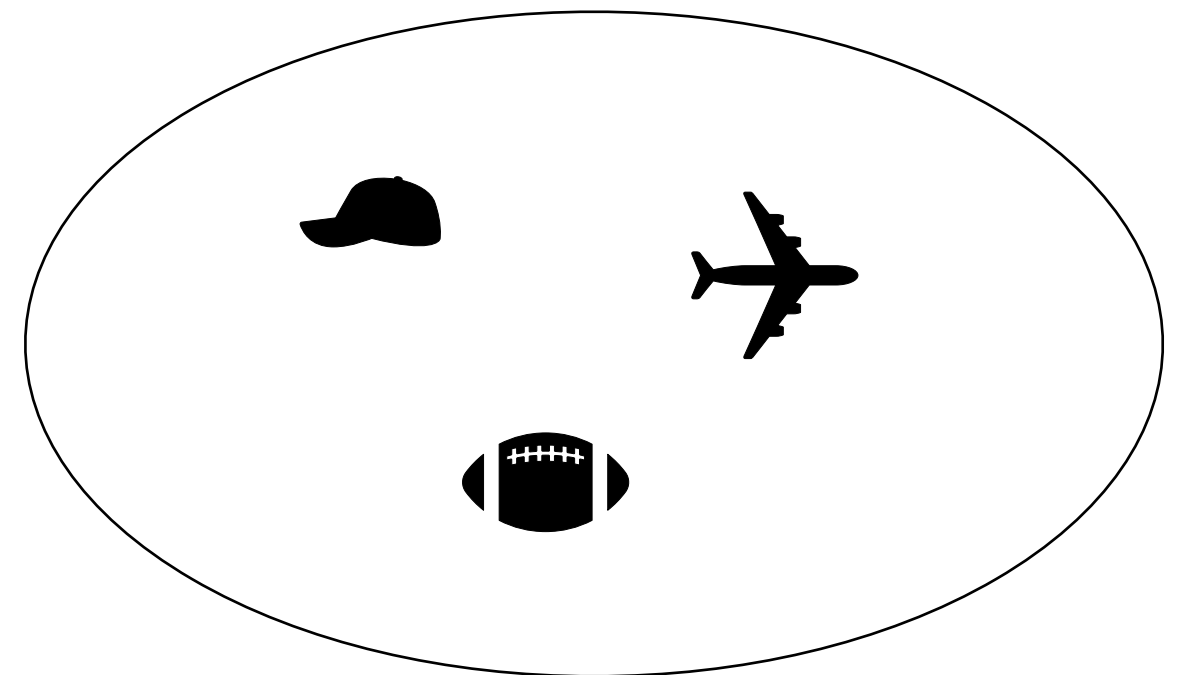
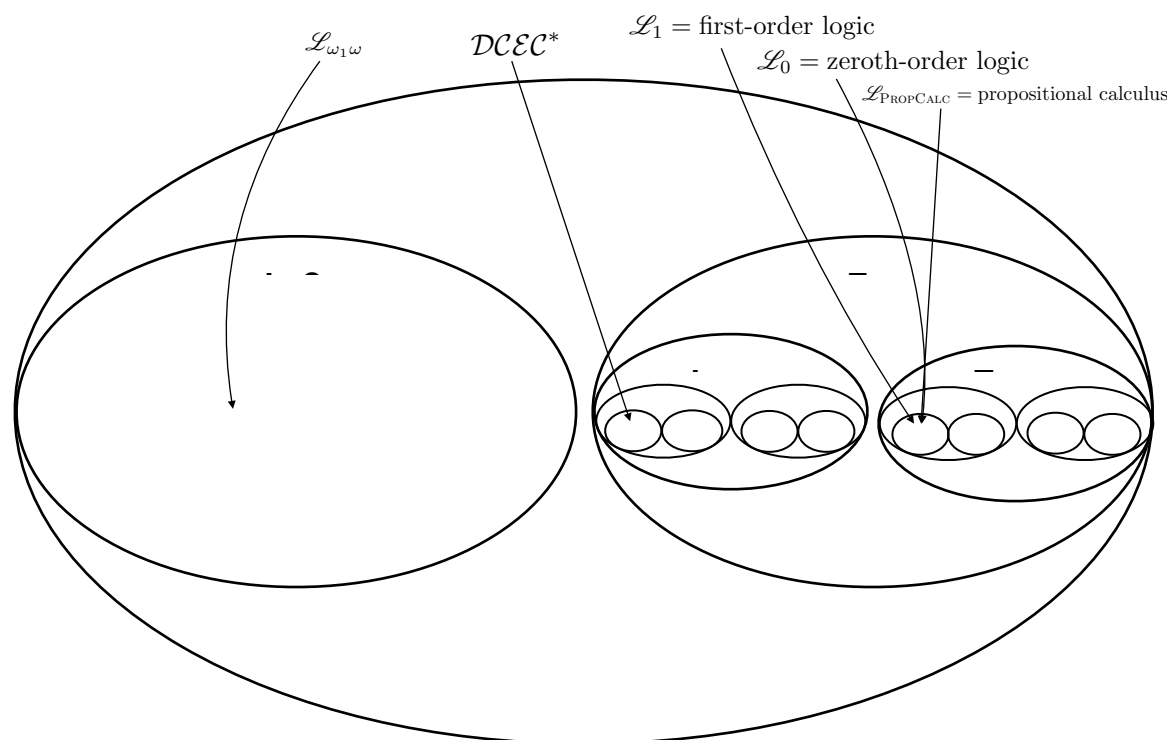


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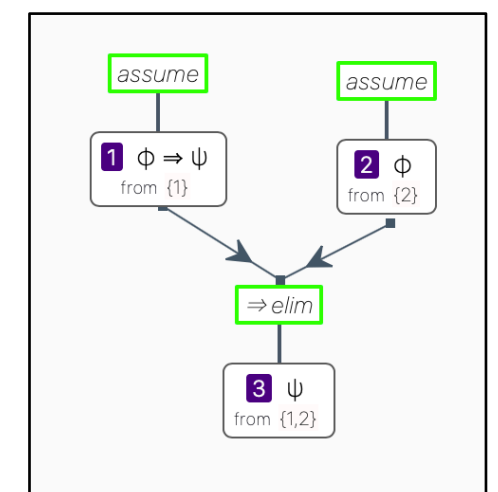


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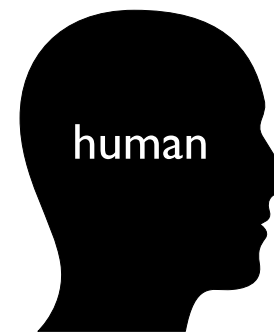
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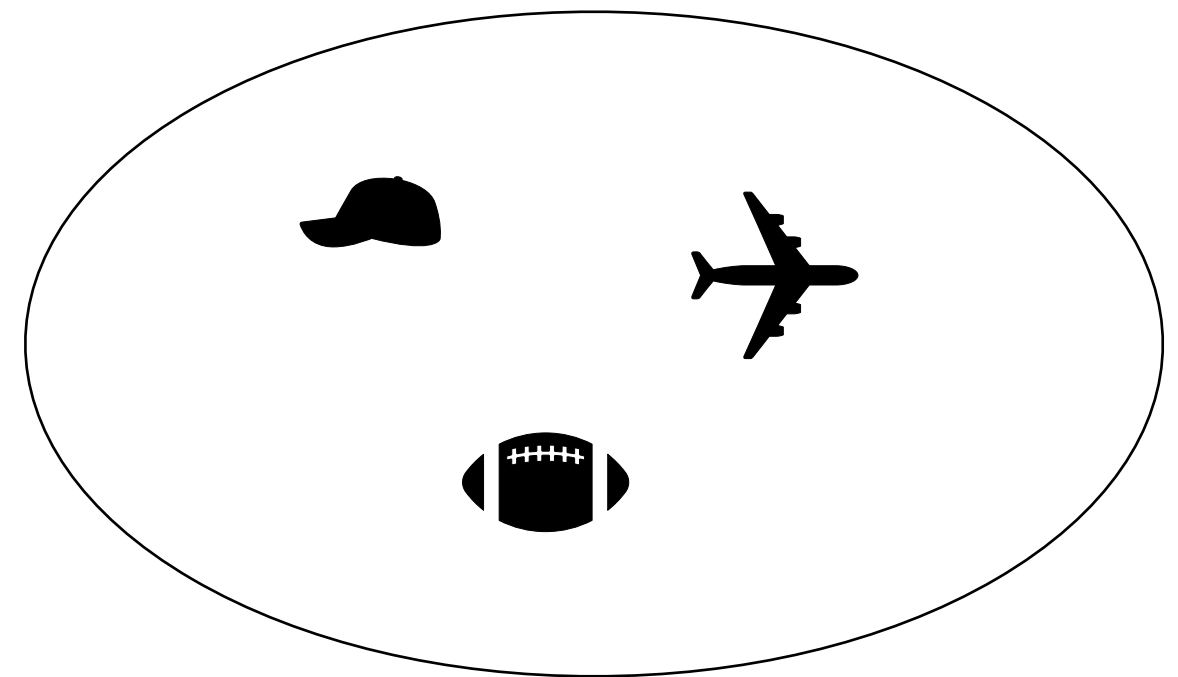
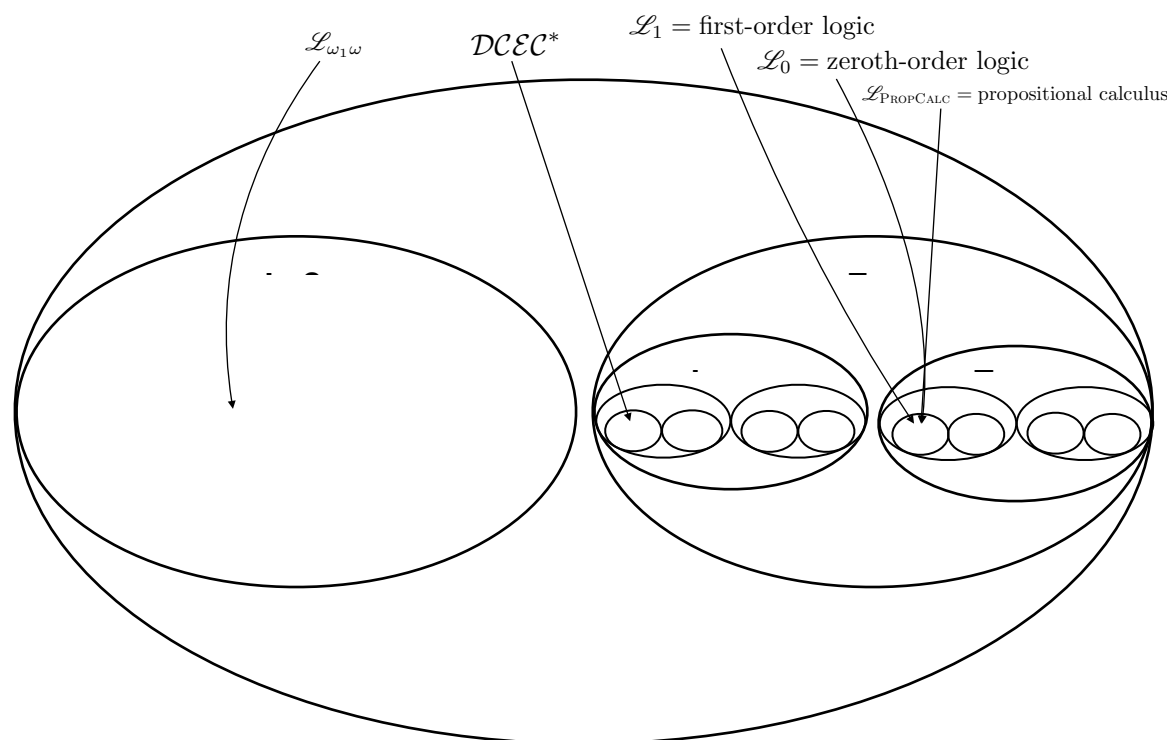


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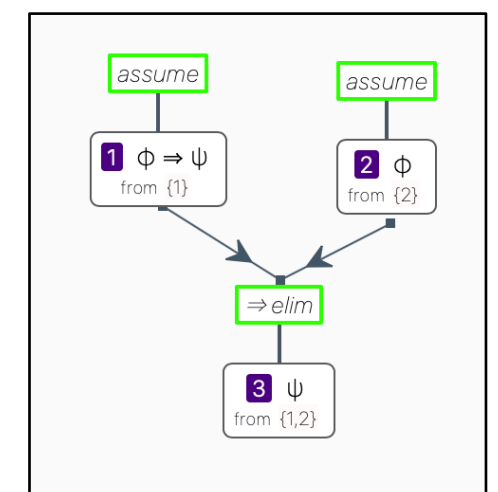


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Really? I’m skeptical. What’s so special about us?

abstract-and-valid inference schemata

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What *is* Logic?

- The key to becoming rational.
- “The science and engineering of reasoning.” — so the not-unreasonable slogan goes.
- The only invincible subject there is.
- The basis for the formal sciences (from mathematics to game theory to decision theory to probability calculi to axiomatic physics) — and hence the basis for disciplines based on the formal sciences (e.g., engineering, computer science).
 - Computer Science!
- The way of escape from shallow content and context to pure, immaterial, and immortal form and structure (which is why the exotic, imaginary, and seemingly non-sensical is so pedagogically useful).
- The most challenging subject there is.
- One of the chief differentiators between dogs and monkeys versus you (let alone bears and you); and mindless machines (like Deep Blue & Watson) versus you.
- A key to riches.
- The key to divining the meaning of life (and other such big questions).
- The better way to program computers; and fundamentally the *only* way to *reliably* program computers.
- One of two fundamental approaches to studying minds, and replicating/simulating minds in machines...
- The thing many creatures of fiction have mastered — have you (as a New Yorker)?...
- ...

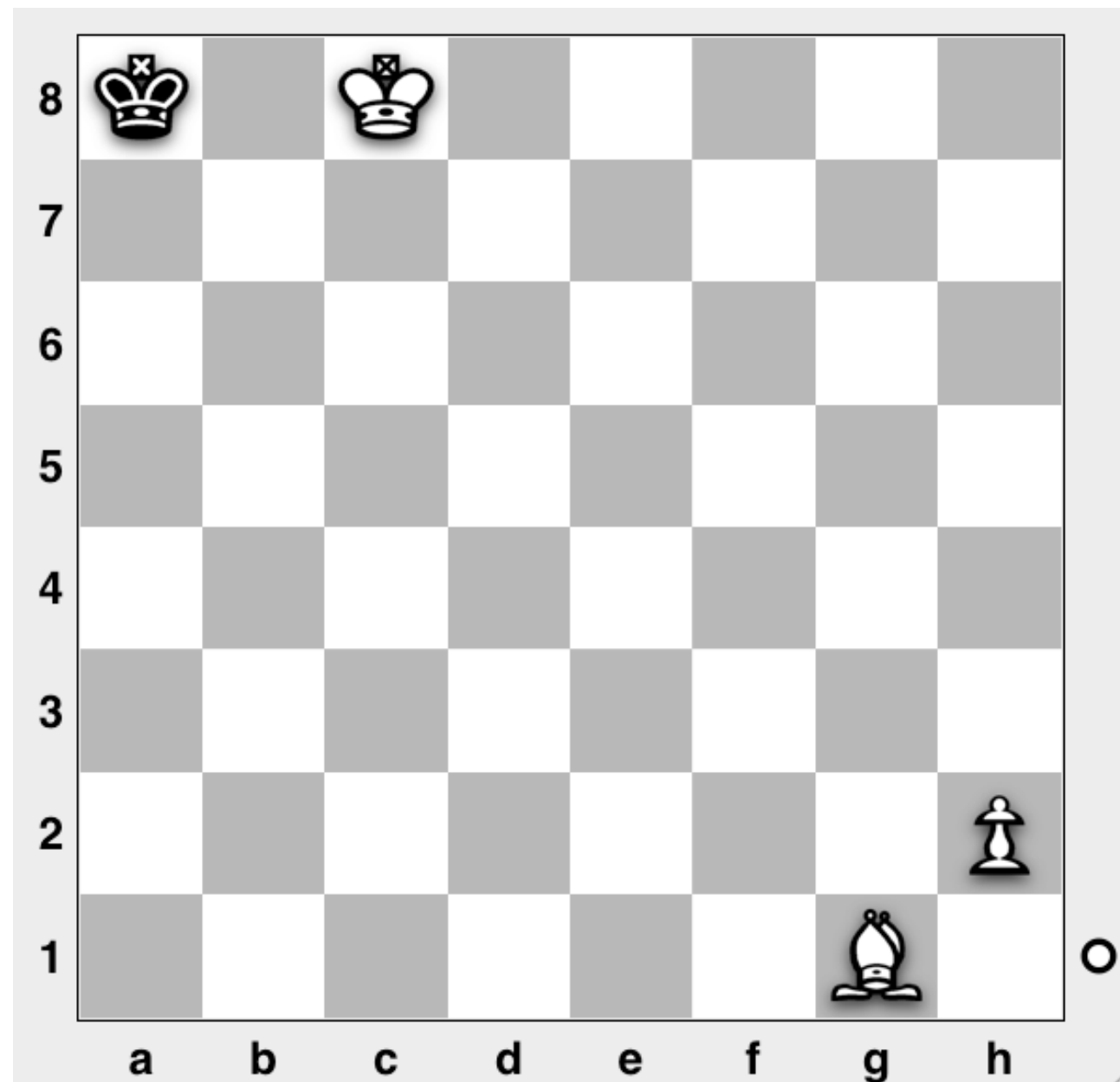
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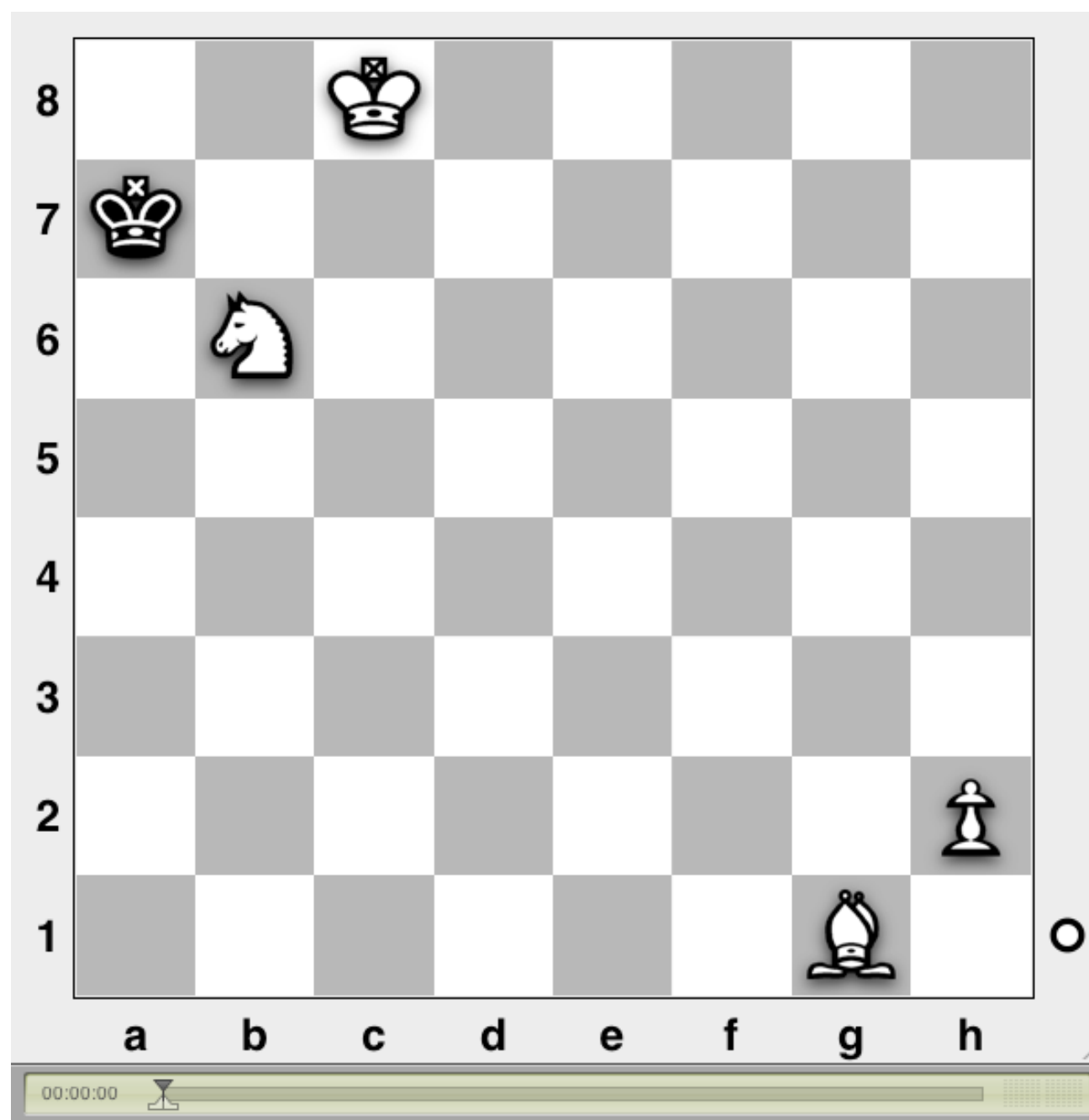
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It's White's turn. What move did Black just make?



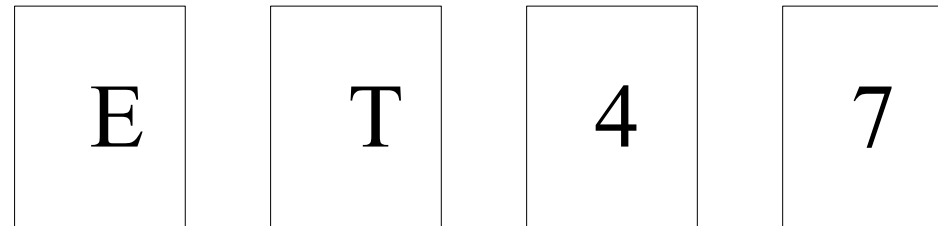
Aha! (Beyond Deep Blue?)

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NOTE: Every card in this game has a capital Roman letter on one side, and a number from 1 to 9, inclusive.

Simple Selection Task



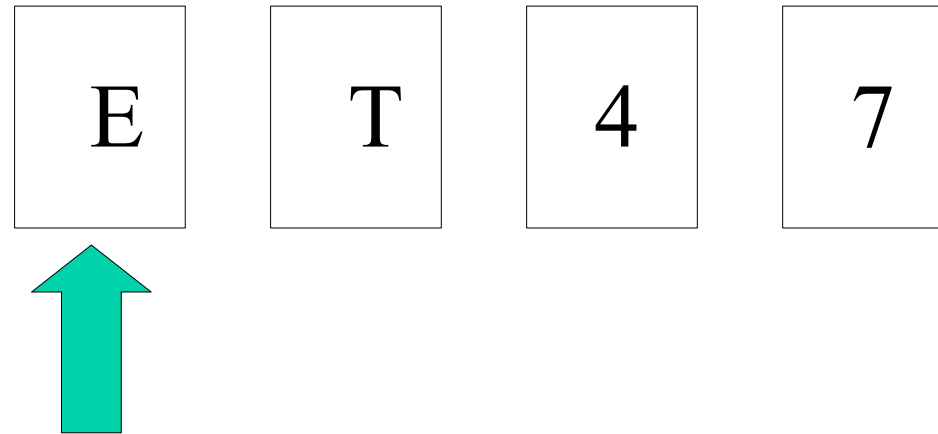
Suppose I claim that the following rule is true.

If a card has a vowel on one side, it has an even number on the other side.

Which card or cards, if any, should you turn over in order to try to efficiently decide whether the rule is true or false?

NOTE: Every card in this game has a capital Roman letter on one side, and a number from 1 to 9, inclusive.

Simple Selection Task



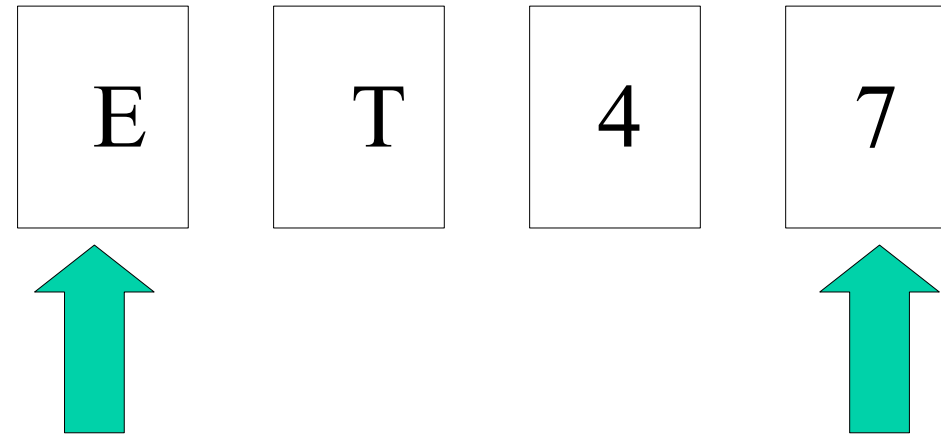
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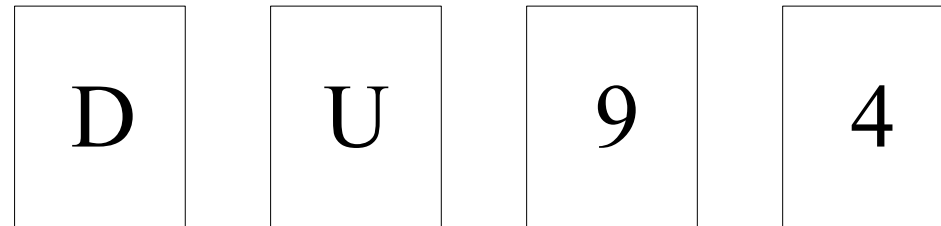


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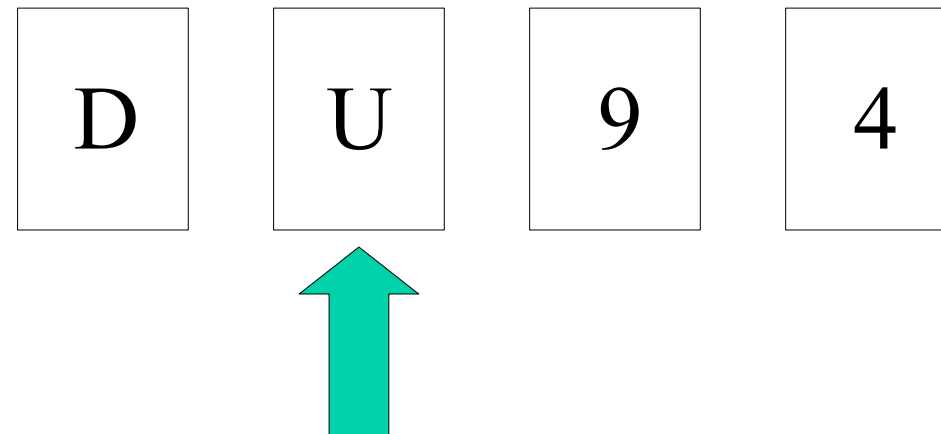


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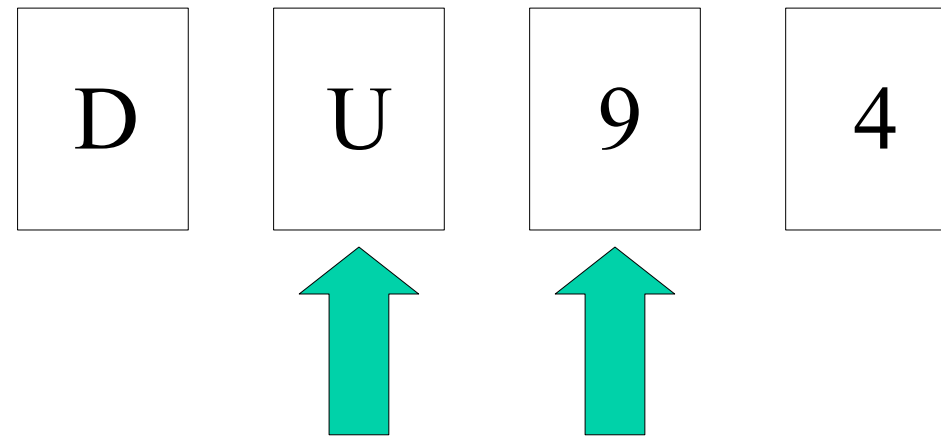


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1	2	3	4

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POLL: Chat your answer now. To suggest flipping a card or cards, just type in the corresponding #/#s, e.g. '1' would be a suggestion to flip card #1.

Another Simple Selection Task

D	U	7	4
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Suppose I claim that the following rule is true.

If a card has a letter on one side, it has a prime number on the other side.

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The Original King-Ace

Suppose that the following premise is true:

If there is a king in the hand, then there is an ace in the hand, or else if there isn't a king in the hand, then there is an ace.

What can you infer from this premise?

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There is an ace in the hand.

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In fact, what you *can* infer is that there *isn't* an ace in the hand!

King-Ace 2

Suppose that the following premise is true:

If there is a king in the hand, then there is an ace in the hand; or if there isn't a king in the hand, then there is an ace; but not both of these if-then statements are true.

What can you infer from this premise?

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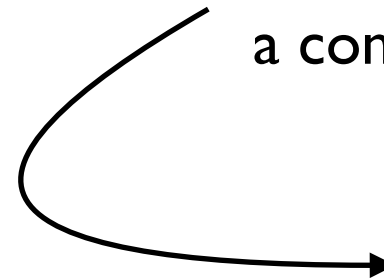
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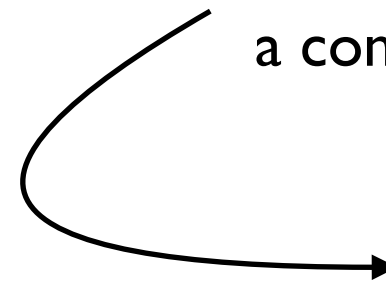
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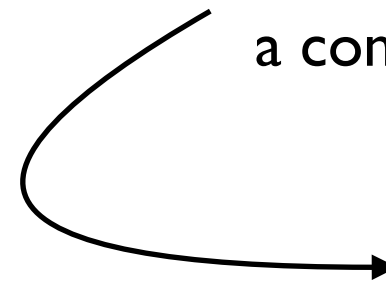
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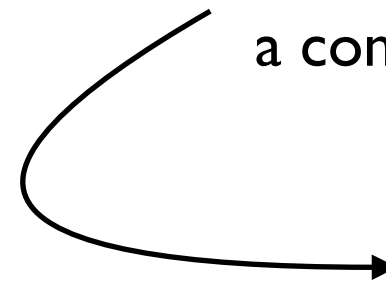
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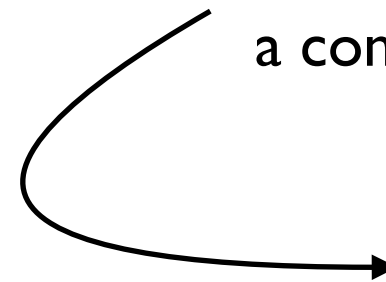
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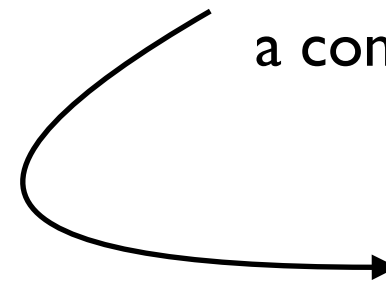
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STARTING \geq 2/8/21

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King-Ace Solved

(informal proof)

Proposition: There is *not* an ace in the hand.

Proof: We know that at least one of the if-thens (i.e., at least one of the **conditionals**) is false. So we have two cases to consider, viz., that $K \Rightarrow A$ is false, and that $\neg K \Rightarrow A$ is false. Take first the first case; accordingly, suppose that $K \Rightarrow A$ is false. Then it follows that K is true (since when a conditional is false, its antecedent holds but its consequent doesn't), and A is false. Now consider the second case, which consists in $\neg K \Rightarrow A$ being false. Here, in a direct parallel, we know $\neg K$ and, once again, $\neg A$. In both of our two cases, which are exhaustive, there is no ace in the hand. The proposition is established. **QED**

Bringsjord I

(1) The following three assertions are either all true or all false:

If Billy helped, Doreen helped.

If Doreen helped, Frank did as well.

If Frank helped, so did Emma.

(2) The following assertion is definitely true: Billy helped.

Can it be inferred from (1) and (2) that Emma helped?

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Can it be inferred from (1) and (2) that Emma helped?

YUP! — & now prove it!

Bringsjord I: Proof

Proof: We have two cases to work from: when the conditionals in (1) are all true, and when they are all false. (In both cases, (2) remains true, and available.) So assume Case 1 first. In this case, we can simply chain through the conditionals by repeated application of *modus ponens* to arrive at the conclusion that Emma helped. Now assume Case 2 holds. This immediately implies that the first two conditionals are false; i.e., we have $\sim(B \Rightarrow D)$ and $\sim(D \Rightarrow F)$. Recalling that a conditional fails to hold exactly when its antecedent is true while its consequent is false, we have, in turn: $B \ \& \ \sim D$, and $D \ \& \ \sim F$. But then we have a contradiction, viz. $\sim D \ \& \ D$. Since everything follows (“explosively”!) from a contradiction, we are done. **QED**

Logic kan redde menneskehten!