Talking Negative Probability with AI and an Axiom Violation

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Abstract

In this brief philosophical and mathematical musing, we explore an unconventional approach to interpreting *negative probabilities*: what if they arise naturally from the presence of an **odd number of logical negations** in a mathematical statement? We propose the *Negation Sign Inversion Principle (NSIP)* and discuss its potential implications in classical and quantum probabilistic reasoning.

1 The Core Idea

We define a new rule:

Negation Sign Inversion Principle (NSIP):

> A probabilistic statement that contains an **odd number of logical negations** is assigned a **negative sign**. A statement with an even number of negations retains a positive sign.

The following table summarizes the behavior:

Statement	Negation Count	Assigned Probability
A	0 (even)	$+p$
$\neg A$	1 (odd)	$-p$
$\neg\neg A$	2 (even)	$+p$
$\neg\neg\neg A$	3 (odd)	$-p$

2 Why It Violates the Axioms

In classical probability theory, the Kolmogorov axioms require:

- $0 \leq P(A) \leq 1$
- $P(\neg A) = 1 - P(A)$

Assigning $-p$ to $P(\neg A)$ contradicts the second axiom and introduces negative measures, thus violating standard assumptions. Yet, in quantum theory, *negative probabilities* appear — not as literal frequencies, but as artifacts in quasiprobability distributions (e.g., Wigner functions).

3 Interpretation and Potential

The odd-negation framework can be viewed as a symbolic or logical abstraction rather than a numerical measure. It offers possible metaphoric or structural explanations for:

- Interference patterns in quantum mechanics
- Signed measures in mathematical logic
- Semantic reversals in language and cognition

Example Questions Arising

- How does $P(A \wedge \neg A)$ behave under this model?
- Can this negation principle aid in modeling quantum contextuality?
- What happens to Bayes' rule under sign-inverted conditionals?

4 Conclusion

This proposal is not a revision of probability theory, but a provocation — to think differently about negation, contradiction, and the edge cases where intuition breaks. The Negation Sign Inversion Principle (NSIP) may have metaphorical power, or it may be formalizable in a new logic for uncertain reasoning — possibly one suited to the post-classical, AI-assisted world.

Contact

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