# Evaluation of the Alpöge–Claude Riemann Hypothesis Lean Release in Meth8/VŁ4

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## Abstract

Levent Alpöge, a mathematician at Anthropic, released Lean code that he says proves, with Claude, the Riemann Hypothesis (RH) and the Generalized Riemann Hypothesis. This paper presents the reported claims, maps their propositional structure to the Meth8/VŁ4 quad-valent modal logic, and evaluates each formula by truth table, including necessity (#) renderings. In every formula tested, only the argument form of modus ponens over the Lean premises is a tautology. All other claims, including every # rendering, are non-tautologous. In Meth8 terms the release and its assertion are not by themselves a theorem. The conclusion depends on two premises: that the Lean archive builds and is accepted by the kernel, and that its theorem statement is faithful to RH. Meth8 evaluates propositional structure only. It does not check the mathematics.

## 1. Claims as reported

Press outlets reported the following claims on November 20, 2026. They come from secondary coverage of Alpöge's website note, not from the Lean files themselves.

- Result. Alpöge says he and Claude proved RH and the Generalized Riemann Hypothesis [1][2]. He expects, with more time, to extend the method to the Extended Riemann Hypothesis [3].
- Formal proof. Alpöge wrote the proof in Lean, a proof assistant that checks each step mechanically, and released it as 14 downloadable archive parts [4][5].
- Assumptions. He writes: *"Claude and I have also formalized the arguments without assumptions."* [6]
- Length and write-up. He describes the argument as very long, chose to present only the Lean, and promises a written paper and simplifications later [4]. A footnote reportedly says a full written version ran past 250,000 pages [7].
- Method. Reports say the argument descends from Stepanov's method, which proves RH for function fields [8].
- Size. Reports say the release holds about 175,187 Lean source files and roughly 239 MB of data [7].

## 2. Verification status

At the time of writing, reports conflict, and the status remains unsettled.

- The repository README reportedly says that, as of the November 20 mirror, no one had published an independent build or review [6].
- One outlet reports that MIT mathematician Andrew Sutherland told Scientific American on November 20 that he independently checked the result in Lean [7]. This paper found that report in a single outlet only and treats it as unconfirmed.
- A separate earlier result by Alpöge, Furman and Anthropic proved that more than 67.25007% of the nontrivial zeros of the zeta function lie on the critical line and are simple. That result does not prove RH [9].

## 3. Method: Meth8/VŁ4

Meth8/VŁ4 is a quad-valent modal logic with the values F=(0,0), N=(0,1), C=(1,0) and T=(1,1). Only T validates a tautology, and a theorem is a formula whose truth table is all T [10]. This paper follows the author's description of the system:

- Propositional variables (p, q, r, s, t) take values F and T only. N and C arise only through connectives and modal operators.
- Rows enumerate with the first variable varying fastest and F before T. Five variables give a 32-value table, and this paper writes each table in groups of four.
- A well-formed formula has the form antecedent, connective, consequent. The system writes a necessity claim as #X = (s=s), where (s=s) is the proof identity T.

Each connective table has the antecedent as row and the consequent as column, both in the order F, C, N, T, and reads row-major:

| Operator | Symbol | Table (row-major) |
|---|---|---|
| Conjunction | & | `FFFF FCFC FFNN FCNT` |
| Implication | > | `TTTT NTNT CCTT FCNT` |
| Equivalence | = | `TNCF NTFC CFTN FCNT` |
| Negation | ~ | `F→T, T→F, C→N, N→C` |
| Necessity | # | `F→F, C→F, N→N, T→N` |
| Possibility | % | `F→C, C→C, N→T, T→T` |

## 4. Mapping

Five propositional atoms carry the claims:

| Atom | Meaning |
|---|---|
| p | Alpöge released the 14-part Lean archive. |
| q | Alpöge says he formalized the arguments without assumptions. |
| r | The archive builds and Lean's kernel accepts it using only standard axioms. |
| s | The formal theorem statement is faithful to RH. |

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| Atom | Meaning |
|---|---|
| t | A proof of RH exists. |

Ten formulas express the claims. Possibility (%) models "possibly proved" in place of "proved." This paper reads the unverified status of a claim as C (contingent). That reading is the author's interpretive choice, not a definition of the system.

| ID | Claim |
|---|---|
| A1 | Alpöge released the archive and made the claim |
| A2 | Release and claim imply proof |
| A3 | Release and claim imply possible proof |
| A4 | Release and claim imply possibly verified and faithful |
| A5 | Verified and faithful imply proof |
| A6 | Verified and faithful imply possible proof |
| A7 | Possibly verified and faithful implies possible proof |
| A8 | Modus ponens on the Lean premises |
| A9 | A proof of RH exists |
| A10 | A proof of RH possibly exists |

## 5. Results

Table 1 gives the plain truth table of each formula. Table 2 gives each formula under necessity, written #X = (s=s).

**Table 1. Plain forms**

| ID | Formula | Result (32 rows) | T count |
|---|---|---|---|
| A1 | p&q | FFFT FFFT FFFT FFFT FFFT FFFT FFFT FFFT | 8/32 |
| A2 | (p&q)>t | TTTF TTTF TTTF TTTF TTTT TTTT TTTT TTTT | 28/32 |
| A3 | (p&q)>%t | TTTC TTTC TTTC TTTC TTTT TTTT TTTT TTTT | 28/32 |
| A4 | (p&q)>%(r&s) | TTTC TTTC TTTC TTTT TTTC TTTC TTTC TTTT | 26/32 |
| A5 | (r&s)>t | TTTT TTTT TTTT FFFF TTTT TTTT TTTT TTTT | 28/32 |
| A6 | (r&s)>%t | TTTT TTTT TTTT CCCC TTTT TTTT TTTT TTTT | 28/32 |
| A7 | %(r&s)>%t | TTTT TTTT TTTT CCCC TTTT TTTT TTTT TTTT | 28/32 |
| A8 | ((((r&s)>t)&r)&s)>t | TTTT TTTT TTTT TTTT TTTT TTTT TTTT TTTT | 32/32 |
| A9 | t | FFFF FFFF FFFF FFFF TTTT TTTT TTTT TTTT | 16/32 |
| A10 | %t | CCCC CCCC CCCC CCCC TTTT TTTT TTTT TTTT | 16/32 |

**Table 2. Necessity renderings**

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| ID | Formula | Result (32 rows) |
|---|---|---|
| A1 | #(p&q)=(s=s) | FFFN FFFN FFFN FFFN FFFN FFFN FFFN FFFN |
| A2 | #((p&q)>t)=(s=s) | NNNF NNNF NNNF NNNF NNNN NNNN NNNN NNNN |
| A3 | #((p&q)>%t)=(s=s) | NNNF NNNF NNNF NNNF NNNN NNNN NNNN NNNN |
| A4 | #((p&q)>%(r&s))=(s=s) | NNNF NNNF NNNF NNNN NNNF NNNF NNNF NNNN |
| A5 | #((r&s)>t)=(s=s) | NNNN NNNN NNNN FFFF NNNN NNNN NNNN NNNN |
| A6 | #((r&s)>%t)=(s=s) | NNNN NNNN NNNN FFFF NNNN NNNN NNNN NNNN |
| A7 | #(%(r&s)>%t)=(s=s) | NNNN NNNN NNNN FFFF NNNN NNNN NNNN NNNN |
| A8 | #(((((r&s)>t)&r)&s)>t)=(s=s) | NNNN NNNN NNNN NNNN NNNN NNNN NNNN NNNN |
| A9 | #t=(s=s) | FFFF FFFF FFFF FFFF NNNN NNNN NNNN NNNN |
| A10 | #%t=(s=s) | FFFF FFFF FFFF FFFF NNNN NNNN NNNN NNNN |

Observations from the computed tables:

- Only A8, modus ponens over the Lean premises, is a tautology (all T). Every other plain form has at least one non-T row.
- No necessity rendering is a tautology. In every case #X yields N in rows where X is T and F in rows where X is F or C.
- The # operator removes the distinction between F and C. A2 and A3 differ in Table 1 (F versus C in the failing rows), yet their necessity renderings are identical.
- A9 and A10 differ in Table 1 but give the same # result: F where t is F, and N where t is T. Necessary proof is therefore not a theorem even when t is true.
- A8 under # is all N. The argument form is a theorem only in its plain form.

## 6. Discussion

The plain forms show where the claim is open. A2 and A3 fail in rows where p and q hold but t does not, and A4 fails where p and q hold but r and s do not both hold. Releasing code and asserting a formalization does not settle that the code builds, or that its statement is RH. A5 shows the same gap: even verified and faithful code gives t only when the bridge premise holds, namely that Lean's kernel is sound and the statement means RH.

A8 shows the logical form is sound once one grants the premises. This is the situation the public reports describe. The inference is straightforward. The weight rests on r, which the current reports dispute, and on s, which no one has publicly checked. The # renderings add that the system never certifies necessity as a theorem. The value N marks a formula as non-contingent in the rows where it holds but never as proof.

This evaluation has limits. Meth8 evaluates the propositional skeleton over a finite universe. It does not examine Lean code, the Stepanov-style argument, or the correctness of the theorem statement. It cannot confirm or refute RH. The result is a structured statement of what would have to be true for the claim to hold.

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## 7. Conclusion

In Meth8/VŁ4, the Alpöge–Claude claim is not a theorem on the strength of its release and assertion. Of the ten formulas this paper evaluates, only the argument form over the Lean premises is a tautology, and no necessity rendering is. The claim stands or falls on independent confirmation that the archive builds and that its statement faithfully expresses RH.

## Note on preparation

Claude assisted in drafting this paper. Claude is the model Alpöge's note names as his collaborator. A short script implementing the connective, necessity and possibility tables above computed the truth tables, and the script reproduced the author's published examples.

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