Refutation of unfalsifiable conjectures

Abstract: In bivalent mathematical logic, the unfalsifiable conjecture is not contradictory, and hence tautologous to be a theorem. The theorem by definition is not contradictory, tautologous, and hence unfalsifiable. There is no distinction between the states of unfalsifiable or confirmable as opposed to falsifiable or refutable.

We assume the method and apparatus of Meth8/VŁ4 with `T`autology as the designated *proof* value, **`F`** as contradiction, `N` as truthity (non-contingency), and `C` as falsity (contingency). Results are a 16-valued truth table in row-major and horizontal, or repeating fragments of 128-tables for more variables.

LET p: p; ~ Not; + Or; & And; > Imply; = Equivalent;
(p=p) `T` tautology; (p@p) **`F`** contradiction.

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Let us assume that the ZFC axioms are consistent ... . Then what are the implications of proving that a mathematical conjecture is unfalsifiable? (1.1.0)

The answer is that even though an unfalsifiable conjecture might not be true, there is still no harm in assuming that it is true, since there is no chance that one could derive any provably false statements from it; (1.2.0)

if one could derive any provably false statements from an unfalsifiable conjecture, this would imply that the conjecture is falsifiable, which is a contradiction. (1.3.0)

Remark: In Eq. 1.1.0, The words "provably" or "proving" are redundant. We take "false" and "falsifiable" as equivalent to avoid semantic confusion and as equivalent to contradictory, and "unfalsifiable" to mean not contradictory. To assume ZFC as consistent (which we show elsewhere is *not* the case) is the equivalent to stating it is tautologous.

We write Eq. 1.1.0 as:

"If ZFC axioms are tautologous, then if a conjecture is not contradictory, [then subsequent implications follow]." (1.1.1)

(p=p)>~(p@p) ; `TTTT TTTT TTTT TTTT` (1.1.2)

Remark: In Eq. 1.2.0, the inexact use of the words "might", "no chance", and "any" are ignored to avoid injection of the modal states of possibility, not necessarily, and necessity. The words "no harm" are a metaphysical term.

We rearrange the verbiage order in Eq. 1.2.0 to read as:

"If a conjecture is not contradictory, then if it is tautologous, then it is not contradictory." (1.2.1)

~(p@p)>((p=p)>~(p@p)) ; TTTT TTTT TTTT TTTT (1.2.2)

We rearrange the verbiage order in the second sentence fragment to read:

"The sentence ((If a conjecture is not contradictory, then it is contradictory), then it is contradictory) is a contradiction." (1.3.1)

((~(p@p)>(p@p))>(p@p))=(p@p) ; FFFF FFFF FFFF FFFF (1.3.2)

We assume the semicolon between Eqs. 1.2.1 and 1.3.1 to mean an "and" pause to what follows and to serve as the operator And.

This produces the sentence of Eqs. 1.1.1 implies 1.2.1 or 1.3.1. (1.4.1)

((p=p)>~(p@p))>((~(p@p)>((p=p)>~(p@p)))&(((~(p@p)>(p@p))>(p@p))
=(p@p))) ; FFFF FFFF FFFF FFFF (1.4.2)

Eqs. 1.3.2 and 1.4.2 are *not* tautologous, hence refuting the proposition of unfalsifiable conjectures.

Remark: In bivalent mathematical logic, the unfalsifiable conjecture is not contradictory, and hence tautologous and a theorem. The theorem by definition is not contradictory, tautologous, and hence unfalsifiable. There is no distinction between the states of unfalsifiable or confirmable as opposed to falsifiable or refutable. This is in the spirit of Popper's *Conjecture and Refutation*.

The advantage of Meth8/VŁ4 is that a conjecture can be not contradictory *and* not tautologous at the same time, meaning it has some proof table result state *between* contradiction and tautology, but neither. This means a conjecture can be effectively falsified if it is *not* unfalsifiable. For example, a proof table with all values for truthity or for falsity, or with mixed values of truthity and falsity, is not contradictory *and* not tautologous.