The Bell-CHSH inequality refuted as Bogus Bellian logic (BBL)

Abstract: The Bell-CHSH inequality is often touted as $S = E(a,b) + E(a',b) + E(a,b') - E(a',b')$, $\neg(2 < |S|) = (|S| \leq 2)$, and $E = (N_{++} + N_{--} - N_{+-} - N_{-+})/(N_{++} + N_{--} + N_{+-} + N_{-+})$. We confirm this is not tautologous and refute the Bell-CHSH inequality as Bogus Bellian logic (BBL).

We assume the method and apparatus of Meth8/VŁ4 with tautology as the designated proof value, $\bot$ 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.

For examples of Bell test experiments, the famous formulas often trotted out are:

\begin{align*}
S &= E(a,b) + E(a',b) + E(a,b') - E(a',b') \\
&= (((p \& (w \& y)) + (p \& (x \& y))) + (p \& (w \& z)) - (p \& (x \& z))) = (p = p) \\
&= (\mathtt{TTFF \ TFFF \ TFFF \ TTFF}, \ \mathtt{TTTT \ TTTT \ TTTT \ TTTT}) \\
\end{align*}

with $\neg(2 < |S|) = (|S| \leq 2).

We define the absolute value operator for $|S|$ to mean $0 \leq S$ for

\begin{align*}
\neg(s < (p \& p)) \\
\neg((%p < #p) < \neg(s < (p \& p))) = (p = p) \\
\end{align*}

We substitute Eqs. 1.1 into 2.1.

\begin{align*}
\neg((%p < #p) < \neg(((p \& (w \& y)) + (p \& (x \& y))) + (p \& (w \& z)) - (p \& (x \& z))) < (p \& p)) = (p = p) \\
\neg((%p < #p) < \neg(((p \& (w \& y)) + (p \& (x \& y))) + (p \& (w \& z)) - (p \& (x \& z))) < (p \& p)) = (p = p) \\
\end{align*}

Remark: Injecting quantifiers onto variables does not help.

Eqs. 1.2, 2.2, and 3.2 are not tautologous and not equal, establishing bogus Bellian logic (BBL).

\begin{align*}
E &= (N_{++} + N_{--} - N_{+-} - N_{-+})/(N_{++} + N_{--} + N_{+-} + N_{-+}) \\
p &= (((q + r) - (u - v)) + ((q + r) + (u + v))) \\
&= (\mathtt{FTFT \ FTFT \ FTFT \ FTFT, \ TFFT \ FTFT \ FTFT \ FTFT}) \\
\end{align*}

Remark: Including Eq. 4.1 to map explicitly free variables does not help.
We rewrite Eq. 3.1 to include the explicit definition of Eq. 4.1.

If Eq. 4.1, then Eq. 3.1.  

\[
(p = (((q+r)-(u-v))((q+r)+(u+v)))) > \\
\neg((\neg p \neg q) \neg ((p\neg (w\&y)) + (p\& (x\&y))) + ((p\& (w\&z)) - (p\& (x\&z)))) < (p@p)) ; \\
\text{NTTN TNTN NTTN TTTN, TTTT TTTT TTTT TTTT,} \\
\text{NTTT NTTT NTTT TTTT, TNTN TNTN TNTN TNTN,} \\
\text{NTNT TNTN NTNT TNTN} \tag{5.2}
\]

Eqs. 4.2 and 5.2 are also not tautologous, further establishing bogus Bellian logic (BBL), and refuting the Bell-CHSH inequality.

**Remark:** The assumption of fair sampling as a loophole here is irrelevant because it is not bivalent, but based on a probabilistic vector space.