Refutation of a modal aleatoric calculus for probabilistic reasoning: extended version

Abstract: We evaluate a modal aleatoric calculus for probabilistic reasoning using the assumption of probabilistic definitions as P(¬α) = 1−P(α). Five equations in Lemma 1 and its argument are tested. All equations are *not* tautologous, hence refuting the calculus.

We assume the method and apparatus of Meth8/VŁ4 with Tautology as the designated *proof* value, **F** as contradiction, N as truthity (non-contingency), and C as falsity (contingency). For results, the 16-valued truth table is row-major and horizontal, or repeating fragments of 128-tables, sometimes with table counts, for more variables. (See ersatz-systems.com.)

LET p, q, r, s: P, x, y, z;
~ Not, ¬ ; + Or, ∨, ∪; - Not Or; & And, ∧, ∩; \ Not And;
> Imply, greater than, →, ⊢; < Not Imply, less than, ∈;
= Equivalent, ≡, ⊨; @ Not Equivalent, ≠;
% possibility, for one or some, ∃, ◊, M; # necessity, for every or all, ∀, □, L;
(p=p) T as tautology; (p@p) **F** as contradiction;
(%p<#p) C as contingency, Δ; (%p>#p) N as non-contingency, ∇;
~(y < x) (x ≤ y), (x ⊆y).

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P(¬α) = 1−P(α), where α = q, r, s (0.1)

(((p&~q)=((%p>#p)-(p&q)))&((p&~r)=((%p>#p)-(p&r))))&((p&~s)=((%p>#p)-(p&s))) ; NCNC NCNC NCNC NCNT (0.2)

Lemma 1.

1−P(x)P(y)−P(¬x)P(z) (2.1)

(%p>#p)-((q&r)-(~q&s)) ; **FFFF** **FF**CC CC**FF** CCCC (2.2)

1−P(x)(1−P(¬y))−P(¬x)(1−P(¬z)) (3.1)

(%p>#p)-(((p&q)&((%p>#p)-(p&~r)))-((p&~q)&((%p>#p)-(p&~s)))) ; **FFFF** **FFF**C **F**C**F**F **F**C**F**C (3.2)

1−P(x) +P(x)P(¬y)−P(¬x) +P(¬x)P(¬z)) (4.1)

(%p>#p) - (((p&q)+((p&q)&(p&~r))) - ((p&~q)+((p&~q)&(p&~s)))) ; **F**C**F**C **F**C**F**C **F**C**F**C **F**C**F**C (4.2)

P(x)P(¬y) +P(¬x)P(¬z)) (5.1)

(q&~r)+(~q&s) ; **FF**TT **FFFF** TTTT TTT**F** (5.2)

The main argument of Lemma 1 is that if Eq. 0.1, then 2.1 = 3.1 = 4.1 = 5.1. (6.1)

((((p&~q)=((%p>#p)-(p&q)))&((p&~r)=((%p>#p)-(p&r))))&((p&~s)=
((%p>#p)-(p&s)))) > ((((%p>#p)-((q&r)-(~q&s)))=
((%p>#p)-(((p&q)&((%p>#p)-(p&~r)))-((p&~q)&((%p>#p)-(p&~s))))))=
(((%p>#p) - (((p&q)+((p&q)&(p&~r))) - ((p&~q)+((p&~q)&(p&~s)))))=
((q&~r)+(~q&s)))) ; TNCT TNTN CTCT CTTN (6.2)

Eqs. 0.2 and 2.2-5.2 are *not* tautologous. Lemma 1 as 6.2 is also *not* tautologous. This refutes a modal aleatoric calculus for probabilistic reasoning. We stop analysis after Lemma 1.