Theorem prover Meth8 applies four valued Boolean logic for modal interpretation

A new modal theorem prover is named *Me*chanical *th*eorem in *8*-bits for *Meth8*. A demonstration version is scaled down to process segments for two propositions named (p, q) out of 13 (n, ... , z) and for two theorems named (A, B) out of 13 (A, ... , M). It uses novel technology named sliding windows to parse input strings into logical tokens for antecedent, conditional, and consequent. The tokens then index a lookup table for the pre-loaded results.

Each literal of the 13 literals has 6 modified conditions. There are 4 conditionals, which can be negated, as: & AND; + OR; > IMP; and = EQV. The combinations for an expression of (antecedent * conditional * consequent) are: (13*6) * (4*2) * (13*6) or 46,208 atomic expressions. There are two literal segments and 10 models for 924,160 combinations of expressions. An expression requires 8 bits per row in each of 4 rows of a proof table or 4-bytes per expression. Hence the expressions total 3,696,640 bytes or about 3.6 MB.

The lookup tables can be calculated, loaded, or in ROM. Computation speed is limited in polynomial time by the complexity of the input expression submitted to the parsing engine.

The direct application of Meth8 is for real time situation awareness. Current devices use modal logic but some of their theorems and rules are provably false. To correct this, the back end logical system implemented here in Meth8 is four valued Boolean logic applied to modal interpretation as developed by Garry Goodwin (garry_goodwin@hotmail.co.uk) below.

The modal logic $Ł_4$ is widely deemed implausible. These theorems show problems. Béziau (2011) points out that defending (◊A & ◊B → ◊(A & B)) proved a lifelong nightmare for Łukasiewicz. For example, consider: *If possibly Wilkes Booth killed Lincoln and possibly he never killed anyone, then it is possible Wilkes Booth both killed Lincoln and never killed anyone.* Font and Hájek (2002) find particularly egregious (□A → (◊B → □B)), for example: *Necessarily every coin has two sides implies if possibly the next flip of the coin lands heads, then necessarily the coin lands heads.*

Despite failings of $Ł_4$, its classical credentials are reason enough to persevere. Our motivation is to find a subset of more plausible $Ł_4$ theorems using additional models. A theorem would be proved in all of our 10 models based on three options: Option 1 for <Contradiction, False, True, Proof>; Option 2 for <False, Contingent, Noncontingent, True>; and Option 3 for <Unevaluated, Improper, Proper, Evaluated>. We believe the correct interpretation of many valued Boolean logic leads to incompleteness. Thus some arguments which are never false also fail to be theorems. A nuance of necessitation is that if A is any argument, then the following is *not* an inference "where A is true implies □A".

Several K theorems are found false. Hence clearly normal modal logics are not a subset of this variant. The variant seems to tolerate systems T and D. One S4 theorem is found false: 42 (◊A & □B) → ◊(A & □B). Consider this. *That possibly Obama was born in Kenya and that necessarily Obama was not born in America, implies possibly both: that Obama was born in Kenya; and that necessarily Obama was not born in America.*