Rejection of the quantified modal logic theorem proving (QMLTP) library

Abstract: We evaluate five equations from the quantified modal logic theorem proving (QMLTP) library. None is tautologous for the status of the claimed conjecture, rejecting the approach and library. Other objections include: clarity such as not all problems are in English descriptions; skewed coverage such as about 50% the equations are assumed for Gödel's embedding; and usability such as the utility tool, to translate QMLTP scripts for pre-selected provers, in Prolog source code which is not compiled into executables for major hardware/OS platforms. Based on these results, the QMLTP approach and library forms a *non* tautologous fragment of the universal logic VŁ4.

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). 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 ~ 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;
(z=z) `T` as tautology, ⊤, ordinal 3; (z@z) **`F`** as contradiction, Ø, Null, ⊥ , zero;
(%z>#z) `N` as non-contingency, Δ, ordinal 1; (%z<#z) `C` as contingency, ∇, ordinal 2;
~(y < x) (x ≤ y), (x ⊆ y), (x ⊑ y); (A=B) (A~B).
Note for clarity, we usually distribute quantifiers onto each designated variable.

From: Raths, T.; Otten J. (2011). The QMLTP library: benchmarking theorem provers for modal logics. iltp.de/qmltp

Abstract. The quantified modal logic theorem proving (QMLTP) library provides a platform for testing and evaluating automated theorem proving (ATP) systems for first-order modal logics. The main purpose of the library is to foster the development of new ATP systems and to put their comparison onto a firm basis. The current version 1.0.1 of the QMLTP library includes 500 problems represented in a standardized extended TPTP syntax [manipulated only with a utility tool with Prolog source code to be compiled by platform]. ...

2.1 The QMLTP domain structure

The 500 problems of the QMLTP library are divided into eight problem domains … APM, GAL, GLC, GNL, GSE, GSV, GSY, and SYM.

1. APM – *applications mixed*.
   10 problems from planning, querying databases, natural language processing and communication, and software verification.
2. GAL/GLC/GNL/GSE/GSV/GSY – *Gödel's embedding*.
   245 problems are generated by using Gödel's embedding of intuitionistic logic into the modal logic S4 .. . The original problems were taken from the TPTP library .. and derived from problems in the domains ALG (general algebra), LCL (logic calculi), NLP (natural language processing), SET (set theory), SWV (software verification), and SYN (syntactic), respectively.
3. SYM – *syntactic modal*.
   175 problems from various textbooks .. and 70 problems from the TANCS-2000 system competition for modal ATP systems.

Multi-Modal Logic (Security Protocols) Status: unsolved
Phone user U and phone company C have following relationship:
U does not pay a call before he has dialed it. Both U and C
are able to prove when U is being charged.
U is able to prove that C can prove that U has made a call,
C is able to prove that U can prove that U has paid his call,
U is able to prove that C cannot prove that U has made a call,
C is able to prove that U cannot prove that he has paid his call,
whenever these facts are true, respectively.
Then, the following requirement is true:
From U's point of view, C should charge U only if he has made a call that is not yet paid.
Status: unsolved MML012+1.1

LET p, q, r, s: phone company, pay or paid, user, call

((((~((r>q)>(r>s))+((r&p)>((r>q)=(s=s))))+(((r>(p>(r>q)))=(s=s))+((p>(r>(r>q)))=(s=s))))+
(((r>~(p>(r>q)))=(s=s))+(p>(~(r>(q>s))=(s=s)))))=(s=s))>(r>
(((r>s)&~(r>q))>(p>r))) ;
TTTT TTTT TTTT TTTT MML012+1.2

Barcan scheme instance Status: non-theorem
if for all x necessarily f(x), then it is necessary that for all x f(x) SYM001+1.1

LET p, q: f, x

(#q&#(p&#q))>#(#q&(p&#q)) ;
TTTT TTTT TTTT TTTT SYM001+1.2

converse Barcan scheme instance Status: non theorem
if it is necessary that for all x f(x), then for all x necessarily f(x) SYM002+1.1

#(#q&(p&#q))>(#q&#(p&#q)) ; TTTT TTTT TTTT TTTT SYM002+1.2

Set theory (naive) Status: unsolved

If {{A},{A,B}} = {{U},{U,V}} then A = U. SET016+4.1

LET p, q, r,s: A, B, U, V

((p&(p+q))=(r&(r+s)))>(p=r) ; TTTT TTTT TTTT TTTT SET016+4.2

If {{A},{A,B}} = {{U},{U,V}} then B = V. SET018+4.1

((p&(p+q))=(r&(r+s)))>(q=s) ; TTFT TTTF FTTT TFTT SET018+4.2

The five equations above are *not* tautologous for the status of the claimed conjecture. This rejects the quantified modal logic theorem proving (QMLTP) library. Other objections include: clarity such as not all problems are in English descriptions; skewed coverage such as about 50% the equations are assumed for Gödel's embedding; and usability such as the utility tool, to translate QMLTP scripts for pre-selected provers, in Prolog source code which is not compiled into executables for major hardware/OS platforms.