KtSeqC : System Description

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Architecture and Algorithm: **KtSeqC** is based upon the right sided labelled sequent system for tense logic **Kt** described in [BG98] which itself is based upon the work of [BP95, Mas94, HSZ96]. The work of Pitt [PC96] is closely related but Pitt uses the calculus KE incorporating an analytical cut-rule. We have also incorporated simplification as reported in [Mas98, HS98].

The system converts a given formula to implication-free negated normal form and performs some optimisations that handle the commutativity of the binary connectives. The search strategy picks the left-most formula on the right hand side of the sequent and then applies the appropriate (unique and invertible) rule. Hence the order of rule applications does not affect completeness. Special mechanisms for loop detection would have to be added to handle transitive extensions of **Kt** or to handle global logical consequence.

Implementation: **KtSeqC** is implemented in roughly 1800 lines of C (which we expect to halve by using C++ and inheritance). Every formula is stored as a pair A and $nnf(A)$ which point to each other via a "negation" pointer in their representation. This allows us to access the negation of any formula in constant time and has proved useful in many places. We use a hash table to store the formula so that a sequent consists of a linked list of pointers into this table.

Special Features: **KtSeqC** is still a prototype (it is only 5 weeks since we began!) and handles local logical consequence in the minimal tense logic **Kt** (including the minimal normal modal logic **K**). It is trivially extendible to the multimodal logic **K**(m) but the necessary extensions have not been included so far. The current system **does not** handle global logical consequence. A proof trace of the sequents in the derivation can be obtained but it is not structured into an actual sequent tree proof. Printing the labelled literals associated with an open branch trivially gives a counter-model as required.

Performance Analysis: We tested **KtSeqC** successfully on Heuerding's benchmarks [Heu98] to test for soundness. The following results are for the benchmarks of the current comparison. Or results indicate that our prover is fast for satisfiable formulae but slow for valid formulae. Clearly, further optimisations are required. **KtSeqC** can be found at: `http://arp.anu.edu.au/~rpg/KtSeqC.html`

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Category	Subsection	Problem Number	time (msec)	result
bound-cnf	8	1-6	1000	not valid
bound-cnf	8	7	2000	not valid
bound-cnf	8	8-16	1000	not valid
bound-cnf	16	1-16	1000	not valid
bound-cnf	32	1-5	1000	not valid
bound-cnf	32	5	$>$ 100,000	?
bound-cnf	32	6-15	1000	not valid
bound-cnf	32	16	$>$ 100,000	?
bound-modK	8	1-16	1000	not valid
bound-modK	16	1	2000	not valid
bound-modK	16	2-4	1000	not valid
bound-modK	16	5	2000	not valid
bound-modK	16	6-16	1000	not valid
bound-modK	32	1	$>$ 100,000	?
bound-modK	32	2	4000	not valid
bound-modK	32	3-4	1000	not valid
bound-modK	32	5	$>$ 100,000	?
bound-modK	32	6	1000	not valid
bound-modK	32	7	6000	not valid
bound-modK	32	8	1000	not valid
bound-modK	32	9	3000	not valid
bound-modK	32	10-11	$>$ 100,000	?
bound-modK	32	12-15	2000	not valid
bound-modK	32	16	8000	not valid

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