1069-08-288 **Marcel G. Jackson**, Department of Mathematics and Statistics, LaTrobe University, Bundoora, Victoria 3086, Australia, and **George F Mcnulty*** (mcnulty@math.sc.edu), Department of Mathematics, University of South Carolina, Columbia, SC 29208. *Lyndon's Algebra: a study of equational complexity and the finite algebra membership problem.*

In 1954 Roger Lyndon gave the earliest example of a finite algebra, denoted here by **L**, with a nonfinitely based equational theory. Z. Szekely noticed 40 years later that **L** is associated with a finite automaton and so belongs to the class of automatic algebras. Roughly speaking the equational complexity of an algebra **A** is a function $\beta(n)$ measuring how much of the equational theory of **A** must be examined to determine whether an algebra of size bounded by n belongs to the variety generated by **A**. The finite algebra membership problem for **A** is the problem of deciding, given a finite algebra **B**, whether **B** belongs to the variety generated by **A**. We show the following about Lyndon's algebra:

1. The equational complexity of **L** lies between $n-4$ and $2n+1$.
2. The finite algebra membership problem of **L** is decidable in nondeterministic logarithmic space (and hence in polynomial time).
3. The variety generated by **L** has subdirectly irreducible algebras of every cardinality bigger than 1 except 4.
4. **L** is inherently nonfinitely based relative to the variety generatetd by all automatic algebras.

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