MR2546878 (2011a:68060) 68Q45 (68Q19)

Brzozowski, Janusz (3-WTRL-SC); **Konstantinidis, Stavros** (3-STMR-CS)

State-complexity hierarchies of uniform languages of alphabet-size length. (English summary)

Theoret. Comput. Sci. **410** (2009), *no. 35,* 3223–3235.

Let A be an alphabet of k symbols. A "k-language" is a nonempty set of strings (over A) of length k. The authors show that for each k-language L the state complexity $c(L)$ (i.e., the number of states in the minimal deterministic automaton accepting L) satisfies $k+2 \leq c(L) \leq (k^{k-1}-1)/(k-1)+2^k+1$, and that for each j in between these bounds it is possible to construct a k-language L with $c(L) = j$. This second result follows from three complete hierarchies: (i) $k+2 \leq j \leq k^2-k+3$, based on automata accepting k-powers of symbols, (ii) $k^2-k+3 \leq j \leq 2^k+1$, obtained by automata accepting languages that consist of permutations of the k symbols, and (iii) $2^k+1 \leq j \leq (k^{k-1}-1)/(k-1)+2^k+1$, by automata of which the underlying structure is a k-ary tree.

Reviewed by *Peter R. J. Asveld*

References

1. J.A. Brzozowski, Derivatives of regular expressions, J. Assoc. Comput. Mach. 11 (1964) 481–494. MR0174434 (30 #4638)
2. C. Câmpeanu, How many states can a minimal DFA have that accepts words of length less than or equal to *l*? in: J. Dassow, M. Hoeberechts, H. Jürgensen, D. Wotschke (Eds.), Pre-Proc. Descriptional Complexity of Formal Systems, London, ON, Canada, 2002 (The journal version appeared as [4].).
3. C. Câmpeanu, K. Culik, K. Salomaa, S. Yu, State complexity of basic operations on finite languages, in: Proc. Fourth Int. Workshop on Implementing Automata WIA'99, Potsdam, Germany, in: LNCS, vol: 2214, 2001, pp. 60–70.
4. C. Câmpeanu, W.H. Ho, The maximum state complexity for finite languages, J. Autom. Lang. Comb. 9 (2004) 189–202. MR2167778 (2006d:68123)
5. A. Salomaa, K. Salomaa, S. Yu, State complexity of combined operations, Theoret. Comput. Sci. 383 (2007) 140–152. MR2350788 (2008g:68067)
6. P. Shankar, A. Dasgupta, K. Deshmukh, B.S. Rajan, On viewing block codes as finite automata, Theoret. Comput. Sci. 290 (2003) 1775–1797. MR1937745 (2003j:94104)
7. A. Vardy, Trellis structure of codes, in: Handbook of Coding Theory, Elsevier Science Inc., New York, 1998, pp. 1989–2117. MR1667960
8. S. Yu, Q. Zhuang, K. Salomaa, The state complexities of some basic operations on regular languages, Theoret. Comp. Sci. 125 (1994) 315–328. MR1264137 (95c:68135)

Note: This list reflects references listed in the original paper as accurately as possible with no attempt to correct errors.