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TRADEOFFS BETWEEN RELIABILITY AND CONCISENESS OF DETERMINISTIC FINITE AUTOMATA [1]

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ABSTRACT

In this paper, we propose a model for measuring the reliability of the description of a language L by a deterministic finite automaton M. Intuitively, the reliability M exhibits when used for L is high if the 'difference' between L and the language $T(M)$ accepted by M is small. Using this model, we prove that the savings in the number of states between a fully reliable and a less reliable representation cannot be bounded by any function, even if the unreliable descriptions are required to exceed any given fixed level of reliability. Furthermore, we show that, for a single regular language, there is a level of reliability such that any description exceeding this level is at least as big as the smallest DFA for the language.

Keywords: Software reliability, finite automata, descriptional complexity

1. Introduction

Software reliability is an area of tremendous practical interest for systems in public use. Virtually every device today (from dishwasher to airplane) contains a microprocessor that runs some piece of software. It is apparent that the consequences of a failure of a specific software component can range anywhere from unpleasant to disastrous. One example of the magnitude of software failures is the failed launch of the first Ariane 5 rocket in 1996. The rocket exploded forty seconds after lift-off due to an overflow error caused by a conversion from a 64 bit floating point value into a 16 bit signed integer [1].

[1] Full version of an invited lecture presented at the 4th Workshop on *Descriptional Complexity of Automata, Grammars and Related Structures* (London, Ontario, Canada, August 21–24, 2002).

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