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## Descriptive complexity of translating an NFA into an $\varepsilon$ -free NFA

Investigating the descriptive complexity of translating grammars and automata into some special form has a quite long history now. Some of these problems are solved, whereas others have still lots of room for improvement. A problem that belongs to the latter group is translating an NFA into an  $\varepsilon$ -free NFA---that is, into an NFA that has no  $\varepsilon$ -transitions (transitions that read the empty string)

A quadratic upper bound can be easily achieved: it is a well known fact that any NFA of size  $s$  can be transformed into an  $\varepsilon$ -free NFA that has size  $O(s^2)$ . However, there doesn't seem to be any matching lower bounds so far; even the best seems to be of the order of magnitudes  $\log s$ . In this talk I would like to present some much stronger lower bounds. Nevertheless, as even the best is only of order  $s^{\{3/2\}}$ , the problem of finding the largest possible gap between an NFA and an  $\varepsilon$ -free NFA remains unsolved.

Joint work with Szabolcs Ivan, Judit Nagy-György and György Turán