

ABSTRACT

The thesis continues the study of the notion of usefulness of supplementary information, advice, in problem solving using the formalism of context free grammars. An advice is considered useful, if it enables to replace a solution to a problem by a solution to a new, less complex problem. In the framework of the thesis, a problem is formalized as a formal language with the complexity measured by the complexity of a respective minimal automaton or grammar. In the formalizations using automata, the supplementary information is about the input word and allows the new, less complex, automaton to only check the properties of the input word not guaranteed by the supplementary information. In the new approach, formalizing solutions by grammars, the less complex grammar generates just some parts of the original word the rest being filled in by the advice grammar. Two methods of combining the words from the new less complex language and the language providing the advice are presented. The first uses substitution. The second uses a newly introduced operation of controlled shuffle. The shuffle is proved to be strong enough to simulate common operations on languages and to produce an arbitrary recursively enumerable language from suitable context free languages. A necessary condition for a context free language to be substitution undecomposable is presented. A language is shown to be shuffle decomposable if it is substitution, concatenation, or union decomposable.

Key words: usefulness of supplementary information, formal language, decomposability of language, substitution, controlled shuffle, nonterminal complexity, context free grammar, context free language