Zakopane-Kościelisko, 3rd–7th September 2018

THEORY OF TAILOR AUTOMATA

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ABSTRACT

The new theory of tailor automata makes it possible to define deterministic and nondeterministic finite tailor automata which correspond to informally characterized biomolecular automata of DNA in the spirit of the works [1, 2], but make use of only one restriction enzyme [3]. The theory presents elements of biomolecular automata of DNA on four levels: words, dual words, bi-words, and indiscernible bi-words. The first level enables to represent single-stranded DNA, the second one allows a 'planar' representation of selected double-stranded DNA, the third makes it possible to 'spatially' represent selected double-stranded DNA, whereas the fourth level – indiscernibility, from the point of view of the functioning of a biomolecular automaton of DNA, of certain bi-words determined on the third level. In this sense, the elements of words make representations of nucleotides, while bi-words are sets to which all indiscernible dual words belong and which can be represented by each of the dual words belonging to these sets (are abstract classes).

In this way elements of biomolecular DNA such as: input molecule, transition molecules, detection molecules and output molecule, are represented in the theory of tailor automata by bi-words which we call, respectively: input component, transition components, detection components and finish component. In order to theoretically represent the working of the restriction enzyme and ligase enzyme, the notion of cutting function (bi-words) and that of sticking function (two bi-words) are introduced. They are defined on bi-words, but "act" on dual words being their representations. Hence, on the levels of words and dual words, the following relations are introduced, among others: inclusion of words, concatenation of words, prefix and suffix of a word, inclusion of dual words, concatenation of selected dual words, stickability of dual words.

The constructs introduced in the theory of tailor automata allow defining a deterministic and nondeterministic finite tailor automaton (including the transition function for the automaton), extending the transition function, acceptability of words built from symbols of the alphabet of the tailor automaton, as well as language acceptability by the tailor automaton.

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