AUTOMATION OF DNA COMPUTING READOUT METHOD BASED ON REAL-TIME PCR IMPLEMENTED ON DNA ENGINE OPTICON 2 SYSTEM

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ABSTRACT. *Previously, an automation of a DNA computing readout method for the Hamiltonian Path Problem (HPP) has been implemented based on LightCycler System. In this study, a similar readout approach is implemented based on DNA Engine Opticon 2 System. The readout approach consists of two steps: real-time amplification in vitro using TaqMan-based real-time PCR, followed by an in silico phase. The in silico phase consists of a data clustering algorithm and an information processing to extract the Hamiltonian path after the TaqMan "YES" and "NO" reactions have been identified. The result indicates that the automation of DNA computing readout method can be efficiently implemented on DNA Engine Opticon 2 System.*
Keywords: DNA computing, Hamiltonian path problem, Real-time PCR

1. **Introduction.** A new computing paradigm based on DNA molecules appeared in 1994 when L. M. Adleman [1] launched a novel *in vitro* approach to solve the so-called Hamiltonian Path Problem (HPP) with seven vertices by DNA molecules. The goal of the HPP is to determine whether any path exists which commences at the 'start city' and finishes at the 'end city', and passes through each of the remaining cities exactly once. In conventional silicon-based computers, information is stored as binary numbers in silicon-based memories; in this approach, he encoded the information of the vertices by random DNA sequences. The computation is performed in bio-molecular reaction fashion involving procedures such as hybridization, denaturation, ligation and Polymerase Chain Reaction (PCR). The output of the computation, also in the form of DNA molecules can be read and printed by a process called electrophoretical fluorescence.

Existing models of DNA computation are based on various combinations of bio-operations, which are *synthesizing*, *mixing*, *annealing* (*hybridization*), *melting* (*denaturation*),