

PARALLEL OVERLAP ASSEMBLY FOR INITIAL POOL GENERATION OF DIRECT-PROPORTIONAL LENGTH-BASED DNA COMPUTING

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ABSTRACT. *In the previous work, in order to overcome the limitation of constant-proportional length-based DNA computing, an alternative approach, which is called direct-proportional length-based DNA computing for weighted graph problem has been proposed. Based on the proposed approach, the cost of each path is encoded proportionally to the length of oligonucleotides, or oligos for short. In other words, the longer oligos are employed to encode larger cost and vice versa. During the initial pool generation, the phase where all the combinations are generated in the solution, a method called hybridization/ligation is employed. However, the initial pool generation based on hybridization/ligation suffers from the biochemical behavior of hybridization because the longer oligos are more likely to hybridize compared to the shorter oligos. In this paper, an efficient method for initial pool generation, which is parallel overlap assembly is studied, examined, and applied. It turns out that the hybridization/ligation method should be replaced with parallel overlap assembly, for a better and efficient initial pool generation of direct-proportional length-based DNA computing, and our argument is supported by implementing actual experiments.*

Keywords: Direct-proportional length-based DNA computing, Parallel overlap assembly, Initial pool generation, Weighted graph problems

1. Introduction. Currently, there are three kind of initial pool generation methods for DNA computing: hybridization/ligation, parallel overlap assembly, and mix/split. The hybridization/ligation method has been firstly introduced in [1] to solve a Hamiltonian path problem (HPP). During the operation, the link oligos hybridize through the hydrogen bonds by enzymatic reaction. The hybridization/ligation reaction is well shown in Figure 1 ([2]) where the arrowhead indicates the 3' end of oligos.

Parallel overlap assembly (POA) has been used [3] and broadly applied in gene construction [4-6], gene reconstruction [7], and DNA shuffling [8]. POA involves thermal cycle