

Survey On Using DNA To Solve TSP And Bounded PCP

Abstract:

Advances in DNA sequencing and CRISPR research has enabled design and experiments to determine solutions for various NP-complete problems such as Post Correspondence Problem (PCP), Travelling Salesman Problem (TSP), and Maximum Clique Problem. DNA computing takes significantly shorter time to process and compute all possible solutions in parallel, reducing run time and computing power compared to electronic supercomputers. Although a solution can be computed in fewer steps using DNA computing, filtering and extracting the right answer can be tedious and time consuming due to the inherent nature of its building blocks - DNA strands and nucleotides being microscopically small. In this study, we will explain the basics of DNA and CRISPR along with their relation to computing, as well as the use of DNA computing, specifically biomolecular computing to attack and solve computational problems - bounded PCP and TSP. We examine how DNA computing can produce answers to these NP-complete problems in significantly shorter time and then explain the steps included in filtering the correct answer. Furthermore, as DNA computing provides a powerful mean to generate answers for a complex problem, we also discuss the advancements done using DNA computing in past two decades and about the future of DNA computing.

Citations:

- [1] Kari, L., Gloor, G., & Yu, S. (2000). Using DNA to solve the bounded post correspondence problem. *Theoretical Computer Science*, 231(2), 193-203.
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- [3] Adleman, L. M. (1994). Molecular computation of solutions to combinatorial problems. *Science*, 266(5187), 1021-1024.
- [4] Lipton, R. J. (1995). DNA solution of hard computational problems. *Science*, 268(5210), 542-545.
- [5] Braich, R. S., Chelyapov, N., Johnson, C., Rothmund, P. W., & Adleman, L. (2002). Solution of a 20-variable 3-SAT problem on a DNA computer. *Science*, 296(5567), 499-502.
- [6] Computing with DNA The manipulation of DNA to solve mathematical problems is redefining what is meant by "computation"

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