

CSE 599 Winter 2001

Homework Assignment # 3

Due Date: February 8 (two weeks from today Jan 25)

The purpose of this homework assignment is to familiarize yourself with the basic steps involved in solving a problem using DNA. The problem we will solve is the NP-complete problem known as SUBSET SUM:

Given a set of N positive integers S_0, S_1, \dots, S_N and a positive integer T (the "target"), is there some subset of these integers S_i (with possible repetitions) that sums exactly to T ?

Examples:

Input: $S = \{ 2, 4, 6, 8, 10 \}$, $T = 12$; Answer: Yes ($4 + 8$ or $6 + 6$ or $2 + 10$ or $2 + 4 + 6$)

Input: $S = \{ 2, 4, 6, 8, 10 \}$, $T = 13$; Answer: No

Input: $S = \{ 1, 5, 4, 2, 7, 2, 12, 19, 17 \}$, $T = 42$; Answer: Yes ($1 + 5 + 5 + 2 + 12 + 17$)

- (a) Describe a suitable DNA-based encoding of this problem. In particular, how would you encode the integers S_i and target T using DNA strands?
- (b) Describe the basic steps of an algorithm that uses the encoding in (a) to extract a yes/no answer to the SUBSET SUM problem. Where possible, mention the molecular technique from the ones we discussed in class that could be useful in carrying out each step of your algorithm.
- (c) Implement your ideas in (a) and (b) using the "Strand" DNA computer simulator package developed by Ville Kyrki. See <http://www.lut.fi/~kyrki/dna/> and <http://www.lut.fi/~kyrki/dna/doku.html> for more information, documentation, and sample programs. The package is available for download at <http://www.lut.fi/~kyrki/dna/strand.tar.gz>. Contact the instructor or TA if you are having problems downloading or compiling the sample programs, or if you have any other questions.

Additional information and articles on DNA computing can be found in the lecture slides and on the on-line resources page on the class web site:

<http://www.cs.washington.edu/education/courses/599/01wi/papers/index.html>