COMP 157 Assignment 3

Exercises 3.2:

5. How many comparisons (both successful and unsuccessful) are made by the brute-force string-matching algorithm in searching for each of the following patterns in the binary text of 1000 zeros?

   a. 00001 b. 10000 c. 01010

Exercises 3.3:

5. The closest-pair problem can be posed in k-dimensional space in which the Euclidean distance between two points $P' = (x'_1, ..., x'_k)$ and $P'' = (x''_1, ..., x''_k)$ is defined as

$$d(P', P'') = \sqrt{\sum_{s=1}^{k} (x'_s - x''_s)^2}.$$

   What is the time-efficiency class of the brute-force algorithm for the k-dimensional closest-pair problem?

Exercises 3.4:

5. Give an example of the assignment problem whose optimal solution does not include the smallest element of its cost matrix.

6. Consider the ***partition problem***: given n positive integers, partition them into two disjoint subsets with the same sum of their elements. (Of course, the problem does not always have a solution.) Design an exhaustive search algorithm for this problem. Try to minimize the number of subsets the algorithm needs to generate.

9. A magic square of order n is an arrangement of the numbers from 1 to n^2 in an n-by-n matrix, with each number occurring exactly once, so that each row, each column, and each main diagonal has the same sum.

   a. Prove that if a magic square of order n exists, the sum in question must be equal to $n(n^2 + 1)/2$.

   b. Design an exhaustive search algorithm for generating all magic squares of order n.

   c. Go to the Internet or your library and find a better algorithm for generating magic squares.

   d. Implement the two algorithms—the exhaustive search and the one you have found—and run an experiment to determine the largest value of n for which each of the algorithms is able to find a magic square of order n in less than one minute of your computer's time.

Submission Requirements:

- Submit your answers via Canvas.
- All submissions must be typeset. No handwritten work will be accepted.
- Word or PDF formats are preferred. If submitting documents in another format, include a separate text note indicating tools needed to read the document.