CISC-471 FALL 2019

HOMEWORK 2

Please work on these problems and be prepared to share your solutions with classmates in class on Thursday September 19. Assignments will **not** be collected for grading.

Programming

Write a program in the language of your choosing (I recommend Python) and verify that it works on the sample data (using the on-line Rosalind platform). For each problem be prepared to tell us why you think your algorithm is correct (whether you program worked on the sample data or not). Also provide an estimate of the time and space complexity of your algorithm.

Creating a Restriction Map:
http://rosalind.info/problems/pdpl/

Problems

These questions come from *An Introduction to Bioinformatics Algorithms* by Neil C. Jones and Pavel A. Pevzner.

Problem 4.1: Write an algorithm that, given a set X, calculates the multiset ΔX.

Problem 4.2: Consider the partial digest

$$L = \{1, 1, 1, 2, 2, 3, 3, 3, 4, 4, 5, 5, 6, 6, 6, 9, 9, 10, 11, 12, 15\}$$

Solve the Partial Digest problem for L (that is, find X such that $\Delta X = L$).

Problem 4.3: Write an algorithm that, given an n-element set, generates all m-element subsets of this set. For example, the set $\{1, 2, 3, 4\}$ has six two-element subsets {1, 2}, {1, 3}, {1,4}, {2,4}, {2, 3}, and {3, 4}. How long will your algorithm take to run?

Problem 4.5: Prove that the sets $U \oplus V = \{u + v : u \in U, v \in V\}$ and $U \ominus V = \{u - v : u \in U, v \in V\}$ are homometric for any two sets U and V.

Problem not in text book: In the game of chess a queen can move any number squares along a horizontal, vertical or diagonal path. See https://en.wikipedia.org/wiki/Queen_(chess). A *peaceful placement* of n queens on an $n \times n$ chessboard places the queens so that no two queens are in each other's path. Consider a $n \times n$ chess board. What is the smallest n such that n be peacefully placed Write a recursive algorithm that either places the n Queen's or determines that no such placement is possible. Modify the algorithm so that it counts all peaceful placements.