Problem 1. Give an $O(n^{k/2})$ time algorithm for k-SUM.

Problem 2. Give a $\tilde{O}(n + d)$ time algorithm for 3SUM, where $d$ denotes the largest absolute value of an integer in the input. Hint: Use FFT.

Problem 3. In the X+Y problem we are given two sets $X$ and $Y$, each containing $n$ integers, and we need to determine whether the sumset $X + Y = \{a + b \mid a \in X, b \in Y\}$ contains $n^2$ distinct integers. Prove that if the X+Y problem can be solved in truly subquadratic time, then 3SUM can also be solved in truly subquadratic time.

Problem 4. In the Unbounded Subset Sum problem we are given $n$ integers $s_1, \ldots, s_n$ and a target value $t$, and we need to decide if there exist nonnegative integers $x_1, \ldots, x_n$ such that $\sum_{i \in [n]} x_i s_i = t$. Give a $\tilde{O}(n + t)$ time algorithm for Unbounded Subset Sum.

This problem set adds 1 point to the threshold for grade 4.0, and 2 points for 6.0.