Problem 1: A jar contains 200 pennies, 200 nickels, 200 dimes, and 200 quarters. If one coin is taken out of this jar every day, how long would it be until we were guaranteed of choosing at least 50 coins of the same type?

Problem 2: Let $X = \{1, 2, 3, \ldots, 10\}$, and for $A \subseteq X$, define $S(A)$ to be the sum of the elements of $A$, where $S(\emptyset) := 0$. Show that if we choose any 29 subsets of $X$ such that no subset has more than 3 elements, then there exist two if these subsets, say $U$ and $V$, such that $S(U) = S(V)$.

Problem 3: Prove that is any five points are chosen within a square of side length 2, then there are two points whose distance apart is at most $\sqrt{2}$.

Problem 4: A party is attended by $n \geq 2$ people. Prove that there will always be two people in attendance who have the same number of friends at the party. (We may assume that the relation “is a friend of” is symmetric, that is, if $x$ is a friend of $y$, then $y$ is a friend of $x$.)

Problem 5: Let $n \in \mathbb{N}$. Prove that if any $n + 1$ numbers are chosen from the set $\{1, 2, 3, \ldots, 2n\}$, then there exist two which are relatively prime, i.e., share no common factors other than 1.

Problem 6: Let $n \in \mathbb{N}$. Prove that if any $n + 1$ numbers are chosen from the set $\{1, 2, 3, \ldots, 2n\}$, then there exist two such that one divides the other.

Problem 7: Show that if you are given any set of 52 integers, then there are two of them whose sum or difference is divisible by 100.