Problem 1: Let $n$ and $k$ be positive integers. Give a formula for the number of solutions of $n = x_1 + \cdots + x_k$ where the $x_i$ are positive integers (not equal to zero). (We solved a similar problem in class in which $x_i$ were non-negative integers, i.e. zero solutions allowed.)

Problem 2: Consider a polygon with $n$-edges (i.e. an $n$-gon). How many triangles can be drawn all of whose vertices are among those of this $n$-gon and all of whose sides are diagonals (but not sides) of the $n$-gon?

Problem 3: (Inclusion-Exclusion Principle) Let $A_1$, $A_2$, $A_3$ be finite subsets. Prove the following:

$$|A_1 \cup A_2 \cup A_3| = |A_1| + |A_2| + |A_3| - |A_1 \cap A_2| - |A_2 \cap A_3| - |A_1 \cap A_3| + |A_1 \cap A_2 \cap A_3|.$$ 

Problem 4: Let $A$ be a set with 10 elements. How many partitions does $A$ have which contain exactly 2 classes with 3 elements and 1 class with 4 elements (Stirling number of the second kind).

Problem 5: Let $A$ and $B$ be finite sets with $|A| = n$ and $|B| = k$. (b) Show that there are $k^n$ functions from $A$ to $B$. (b) Also show that there are $k!S_n^k$ onto (surjective) functions from $A$ to $B$. 