Problem 1. Compute $\binom{100}{99}$.

A) 1 B) 99 C) 100 D) 100! E) None of these

Problem 2. For any positive integers n, a, and b with $0 < a < b < n$ we have $\binom{n}{a} < \binom{n}{b}$.

A) True B) False

Problem 3. Suppose that S is a set with n elements and R is an equivalence relation on S. What is the largest the number of equivalence classes of R could possibly be?

A) 1 B) n C) 2^n D) $n!$ E) None of these

Problem 4. How many distinct rearrangements are there of the letters of my name, JONATHAN?

A) 1 B) 8 C) $2 \times 7!$ D) 8! E) None of these

Problem 5. Let S be a set with n elements. How many ways are there to partition S into *two* subsets.

A) 1 B) n C) $2^n - 2$ D) 2^n E) None of these

Problem 6. Let S be a set. Construct a one-to-one correspondence between the set of partitions of S and the set of equivalence relations on S.

Problem 7. Let S be a set with n elements and let a, b, and c be three positive integers with $a + b + c = n$. You may assume that a, b, and c are all different numbers. Devise a formula using addition, subtraction, multiplication, division, exponentiation, and the factorial for the number of partitions of S into three subsets of sizes a, b, and c.

Problem 8. How does your formula from the last problem change when $a = b \neq c$? What about when $a = b = c$?