MATH 113: DISCRETE STRUCTURES
WEDNESDAY WEEK 4 HANDOUT

Problem 1. Use induction to show that

$$2^0 + 2^1 + 2^2 + \cdots + 2^{n-1} = 2^n - 1$$

for $n \geq 1$.

Problem 2. Use induction to prove that the number of permutations of $\underline{n} = \{1, 2, \ldots, n\}$ is $n!$.

Problem 3. Use induction to prove that

$$\frac{1}{1 \cdot 2} + \frac{1}{2 \cdot 3} + \frac{1}{3 \cdot 4} + \cdots + \frac{1}{n(n+1)} = \frac{n}{n+1}$$

for $n \geq 1$.

Problem 4. Use induction to prove that a convex n-gon has $n(n-3)/2$ diagonals.

Problem 5. Use induction to prove that

$$\binom{2n}{n} < 2^{2n-2}$$

for $n \geq 5$.