CS113/DISCRETE MATHEMATICS-SPRING 2024

Worksheet 15

Topic: Mathematical Induction

> Today, we will explore mathematical induction—a powerful tool in mathematics.We will see how it can be used to prove summation formulas and inequalities, providing a systematic and rigorous approach to mathematical reasoning. Happy Learning!

Student's Name and ID: _____

Instructor's name: _____

1. Let $P(n)$ be the statement that $1^2 + 2^2 + \ldots + n^2 = \frac{n(n+1)(2n+1)}{6}$ for the positive integer n. Prove that this formula for summation of squares is right.

2. Prove that $1^2 + 3^2 + 5^2 + \ldots + (2n+1)^2 = \frac{(n+1)(2n+1)(2n+3)}{3}$ whenever n is a nonnegative integer.

3. Prove that $2n > n^2$ if n is an integer greater than 4.

4. Let $P(n)$ be the statement that $n! < n^n$, where n is an integer greater than 1.