

CSC2110

Extra exercise

Topic : Proof by mathematical induction and contradiction

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## 1 Mathematical Induction

Prove the following statements.

1.  $\sum_{i=1}^n i^2 = \frac{n(n+1)(2n+1)}{6}$  for all integer  $n \geq 1$ .
2.  $\frac{1}{1 \cdot 2} + \frac{1}{2 \cdot 3} + \dots + \frac{1}{n(n+1)} = \frac{n}{n+1}$  for every positive integer  $n$ .
3.  $2^n > n^2$  whenever  $n$  is an integer greater than 4.
4.  $(1+x)^n \geq 1+nx$ , for  $x \geq 1$  and  $n \geq 1$ .
5. 3 divides  $n^3 + 2n$  for all non negative integer  $n$ .
6.  $7^n - 1$  is divisible by 6, for all  $n \geq 1$ .

## 2 Contradiction

1. Prove for all integer  $n$ , if  $3n + 1$  is even, then  $n$  is odd.