

01204211 Discrete Mathematics
Lecture 6: Mathematical Induction 1

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September 1, 2015

Mathematical Induction

- ▶ In this lecture, we will focus on how to prove properties on natural numbers.
- ▶ For example, we may want to prove that for any integer $n \geq 1$,

$$\sum_{i=1}^n i = i(i+1)/2,$$

or for any integer $n \geq 1$,

$$\sum_{i=1}^n i^2 = \frac{n}{6}(n+1)(2n+1),$$

or “We can pay any integer amount $x \geq 4$ baht with 2-baht coins and 5-baht coins.”

Informal arguments

- ▶ Let's try to check that $\sum_{i=1}^n i = i(i+1)/2$, for any integer $n \geq 1$, by experimentation.
- ▶ Try $n = 1$: LHS: 1, RHS: $1(1+1)/2 = 1$, OK
- ▶ Try $n = 2$: LHS: $1 + 2 = 3$, RHS: $2(2+1)/2 = 3$, OK
- ▶ Try $n = 3$: LHS: $1 + 2 + 3 = 6$, RHS: $3(3+1)/2 = 6$, OK
- ▶ Try ...
- ▶ With this approach, we can't actually prove this statement.