Administrivia

Slide 1

- Reminder: Homework 3 due Wednesday.

Mathematical Induction, Recap

Slide 2

- Basic idea is to prove something true for all integers greater than some base value (usually 0 or 1) in two steps:
  - Base case — prove directly for smallest value.
  - Inductive step — prove that if true for k (first principle), or all numbers from base case through k (second principle), then also true for $k + 1$.

Second Principle of Mathematical Induction — Example

- Consider a perforated sheet of stamps. How many “tear into two sheets” operations are needed to produce single stamps?
- Conjecture, based on some examples — ?
- Can prove with second principle . . .

Slide 3

More Examples

- Section 2.2 problem 31 (to be continued next time).

Slide 4

Minute Essay

- Prove using mathematical induction that for all $n \geq 1$

$$\sum_{i=1}^{n} (2i-1) = n^2$$

Slide 5

Minute Essay Answer

- Base case: $n = 1$. $n^2 = 1$ and

$$\sum_{i=1}^{n} (2i-1) = 1$$

- Inductive step: Assume

$$\sum_{i=1}^{k} (2i-1) = k^2$$

and show

$$\sum_{i=1}^{k+1} (2i-1) = (k+1)^2$$

Using inductive hypothesis:

$$\sum_{i=1}^{k+1} (2i-1) = \sum_{i=1}^{k} (2i-1) + 2(k+1) - 1 = k^2 + 2k + 1 = (k+1)^2$$

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