

Mathematical Induction

CS/APMA 202

Rosen section 3.3

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What is induction?

- A method of proof
- It does not generate answers: it only can prove them
- Three parts:
 - Base case(s): show it is true for one element
 - Inductive hypothesis: assume it is true for any given element
 - **Must be clearly labeled!!!**
 - Show that if it true for the next highest element



Induction example

• Show that the sum of the first n odd integers is n^2

▪ Example: If $n = 5$, $1+3+5+7+9 = 25 = 5^2$

▪ Formally, Show

$$\forall n P(n) \text{ where } P(n) = \sum_{i=1}^n 2i - 1 = n^2$$

• Base case: Show that $P(1)$ is true

$$\begin{aligned} P(1) &= \sum_{i=1}^1 2(i) - 1 = 1^2 \\ &= 1 = 1 \end{aligned}$$