Fall 2022 - CSC236

TUTORIAL 2
SIMPLE INDUCTION

September 19 / 20

LEARNING OBJECTIVES

01 Recall what a predicate is and how to properly structure it

02 Recall, understand, and implement the concept of simple induction

03 Practice using simple induction

PREDICATE

- $P(x)$ is a function on an input x that returns a boolean value
- The function can take 1 or more parameters
- Has a domain, scope

SIMPLE INDUCTION

*Simple induction on **n**

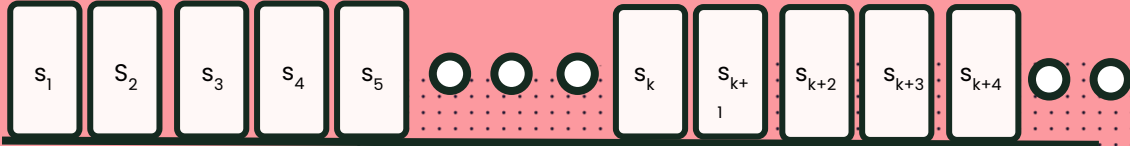**Important Note:**
0 is considered a natural number in CSC236

(1) $P(0)$ is true (0 is the "first" natural number)

(2) $\forall k \in \mathbb{N}, P(k) \Rightarrow P(k+1)$

(3) $\forall n \in \mathbb{N}, P(n)$ is true

*From Textbook pg 11

IDEA BEHIND SIMPLE INDUCTION

S_1 S_2 S_3 S_4 S_5 ○ ○ ○ S_k S_{k+1} S_{k+2} S_{k+3} S_{k+4} ○ ○

Statements are lined up like dominoes

S_1 S_2 S_3 S_4 S_5 ○ ○ ○ S_k S_{k+1} S_{k+2} S_{k+3} S_{k+4} ○ ○

Suppose the 1st statement falls (is proved true)

S_1 S_2 S_3 S_4 S_5 ○ ○ ○ S_k S_{k+1} S_{k+2} S_{k+3} S_{k+4} ○ ○

Suppose the kth falling *always* causes the $(k+1)^{th}$ to fall

S_1 S_2 S_3 S_4 S_5 ○ ○ ○ S_k S_{k+1} S_{k+2} S_{k+3} S_{k+4}
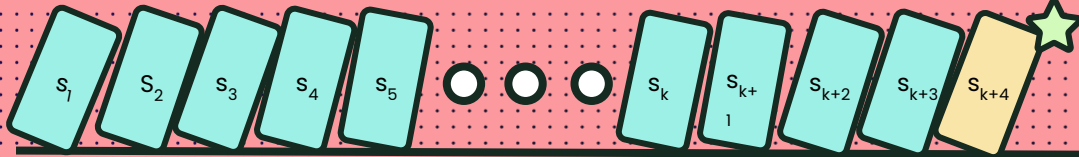
Then all statements must fall (All statements proved true)

INDUCTION: PROOF RECIPE

01 Define the **predicate** P(n)

02 **Base Case**: Prove the smallest input case

03 **Inductive Hypothesis**: For some $k \in \mathbb{N}$, assume P(k)

04 **Inductive Step:** Prove P($k+1$)