

## Some Big Ideas, Week 6

Feb 24 – Feb 28, 2025

⊙ *General structure of a Proof by Strong Induction:*

Start by giving the statement that you want to prove:

*Let  $P(n)$  be the statement ...*

To prove  $P(n)$  is true for all  $n \geq a$ , requires two steps:

1. **Base case:** Prove that each of the statements  $P(a), P(a + 1), \dots, P(m)$  is true.  
*The value of  $m$  depends upon the statement.*
2. **Inductive case:** Assume that  $P(b)$  is true  $\forall b \leq k$ , and prove that  $P(k + 1)$  is true.

If you successfully proved both results, then you can conclude

*Thus, by the principle of strong mathematical induction,  $P(n)$  is true  $\forall n \geq a$ .*

*Compare this to last week's Big Picture Ideas for a proof by induction. What is different?*

⊙ Review the Big Picture Ideas from previous weeks.

⊙ Read Appendix A, Elements of Style for Proofs, in Ernst *Introduction to Proof via Inquiry-Based Learning* at <http://danaernst.com/IBL-IntroToProof/>.

It includes some really good, concrete stylistic advice when writing up your proofs (although I think reasonable people may disagree about their suggestion #9).

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Some of the resources I used in constructing the Big Ideas notes this semester are: Ernst: *Introduction to Proof via Inquiry-Based Learning*; Epp: *Discrete Mathematics with Applications, 4th edition*; Levin: *Discrete Mathematics, An Open Introduction, 4th edition*; Sundstrom: *Mathematical Reasoning, Writing and Proof, Version 3*.

Check the ***Tentative Weekly Syllabus*** on the course webpage for the specific sections relevant for this week.