CSE 2315 - Induction
September 21, 2020
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1 Induction

Induction is best explained through an example. Imagine you're climbing an infinitely high ladder. We make 2 assertions about your climbing abilities. First, $P(1) =$ you can reach the first rung, and $P(k) \rightarrow P(k+1)$ for any positive k (you can reach the next rung).

So by statement 1, you can reach the first rung, and by statement 2 you can reach the $k+1=2$ rung. By statement 2 again you can reach the 3rd rung, then the 4th, and so on. By statement 2, there is no rung you cannot reach.

More formally

- First principle
  - $P(1)$ is true
  - $(\forall k)[P(k) \text{ true} \rightarrow P(k+1) \text{ true}]$
  - $P(n)$ is true for all positive integers n.
- Second principle
  - $P(1)$ is true
  - $(\forall k)[P(r) \text{ is true for all } r, 1 \leq r \leq k \rightarrow P(k+1) \text{ true}]$
  - Use this principle when the case $k+1$ depends on results further back than k