Weak Induction Template

1. Define $P(n)$. State that your proof is by induction on n.
2. Base Case: Show $P(b)$ i.e. show the base case
3. Inductive Hypothesis: Suppose $P(k)$ for an arbitrary $k \geq b$.
4. Inductive Step: Show $P(k+1)$ (i.e. get $P(k) \rightarrow P(k+1)$)
5. Conclude by saying $P(n)$ is true for all $n \geq b$ by the principle of induction.

Strong Induction Template (with multiple base cases)

1. Define $P(n)$. State that your proof is by induction on n.

2. Base Cases: Show $P(b_{min}), P(b_{min+1}) \ldots P(b_{max})$ i.e. show the base cases

3. Inductive Hypothesis: Suppose $P(b_{min}) \wedge P(b_{min} + 1) \wedge \cdots \wedge P(k)$ for an arbitrary $k \geq b_{max}$. (The smallest value of k assumes **all** bases cases, but nothing else)

4. Inductive Step: Show $P(k + 1)$ (i.e. get $[\mathrm{P}(\mathrm{b}_{min} \wedge \cdots \wedge P(k)] \rightarrow P(k + 1)$)

5. Conclude by saying $P(n)$ is true for all $n \geq b_{min}$ by the principle of induction.

Structural Induction Template

1. Define $P()$ Show that $P(x)$ holds for all $x \in S$. State your proof is by structural induction.

2. Base Case: Show $P(x)$
[Do that for every base cases x in S.]

Let y be an arbitrary element of S not covered by the base cases. By the exclusion rule, $y =$<recursive rules>

3. Inductive Hypothesis: Suppose $P(x)$
[Do that for every x listed as in S in the recursive rules.]

4. Inductive Step: Show $P()$ holds for y.
[You will need a separate case/step for every recursive rule.]

5. Therefore $P(x)$ holds for all $x \in S$ by the principle of induction.