CSE 311: Foundations of Computing I Induction Proof Templates

(Ordinary) Induction Template

To prove by induction that $\forall n ((b \leq n) \rightarrow P(n))$ holds, fill in the $\langle \langle \dots \rangle \rangle$ parts below.

The first base case must be n = b. The last base case can be any number $c \ge b$ (including b itself). Whatever c is chosen, all integers in the range $b \dots c$ must be included as base cases.

Let P(n) be the statement " $\langle \langle \text{define } P(n) \rangle$ mathematically ". We will prove P(n) for all $n \ge b$ by induction.

```
Base Case (n = b). \langle \langle \text{prove } P(b) \text{ here} \rangle \rangle
```

•••

Base Case (n = c**).** $\langle \langle \text{prove } P(c) \text{ here} \rangle \rangle$

Induction Hypothesis. Suppose P(k) holds for some arbitrary $k \ge c$, i.e., that $\langle \langle \text{state } P(k) \text{ mathematically} \rangle \rangle$. Induction Step. $\langle \langle \text{prove } P(k+1) \text{ here} \rangle \rangle$ (Your must use P(k)!)

Thus, P(n) holds for all $n \ge b$ by induction.

Strong Induction Template

Let P(n) be " $\langle \langle \text{define } P(n) \rangle$ mathematically ". We will prove P(n) for all $n \ge b$ by strong induction.

Base Case (n = b**).** $\langle \langle \text{prove } P(b) \text{ here} \rangle \rangle$

•••

Base Case (n = c**).** $\langle \langle \text{prove } P(c) \text{ here} \rangle \rangle$

Induction Hypothesis. Suppose, for some arbitrary $k \ge c$, that P(j) holds for very integer j from b to k.

Induction Step. $\langle (\text{prove } P(k+1) \text{ here} \rangle \rangle$ (When you use P(j), you **must** confirm j falls in the range above!)

Thus, P(n) holds for all $n \ge b$ by strong induction.