Solving recurrences

The master method

The substitution method
- guess and verify

by induction

"play" with the recurrence – the iteration method

do so visually – the recursion tree method

> ***4.3-1***
> Show that the solution of $T(n) = T(n-1) + n$ is $O(n^2)$.

Proof by Induction

4.3-1

Show that the solution of $T(n) = T(n-1) + n$ is $O(n^2)$.

S1. State the "for all" statement that you want to prove: $\forall x \in S\ P(x)$

S2. Say ***we prove this by induction on*** and state the induction parameter.

S3. Prove the base case[s], often $n = 0$ or $n = 1$ or both.

S4. Write ***Induction Step: for a given*** x ***with size*** $n >$ ***the base cases, ...***

S5. State the ***Induction Hypothesis (IH): I can assume, for all*** y ***of size*** k***, with base cases*** $k < n$***, that ...*** (e.g., that $P(y)$ *is true*.)

S6. State what you are going to prove about your specific value of x of size n that was given to you in S4: e.g., *I want to prove* $P(x)$.

S7. Do the proof for the specific x and n, often by expanding the basic definition, applying the IH, then doing some calculation.

S8. Declare victory: ***Therefore, we have proved*** $\forall x\ P(x)$ ***by induction.***