Time and Space Complexity:

Upper bounds:

\[ O(f(n)) \]

Lower bounds:

\[ \Omega(g(n)) \]

No algorithm can be better:

\[ f(n) \geq g(n) \]

\( f(n) \) and \( g(n) \) are "asymptotically in the same class"

## Primitive Instructions

Set of instructions: \{ Read, Write, Arithmetic, Comparison, Logical \}

Tightness of the analysis using a concrete input should not be confused with lower bound
\[ a = 2 \]
\[
\text{for } i := 1 \text{ to } n \text{ do }
\]
\[ a \leftarrow a \times a \]
\[
\text{end}
\]
\[
\text{print } a
\]

2

\[ 2^n \]

**What is the value printed?**

**Notion of induction**

**Claim** After \( i \) iterations, \( i \geq 0 \), value \( a = 2 \)

**Base case**: \( i = 0 \quad a = 2^0 = 2^1 = 2 \)

**Inductive step**: If assertion \( P(i) \) is true after \( i \) steps then it is true after \( i+1 \) steps \( P(i) \Rightarrow P(i+1) \) for all \( i \geq 0 \)

**Size of operands is crucial for analysis**: Operands must fit into a few "words".

For inputs of size \( n \), the operands should be \( O(\log n) \) bits.
Given a set $S$ of $n$ pairs of the form $(x_i, y_i)$, $i=1 \ldots n$.

A pair $(x_i, y_i)$ "dominates" $(x_j, y_j)$ if $x_i \geq x_j$ and $y_i \geq y_j$.

A maximal subset of $S$ is one whose pairs that are not dominated.

Problem: Find all maximal pairs.