4s. Reductions

Monday, February 21, 2022 11:24 AM

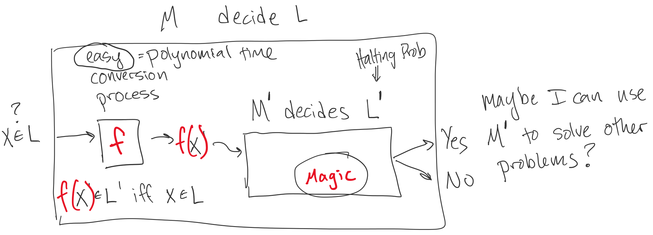
Goals

- Describe how we use reductions to compare problems
- Write a proof using reductions.

What is Computational Complexity?

- What resources are required to solve a problem? ← Hard
- What is the relative power of computational resources? ←
- What is the relative difficulty of solving various problems ← Easier

Addition vs. Multipl. vs. Trav. Sales



Resources needed to solve L' are sufficient to solve L. (Might be way more than needed)

"L' is harder than L"

Reductions

A language $L \subseteq \{0,1\}^*$ is polynomial time reducible to $L' \subseteq \{0,1\}^*$, denoted $L \leq_p L'$, if there is a polynomial-time computable function $f: \{0,1\}^* \to \{0,1\}^*$ s.t. $\forall x \in \{0,1\}^*$, $x \in L$ iff $f(x) \in L'$.

↓ $O(n^c)$ for some $c \geq 1$.

Prove: If $L' \in P$ and $L \leq_p L'$, then $L \in P$

Let M be the TM that does [~~~]

Then $M(x) = 1$ iff $x \in L$ b/c [~~~]

Now M runs in $O(n^{??})$ steps b/c

[~~~]