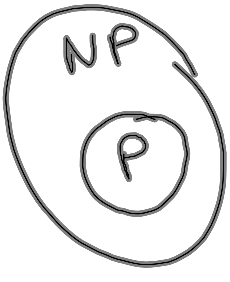


Cook and Levin

boolean formula

- variables: x, y, z
- operations: $\wedge, \vee, \neg$

$\neg x$ $\quad \bar{x}$

$!x$ $\quad \sim x$

Is there an assignment of t or f values to the variables that makes the formula true? (satisfying assignment)

If so, the formula is satisfiable.

$x \wedge y$ yes $x=t, y=t$

$x \wedge \bar{x}$ no

$SAT = \{ \langle \phi \rangle \mid \phi$ is a satisfiable boolean formula$\}$

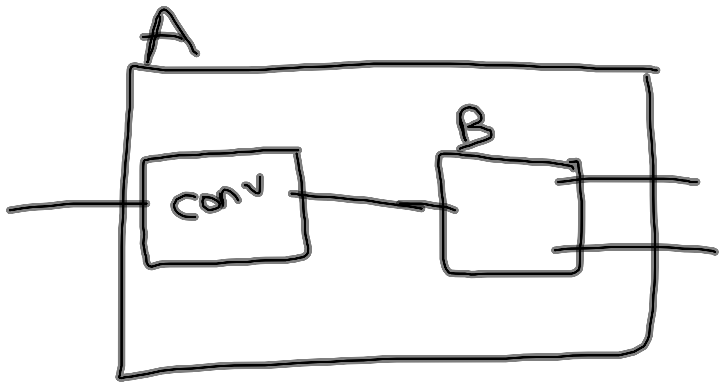
Cook-Levin Thm:

$SAT \in P$ iff $P = NP$

NP-complete (NPC)

if an NPC problem is solvable in polynomial time, then <u>all</u> NP problems are solvable in polynomial time.

A reduces to B



A function $f : \Sigma^* \to \Sigma^*$ is a polynomial time computable function if some polynomial time TM exists that halts w/ just $f(w)$ on its tape, when started on any input w.

Language A is poly-time reducible to language, $A \leq_p B$ if a poly-time function f exists where for every w

$$w \in A \text{ iff } f(w) \in B$$

if $A \leq_p B$ and $B \in P$ then $A \in P$

3-SAT

1. formulas are in conjunctive normal form
   - literals: $x, \bar{x}$
   - terms: literals or'd together $(x \vee \bar{y})$ $(x \vee y \vee z)$
   - formulas: terms and'd together $(x \vee y) \wedge (\bar{x} \vee \bar{y})$

AND

2. each term contains exactly 3 literals.

3CNF

$3SAT = \{\langle \phi \rangle \mid \phi$ is a satisfiable 3cnf formula$\}$

$3SAT \leq_p$ CLIQUE

$\{\langle G, k \rangle \mid G$ is an undir. graph that contains a k-clique$\}$

3SAT