CS477
Termination
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Does a given program $P$ terminate on all inputs?
Equivalence: Given a TM, does it halt on all inputs?

\[ L = \{ <TM> \mid \exists \text{ input } w \text{ s.t. } \forall u \text{ TM does not halt on time } n \} \]
\[ f(s) > f(s') \]
\[ \mathbb{N} \quad 0 \rightarrow 1 \rightarrow 2 \rightarrow \cdots \]

\( (\mathbb{N}, \leq) \) any order such that strictly there are no infinite descending chains.

\[ \exists S_0, S_1, S_2 \ldots \text{ s.t. } S_i > S_{i+1} \text{ then } \mathbb{N} \]

I can even make \( \leq \) a partial order.

Well-founded orders
\( W = \{ (a,b) \mid a, b \in \mathbb{N} \} \)

\( \leq \equiv \) \( (a,b) \leq (c,d) \) if

\( a < c \) or \( (a = c \land b \leq d) \)

Reflexive.

Transitive.

Antisymmetric.

\( (a,b) \leq (c,d) \) \( (c,d) \leq (a,b) \)

\( a = c \land b = d \)
\[(0,0), (0,1), (0,2), \ldots, (1,0)\]

\[\mathbb{N}\]

\[(1,0), (1,1), \mathbb{N}\]