Polynomial time

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$$P = \bigcup_k \mathsf{TIME}(n^k)$$

Decidable languages are languages for which there is at least one Turing machine that halts in a finite number of state table lookups for each input.

P is the set of languages that are decidable in polynomial time using a deterministic Turing machine.

Polynomial means that for a length of input n the number of steps (state table lookups) is $O(n^k)$ for some $k \in \mathbb{N}$.

TIME(n^k) is the set of languages decidable in $O(n^k)$ steps.