

0.0.1 Function problem

Definition 0.1. A functional problem P is defined by a relation R over strings of an arbitrary alphabet Σ : $R \subseteq \Sigma^* \times \Sigma^*$.

An algorithm solves P if for every input x such that there exists a y satisfying $(x, y) \in R$, the algorithm produces one such y , and if there are no such y , it rejects. The output for function problems is more complex than that of a decision problem, which means it's not simply 'yes' or 'no'.

1. FP: the set of binary relations for which there is a polynomial time algorithm that, given x , finds some y for which $R(x, y)$ holds.
2. FNP: the set of binary relations for which there is a polynomial time algorithm that can determine whether $R(x, y)$ holds given both x and y .
3. TFNP: a subset of FNP for which are total relation.

0.0.2 Black-Box model