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演習第十三

Solve at least three of the following four problems.

1. Prove or disprove the following:
   There exists a function $\mathsf{f} \in \mathcal{P}$ *such that there is no function* $\mathsf{g} \in \mathcal{R}$ *with* $\mathsf{f} \subseteq \mathsf{g}$.
2. Let $\mathsf{S} = \{\mathtt{i} \mid \mathtt{i} \in \mathbb{N} \text{ and } \mathsf{U}(\mathtt{i}, \mathtt{x}) \text{ stops for all } \mathtt{x} \in \mathbb{N}\}$.
   Prove or disprove the following: S is decidable.
3. Let A, $\mathsf{B} \subseteq \mathbb{N}$. Prove or disprove the following assertions to be true.
   (a) If A and B are decidable then $\mathsf{A} \cup \mathsf{B}$ is decidable.
   (b) If A and B are decidable then $\mathsf{A} \setminus \mathsf{B}$ is decidable.
   (c) If $\mathbb{N} \setminus \mathsf{A}$ is finite, then A is decidable.
   (d) There exists a set A such that A and $\mathbb{N} \setminus \mathsf{A}$ are both undecidable.
4. Show the relation $\leqslant_{red}$ to be transitive.