Homework 4, 2024 Individual

(1) 9.2.36 (d,e)

(d) True. If L_1, L_2 are Duck-decidable, then $L_1 = \sum^{k_1} \cup \ldots \cup \sum^{k_m}$ and $L_2 = \sum^{k'_1} \cup \ldots \cup \sum^{k'_{m'}}$. Hence

$$L_1 \setminus L_2 = \bigcup_{k \in K} \sum^{k}$$ where $K = \{k_1, \ldots, k_m\} \setminus \{k'_1, \ldots, k'_{m'}\}$

so K is a finite subset of $\mathbb{Z}_{\geq 0}$. Hence $L_1 \setminus L_2$ is Duck recognizable.

(e) False. If $L_1 = \{a\}$ and $L_2 = \sum_{\text{ASCII}} \setminus \{a\}$ then $L_1, L_2 \subset \sum'_{\text{ASCII}}$ but L_1, L_2 are not all of $\sum'_{\text{ASCII}}$. Hence L_1, L_2 are Duck

undecidable. But $L_1 \cup L_2 = \Sigma^*_{ASCII}$, which is Duck decidable.

(2) 9.2.37. No: L = ACCEPTANCE and ACCEPTANCE^{Comp} are both undecidable, but L = ACCEPTANCE is recognizable.