# Exercise sheet 12: Sample Exam Questions and Q&A

**Exercise 1.** *Show that the following set is undecidable*

$$\{([\mathcal{T}_1],[\mathcal{T}_2]) \mid \mathcal{T}_1,\mathcal{T}_2 \in \mathbf{TM},\ \text{there exists } n \in \mathbb{N} \text{ such that } \varphi_{\mathcal{T}_1}(n) = \varphi_{\mathcal{T}_2}(n)\}.$$

**Exercise 2.** *Prove that the elementary CA Rule 204 is not globally universal.*

**Exercise 3.** *Let $L$ be a possibly infinite set of patterns in $\{0,1\}^{\mathbb{Z}}$ such that $\Sigma_L = \emptyset$. Must there be a finite subset $L' \subset_{\text{Fin}} L$ such that $\Sigma_{L'} = \emptyset$?*