Regular or Not? You Decide
Define \text{REGULAR} = \{ \langle M \rangle \mid \text{the set of strings accepted by } M \text{ is a regular language} \}.
Show that \text{REGULAR} is undecidable.

Counting sheep
For each set below, determine if it is countable or not. Prove your answers.
(a) \( S = \{ a_1a_2a_3 \ldots \in \{0, 1\}^\infty \mid \forall n \geq 1 \text{ the string } a_1 \ldots a_n \text{ contains more } 1\text{'s than } 0\text{'s.} \} \).
(b) \( \Sigma^* \), where \( \Sigma \) is an alphabet that is allowed to be countably infinite (e.g., \( \Sigma = \mathbb{N} \)).

Turing's Revenge
Determine whether the following languages are decidable or not. You may “use the Church–Turing Thesis” when proving your answers.
(a) \( T = \{ \langle M \rangle \mid \text{Turing machine } M \text{ accepts finitely many strings} \} \).
(b) \( U = \{ \langle M \rangle, w \mid M \text{ visits more than 251 distinct cells on its tape when processing } w \} \).