Q1)

Construct a single – tape Turing Machine that decides the language \( \{ v#w \mid v, w \in \{a, b\}^* \text{ and } 2^{|v|} = |w| \} \)

Q2)

Let \( L = \{ <M_1, M_2, M_3, M_4> \mid L(M_1) - L(M_2) = L(M_3) - L(M_4) \} \).

Where the “–” symbol is the set difference operation.

Prove that \( L \) is undecidable.

Hint: \( L_E = \{ <M_1, M_2> \mid L(M_1) = L(M_2) \} \). \( L_E \) is undecidable.