Q1: Let $\text{Infinite}_{\text{DFA}} = \{ \langle A \rangle : A \text{ is a DFA and } L(A) \text{ is an infinite language} \}$. Show that $\text{Infinite}_{\text{DFA}}$ is decidable.

Q2: Let $A = \{ \langle M \rangle : M \text{ is a DFA which doesn’t accept any string containing an odd number of 1s} \}$. Show that $A$ is decidable.

Q3: Let $A$ and $B$ be two disjoint languages. Say that language $C$ separates $A$ and $B$ if $A \subseteq C$ and $B \subseteq \overline{C}$. Show that any two disjoint co-Turing-recognizable languages are separable by some decidable language.

Q4: Let $\text{PAL}_{\text{DFA}} = \{ \langle M \rangle : M \text{ is a DFA that accepts some palindrome} \}$. Show that $\text{PAL}_{\text{DFA}}$ is decidable.

Q5: Let $A$ be a Turing-recognizable language consisting of descriptions of Turing machines $\{ \langle M_1 \rangle, \langle M_2 \rangle, \ldots \}$, where every $M_i$ is a decider. Prove that some decidable language $D$ is not decided by any decider $M_i$ whose description appears in $A$.

Q6: Let $B$ be a Turing-recognizable language consisting of TM descriptions. Show that there is a decidable language $C$ consisting of TM descriptions such that every machine described in $B$ has an equivalent machine in $C$ and vice versa.

Q7: Show that $\{ \langle G \rangle : G \text{ is a CFG over } \{0, 1\} \text{ and } 1^* \subseteq L(G) \}$ is decidable.