CS3231 : Tutorial - 7

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

Q2 : Let $A = \{\langle M\rangle : M$ 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 $\text{PAL}_{\mathsf{DFA}} = \{\langle M\rangle : M$is a DFA that accepts some palindrome$\}$. Show that $\text{PAL}_{\mathsf{DFA}}$ 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 $\{\langle G\rangle : G$ is a CFG over $\{0,1\}$ and $1^* \subseteq L(G)\ \}$ is decidable.