Assignment 7
Computer Science 235

Reading. Sections 4.1 and 4.2

1) Consider the problem of determining whether a DFA and a regular expression are equivalent. Express this problem as a language and show that it is decidable.

2) Let \( A_{\epsilon_{\text{CFG}}} = \{<G> \mid G \text{ is a CFG that generates } \epsilon \} \). Show that \( A_{\epsilon_{\text{CFG}}} \) is decidable.

3) Let \( \Psi \) be the set of all infinite sequences over \( \{0, 1\} \). Show that \( \Psi \) is uncountable using a proof by diagonalization.

4) A useless state in a pushdown automaton is never entered on any input string. Consider the problem of determining whether a pushdown automaton has any useless states. Formulate this problem as a language and show that it is decidable.

5) Let \( A = \{<R, S> \mid R \text{ and } S \text{ are regular expressions and } L(R) \subseteq L(S)\} \). Show that \( A \) is decidable.

6) Let \( R \) be a regular expression. Show that the problem of determining whether a CFG generates some string in \( L(R) \) is decidable.