Automata Theory - Final

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1 Instructions

1. Attempt as many problems as you can. You will be given partial credit.
2. The alphabet for each language is $\Sigma = \{0, 1\}$.

2 Problems

1. Design a DFA to accept the language L, that consists of all strings having even length *and not* ending in 1. (5 points)
2. Assume that you are given two DFAs A_1 and A_2; let the languages accepted by these DFAs be $L(A_1)$ and $L(A_2)$ respectively. Design a strategy to check whether $L(A_1) \subseteq L(A_2)$. (5 points)
3. Consider the CFG, G, defined by the following productions:

   $$S \rightarrow 0S1S \mid 1S0S \mid \epsilon$$

   Show that $L(G)$ is the set of all strings with an equal number of 0s and 1s. (5 points)
   Hint: Use Induction.
4. Consider the CFG G_1 defined by:

   $$S \rightarrow 0S \mid 0S1S \mid \epsilon$$

   Show that

   (a) G_1 is ambiguous. (2 points) *Hint: How many leftmost derivations does $w = 001$ have?*
   (b) Is $L(G_1) = \{0^n 1^n \mid n \geq 0\}$? (3 points)
5. Design a PDA to accept the language of palindromes L, i.e., the language L consists of all strings w, such that $w = w^R$. (5 points)
6. Design a Turing Machine to accept the regular language described by the expression $1 \cdot 0^* + 0 \cdot 1^*$. (5 points)

3 Abbreviations

1. CFG - Context Free Grammar
2. PDA - Pushdown Automaton