QUIZ - 4

Theory of Computation

10/11/2016

1. *[3 marks]* A word w is said to be cyclic if there exist $u, v \in \Sigma^* \setminus \{\epsilon\}$ such that $uv = w = vu$. Design a Turing machine that accepts an input if and only if it is cyclic.

2. *[6 marks]* Consider the following languages. (Here, $\langle M \rangle$ denotes the description of a Turing machine M.)

$$L_1 = \{\langle M \rangle \mid M \text{ halts on input } \langle M \rangle\}$$

$$L_2 = \{\langle M \rangle \mid M \text{ accepts input } \langle M \rangle\}$$

   Justify your answers to the following questions.

   (a) Is L_1 recursive? Is it recursively enumerable? Is it co-recursively enumerable?

   (b) Is L_2 recursive? Is it recursively enumerable? Is it co-recursively enumerable?

   (c) Is $(L_1)^c \cup L_2$ recursive? Is it recursively enumerable? Is it co-recursively enumerable?

   (d) Is $L_1 \cup (L_2)^c$ recursive? Is it recursively enumerable? Is it co-recursively enumerable?

3. *[5 marks]* The language-finiteness problem for context-free grammars is given below.

LANG-FINITENESS	
Input :	A context-free grammar G
Question:	Is $L(G)$ finite?

   Is LANG-FINITENESS decidable? Justify.