MCS 441 Theory of Computation

Some Sample Final Questions from the Second Half of the Course

1) Let G be the grammar

$$\begin{aligned} S &\rightarrow SAS \mid 0S1 \\ A &\rightarrow 1A \mid \epsilon \end{aligned}$$

Find a context free grammar G_1 in Chomsky Normal Form with $L(G) = L(G_1)$.

2) Give an informal but complete description of a Turing Machine that decides the language $L = \{w\#w : w \in \{0,1\}^*\}$.

3) Suppose L_1 and L_2 are Turing recognizable. Prove that $L_1 \cap L_2$ is Turing recognizable.

4) Outline the proof that the Halting Problem is undecidable.

5) Let Tot=$\{\langle M\rangle : M$ is a Turing machine and M halts on all inputs$\}$. Prove that Tot is undecidable.

6) Let $L_0 = \{w \in \{0,1\}^* : w$ has an even number of zeros.$\}$.

$$L = \{\langle A\rangle : A \text{ is a DFA and } L(A) = L_0\}.$$

Prove that L_0 is decidable.

7) TRUE or FALSE

a) E_{CFG} is decidable.

b) EQ_{CFG} is decidable.

b) If L is Turing recognizable, L is Turing decidable.

c) If L is Turing decidable, L is Turing recognizble.