THEORY OF COMPUTATION - HOMEWORK 5

Assigned 2019.01.12. Submission deadline 2019.01.22 (for only those who want their homework to be marked).

Problems

1. Consider the following "emptiness testing problem": given a DFA $\mathbf{G}$, test if $\mathbf{G}$ accepts no string, i.e. $L(\mathbf{G}) = \emptyset$. This problem can be represented by the following language:

$$E_{\text{DFA}} = \{< \mathbf{G} > |\ L(\mathbf{G}) = \emptyset\}$$

where $< \mathbf{G} >$ is a string that encodes $\mathbf{G}$. The "emptiness testing problem" is equivalent to testing if $< \mathbf{G} > \in E_{\text{DFA}}$.

Prove that the language E_{DFA} is Turing-decidable. HINT: design a (high-level) Turing machine (i.e. algorithm) that decides E_{DFA}.

2. For the Turing machine (algorithm) you designed in Problem 1, analyze its time complexity using the big-O notation. Then conclude if the language E_{DFA} is in class P or class NP.

3. Answer the following.

3.1. $O(2n^3 + 2^{50}n^2 \log n)$

3.2. $O(n2^n) + O(10\,2^n) + O(5n^4)$

3.3. $o(3n)$

3.4. $o(n^2) + o(n^3)$
