THEORY OF COMPUTATION - HOMEWORK 5

Assigned 2020.01.14. Deadline 2020.01.28 (we will discuss them in class).

Problems

1. Consider the following problem: given two DFA $\mathbf{G}_1$ and $\mathbf{G}_2$, test if they accept the same language, i.e. $L_a(\mathbf{G}_1) = L_a(\mathbf{G}_2)$.

Prove that this problem is algorithmically solvable. HINT: first write down the language L that corresponds to the problem; then design a (high-level) Turing machine (i.e. algorithm) that decides the language L.

2. Consider the Turing machine (algorithm) you designed in Problem 1, and suppose the numbers of states of $\mathbf{G}_1$ and $\mathbf{G}_2$ are no more than n.

First analyze the time complexity of the algorithm using the big-O notation with respect to n. Then conclude if the (decidable) language L in Problem 1 is in class P or class NP.

3. Answer the following.

3.1. If $f(n) = 2n^4 + 2^{50}n^2 + 10n$, then $f(n) = O(?)$

3.2. If $f(n) = 9n \log_2 n + 4n \log_2 \log_2 n + 6$, then $f(n) = O(?)$

3.3. If $f(n) = 9n^4 + n2^n$, then $f(n) = O(?)$

3.4. If $f(n) = O(n^3) + O(n^2 \log n) + O(1)$, then $f(n) = O(?)$
