Due 26 September 2019

Homework 4

Math 167 / CS 142: Complexity Theory

1. Problem 8.4.2 of the text.

> A *linear-time reduction* R must complete its output $R(x)$ in $\mathcal{O}(|x|)$ steps. Prove that there are no $\mathbf{P}$-complete problems under linear-time reductions. (Such a problem would be in $\mathbf{TIME}(n^k)$ for some fixed $k > 0$.)

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2. Part (a) of Problem 8.4.7 of the text. (Your circuits should use only AND-, OR-, and NOT-gates. Don't worry if you can't solve Part (b); I believe it is misstated—in any case it is not solved in the paper by Dymond and Cook that is cited.)

> (a) Prove that $\mathrm{CIRCUIT\ VALUE}$ remains $\mathbf{P}$-complete even if the circuit is planar. (Show how wires can cross with no harm to the computed value.)

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3. Prove that $\mathrm{CIRCUIT\ VALUE}$ remains $\mathbf{P}$-complete even if the circuit is monotone (that is, contains only AND- and OR-gates). (Hint: recall the solution to Problem 1 of Homework Assignment 2.)
