COMS W3261 CS Theory: Revised Homework 4. Assigned Nov 13, 2017.
Answers in PDF due by 11:59pm Nov 22, 2017
on Courseworks/COMSW3261/Assignments.

Each problem is worth 20 points. You can discuss problems with others but your answers must be in your own words. Late assignments cannot be accepted.

1. Is L_d reducible to L_u? Prove your answer.

2. Let A, B, and C be three languages. If there is a polynomial-time reduction from A to B and a polynomial-time reduction from B to C, then is there a polynomial-time reduction from A to C?

3. How many solutions does this instance of Post's Correspondence Problem (PCP) have?

    $A = ab, abaaa, a$
    $B = b, ab, aaa$

4. Is PCP over a unary alphabet decidable or undecidable? Prove your answer.

5. A *useless state* in a Turing machine is one that is never entered during a computation on any input. Let $L = \{M \mid M$ is a TM that has no useless states $\}$. Is L (a) recursive, (b) RE but not recursive, or (c) not RE? Prove your answer.

6. Prove that P is closed under complement. Explain why your proof fails to show that NP is closed under complement.

aho@cs.columbia.edu and *verma@cs.columbia.edu*