GROUP HOMEWORK 7, CPSC 421/501, FALL 2020

JOEL FRIEDMAN

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Please note:

(1) You must justify all answers; no credit is given for a correct answer without justification.
(2) Proofs should be written out formally.
(3) Homework that is difficult to read may not be graded.
(4) You may work together on homework in groups of up to four, **but you must submit a single homework as a group submission under Gradescope.**

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(1) Let

$L = \{\langle M \rangle \mid M \text{ is a Turning machine that accepts at least one of its inputs}\}$.

   (a) Use the fact that A_{TM} is undecidable to prove that L is undecidable: assume that L is decidable by some (Turing machine) algorithm, and explain how you can use this algorithm as a subroutine to decide A_{TM}. [On 10_22 we proved that $\mathrm{HALT}_{\mathrm{TM}}$ was undecidable by a similar method.]
   (b) Is L recognizable? Explain.
   (c) Is the complement of L recognizable? Explain.

(2) Is NP is closed under concatenation? Explain.

(3) Is NP closed under intersection? Explain.

(4) Show that if P = NP, then the complement of SAT lies in NP. [As of today, we do not know whether or not the complement of SAT lies in NP.]

Department of Computer Science, University of British Columbia, Vancouver, BC V6T 1Z4, CANADA.
E-mail address: jf@cs.ubc.ca
URL: http://www.cs.ubc.ca/~jf

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