SUPPLEMENTAL FINAL PRACTICE, CPSC 421/501, FALL 2021

JOEL FRIEDMAN

DOCUMENT UNDER CONSTRUCTION AND IS INCOMPLETE

In all the exercises below, for any $k \in \mathbb{N}$, let C_k be, as usual,

$$C_k = \bigl\{ w \in \Sigma^* \mid \textbf{the } k\textbf{-th last symbol of } w \textbf{ is } a \bigr\},$$

where $\Sigma = \{a, b\}$.

(1) True/False:

(a) The oracle ACCEPTANCE is less powerful than the oracle $\mathrm{ACCEPTANCE}^{\mathrm{ACCEPTANCE}}$ in Turning machine computations.

(b) The oracle ACCEPTANCE is less powerful than the oracle $\mathrm{ACCEPTANCE}^{\mathrm{ACCEPTANCE}^{\mathrm{ACCEPTANCE}}}$ in Turning machine computations.

(c) The oracle ACCEPTANCE is less powerful than the oracle HALT in Turning machine computations.

(d) The oracle ACCEPTANCE is more powerful than the oracle HALT in Turning machine computations.

(e) The oracle ACCEPTANCE is just as powerful as the oracle HALT in Turning machine computations.

(f) The set of Turing machines is countably infinite.

(g) The set of standardized Turing machines is countably infinite.

(h) The set of standardized Turing machines with oracle HALT is countably infinite.

Research supported in part by an NSERC grant.

(i) The set of standardized Turing machines with oracle
$$\mathrm{HALT}^{\mathrm{ACCEPTANCE}}$$
is countably infinite.

(j) MORE PROBLEMS MAY BE ADDED LATER.

(k) MORE PROBLEMS MAY BE ADDED LATER.

(l) There exists an algorithm provably in P as of 2021 for the problem 2COLOUR.

(m) If 3COLOUR turns out to be in P, then P = NP.

(n) There exists an algorithm provably in P as of 2021 for the problem 3COLOUR, commonly known to most computer science theoreticians on this planet.

(o) The oracle ACCEPTANCE is provably less powerful than the oracle $\mathrm{ACCEPTANCE}^{\mathrm{ACCEPTANCE}^{\mathrm{ACCEPTANCE}}}$ in Turning machine computations, by techniques commonly known to most computer science theoreticians on this planet as of this year, 2021.

(2) True/False:
  (a) The set of all 2-tape Turing machines is countable.
  (b) The set of all 2-tape standardized Turing machines is countable.
  (c) The set of all algorithms that can be described by 2-tape Turing machines operating on a standarized alphabet (i.e., Σ of the form $[k] = \{1, \ldots, k\}$) is countable.

(3) True/False (based on Homework 9):
  (a) The language CONNECTED, of descriptions of graphs that are connected, lies in P.
  (b) The language CONNECTED, of descriptions of graphs that are connected, lies in NP.
  (c) The language 2COLOUR, of descriptions of graphs that are (legally) 2-colourable, lies in P.

(4) True/False:
  (a) The set of all possible configurations on a given Turing machine can be identified with a subset of all finite strings over some alphabet.
  (b) The set of all possible configurations on a given Turing machine is countable.

(5) MORE PROBLEMS MAY BE ADDED LATER.

(6) MORE PROBLEMS MAY BE ADDED LATER.

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