SUPPLEMENTAL MIDTERM PRACTICE, CPSC 421/501, FALL 2023

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DOCUMENT UNDER CONSTRUCTION AND IS INCOMPLETE

(1) For each of ACCEPTANCE, NON-ACCEPTANCE, NON-PYTHON, HALTING, REJECTING, LOOPING on page 8 of the handout: "Uncomputability in CPSC 421/501," which are decidable? Which are recognizable? Explain.

(2) Explain how we proved in the first few weeks of classes that

$$\text{NON-SELF-ACCEPTING} = \text{GROUCHO-MARX-SELF} = \{p \in \Sigma^*_{\text{ASCII}} \mid p \notin \text{LanguageRecBy}(p)\}$$

is unrecognizable, by appealing to Cantor's theorem (which states that any map $f\colon S \to \text{Power}(S)$ is not surjective). In particular, what values of S and f did we use?

(3) Which of the following are true? Explain: explain why they are (always) true, or give a counterexample and explain why this is a counterexample.
   (a) If L_1, L_2 are decidable, then $L_1 \setminus L_2$ is decidable.
   (b) If L_1, L_2 are undecidable, then $L_1 \setminus L_2$ is undecidable.
   (c) If L_1, L_2 are recognizable, then $L_1 \setminus L_2$ is recognizable.
   (d) If L_1, L_2 are unrecognizable, then $L_1 \setminus L_2$ is unrecognizable.

(4) Same as Question (3), where $L_1 \setminus L_2$ is replaced with $L_1 \cup L_2$.

(5) Same as Question (3), where $L_1 \setminus L_2$ is replaced with $L_1 \cap L_2$.

(6) MORE PROBLEMS MAY BE ADDED LATER.

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