(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
NON-SELF-ACCEPTING = GROUCHO-MARX-SELF = \{p \in \Sigma^*_{ASCII} \mid p \notin \text{LanguageRecBy}(p)\}
is unrecognizable, by appealing to Cantor’s theorem (which states that any map \( f : S \to \text{Power}(S) \) 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.