PROBLEM 1. Here is the Euclidean algorithm for finding the greatest common divisor of two integers:

Input: $(u, v) \in \mathbb{Z}^2$.

def EUCLID(u, v):
    If $v = 0$, then
        return u
    else
        return EUCLID$(v, u\%v)$.

Here, $u\%v$ denotes the remainder of u upon division by v.

Find the lexicographically smallest input (u, v) with $u > v \geq 0$ such that the Euclidean algorithm takes n division steps. Start with the cases $n = 0, 1, 2, 3, 4$.

REVIEW

PROBLEM 2. Is P closed under concatenation? Prove by describing a decider, or give a counterexample.

PROBLEM 3. Is P closed under the Kleene star operator? Prove by describing a decider, or give a counterexample.

PROBLEM 4. What is the statement of Savitch's theorem?

PROBLEM 5. Is NP $\subseteq$ PSPACE?

PROBLEM 6.

(a) What is the complexity class L? NL?

(b) Prove that NL $\subsetneq$ PSPACE.

PROBLEM 7. Prove that NP $\neq$ TIME(n). Generalize this result.

PROBLEM 8. What is the Church-Turing thesis?

PROBLEM 9. Find a match in the following instance of the Post Correspondence Problem:

$$\left\{ \left[\frac{a}{baa}\right], \left[\frac{ab}{aa}\right], \left[\frac{bba}{bb}\right] \right\}.$$