1. Read Kozen Lectures 28–33.

2. Say we had a way of encoding the description of any finite automaton, pushdown automaton, or Turing machine into a string over some alphabet. Would it be possible to build an enumeration machine that enumerated descriptions for the following machines? (Justification is optional, but it can’t hurt to give some.)

   (a) all DFA’s
   (b) all NFA’s
   (c) all PDA’s
   (d) all TM’s
   (e) all total TM’s

3. Classify the following languages as recursive, r.e., or not r.e. Give a short justification for each.

   (a) $A \cap B$ for r.e. sets $A$ and $B$.
   (b) $AB$ for recursive sets $A$ and $B$.

4. Tell whether the following problems are decidable or undecidable. Give a short justification for each. For example, recall that the Halting Problem — whether a given TM halts on input $x$ — is not decidable.

   (a) whether a given TM loops on input string 10110
   (b) whether a given TM runs for at least 101 steps on input $\epsilon$
   (c) whether a given TM runs for at least 101 steps on all inputs
   (d) whether $L(M)$ is a subset of $L(N)$, where $M$ and $N$ are two given TMs

5. Prove that an r.e. set is recursive iff there exists an enumeration machine that enumerates it in increasing order.