Quiz 1

First name: ______ **Last name:** ______ **Seat #:** ______

Instructions: No notes/books/gadgets/neighbors.

1. Prof. Rogaway criticized the book's definition of a *language* as a *set of strings*; he said that one should add in that ______.

2. Let $L = \{10, 001\}$. List the first six strings of L^* in lexicographic order (assume $0 < 1$):
   ______ ______ ______ ______ ______ ______

3. A **DFA** is a five-tuple $M = (Q, \Sigma, \delta, q_0, F)$ where Q is a finite set, Σ is an alphabet, $q_0 \in Q$, $F \subseteq Q$, and δ is a function with domain ______ and range ______. In contrast, the transition function for an **NFA** has domain ______ and range ______.

4. **Left side:** draw a **DFA** for the language $L = \{0, 1\}^* \{111\}$. Make your DFA as small (= as few states) as possible. **Right side:** Draw an **NFA** for L. Make your NFA as small (= as few states) as possible. Among all such NFAs, use as few transitions as possible.

5. **Darken** the **correct** box. No justification is required. If you're not sure, guess.
   (a) **True** **False** There's a language L such that $L = L^R$ (the reversal of L, $\{x^R : x \in L\}$)
   (b) **True** **False** There's a language L_0 that's a subset of every language.
   (c) **True** **False** If L is accepted by a DFA then $\overline{L}$ is accepted by a DFA.
   (d) **True** **False** If $|L| = 5$ then L^* is infinite.
   (e) **True** **False** The concatenation of finite languages A and B is finite.
   (f) **True** **False** Every finite language L is accepted by some NFA.
   (g) **True** **False** There's an algorithm to determine if a multivariate polynomial has an integer root, but the best known algorithm is extremely slow.
   (h) **True** **False** If $M = (Q, \Sigma, \delta, q_0, F)$ is a DFA and $F = Q$ then $L(M) = \Sigma^*$.
   (i) **True** **False** If $M = (Q, \Sigma, \delta, q_0, F)$ is an NFA and $F = Q$ then $L(M) = \Sigma^*$.
   (j) **True** **False** If Σ is an alphabet then $\Sigma^* - \Sigma^+ = \{\varepsilon\}$.

6. In PS #2 we defined $\mathcal{E}(L) = \{x \in L : \text{there exists a } y \in \Sigma^+ \text{ for which } xy \in L\}$.
   Let $L = \{0\}^*\{1\}$. Then $\mathcal{E}(L) =$ ______. (Write it in a simple form.)