Quiz 1

First name: ☐ **Last name:** ☐ **Seat #:** ☐

Instructions: No notes/books/gadgets/neighbors.

1. Let $L = \{a, abb\}$. List the first seven strings of L^* in lexicographic order ($a < b$):

   ☐ ☐ ☐ ☐ ☐ ☐ ☐

2. 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 ☐. Having so defined M we defined δ^*, an *extension* of δ, to have domain ☐ and range ☐.

3. The 65$^{\text{th}}$ binary string in lexicographic order is ☐ (Assume $0 < 1$)

4. **Darken** the **correct** box. No justification is required. If you're not sure, guess.

   (a) **True** **False** $\emptyset^* = \varepsilon$.

   (b) **True** **False** Some alphabets are finite and some alphabets are infinite.

   (c) **True** **False** Some strings are finite and some strings are infinite.

   (d) **True** **False** Some languages are finite and some languages are infinite.

   (e) **True** **False** The set of complex numbers can be regarded as a language $\mathbb{C}$.

   (f) **True** **False** There is a language L_0 that is a subset of every language.

   (g) **True** **False** If $|L| = 2$ then L^* is infinite.

   (h) **True** **False** The Kleene closure of a language is always nonempty.

   (i) **True** **False** The concatenation of finite languages A and B is finite.

   (j) **True** **False** Fix Σ. If $L = \cup_{i \in \mathbb{N}} \{x_i\}$ with $x_i \in \Sigma^*$ then L is regular.

   (k) **True** **False** An algorithm can determine if a graph $G = (V, E)$ has a perfect matching.

   (l) **True** **False** If $M = (Q, \Sigma, \delta, q_0, F)$ is a DFA and $F \neq \emptyset$ then $L(M) \neq \emptyset$.

5. In the *Diophantine equation* problem you are given ☐ and you want to decide ☐. *Be precise and specific.*

6. Draw a DFA that accepts the language $L = \{aab, aba\}$. Your DFA should use as few states as possible. The underlying alphabet is $\Sigma = \{a, b\}$.