# Quiz 1

Your **name:**

**Think**. Be **precise**. Be **careful**. It is always easy to get things **wrong**.

1. Complete the following definition, following the conventions of lecture and your text: A **DFA** is a five-tuple $M = (Q, \Sigma, \delta, q_0, F)$ where $Q$ is a finite set, $\Sigma$ is an alphabet, $q_0 \in Q$, $F \subseteq Q$, and $\delta$ is a function having domain $\boxed{\phantom{xxxxxx}}$ and range $\boxed{\phantom{xxxxxx}}$.
2. Given a DFA $M = (Q, \Sigma, \delta, q_0, F)$, we let $\delta^*(q, \varepsilon) = q$ and $\delta^*(q, ax) = \delta^*(\delta(q, a), x)$. We then said that $M$ **accepts** $x$ if $\boxed{\phantom{xxxxxx}}$. [mathematically rigorous statement involving $\delta^*$] We defined $L(M) = \{x \in \Sigma^* : \boxed{\phantom{xxxxxx}}\}$.
3. Circle the correct answer.
   (a) **True** or **False**: An efficient algorithm is known to decide if map can be colored with three colors (adjacent regions getting distinct colors).
   (b) **True** or **False**: If $M = (Q, \Sigma, \delta, q_0, F)$ is a DFA and $F = Q$ then $L(M) = \Sigma^*$.
   (c) **True** or **False**: If $M = (Q, \Sigma, \delta, q_0, F)$ is a DFA and $F = \emptyset$ then $L(M) = \emptyset$.
   (d) **True** or **False**: If $A$ and $B$ are DFA-acceptable then so is $A \cap B$.
   (e) **True** or **False**: If there's a 10-state DFA that accepts $L$ then there's a 20-state DFA that accepts $L$.
   (f) **True** or **False**: $\emptyset^* = \emptyset$.
   (g) **True** or **False**: The concatenation of an infinite language and a finite language is always infinite.
   (h) **True** or **False**: If $L$ is finite then there is a DFA that accepts $L$.
   (i) **True** or **False**: It is possible to write $\{\mathtt{0}, \mathtt{1}\}^{10} = \{x_0, x_1, \ldots, x_{1023}\}$ in such a way that $\Delta_i = x_i \oplus x_{i+1}$ (where $\oplus$ denotes characterwise xor) has nine 0's and one 1 for all $0 \le i < 1024$.
4. Draw a **DFA** for the following language. Make your DFA as small as possible.
   $L_4 = \{0, 1\}^* - \{0, 01\}^*$.
5. List, in lexicographic order, the first **five** strings of $L_4$.