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 $\square$ and range $\square$.

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 $\square$. We defined $L(M) = \{ x \in \Sigma^* : \square \}$.

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 $\{0, 1\}^{10} = \{ x_0, x_1, \ldots, x_{1023} \}$ 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 $0 \leq i < 1024$.

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 $L_4$. 