CSC 320 Midterm 1 Practice Questions

1) Let $\Sigma = 0, 1$ be an alphabet, and let L be a language over Σ. Circle every true statement.

(a) Σ is countable

(b) Σ^* is counbable

(c) $L \subseteq \Sigma^*$ and L is countable

(d) $\mathcal{P}(\Sigma^*)$ is countable

(e) L^+ is countable

2) Let R be a regular expression. Circle every true statement.

(a) $R \cup \emptyset = \emptyset$

(b) $R\emptyset = R$

(c) There exists a DFA M with $L(M) = L(R)$

(d) There exists an NFA M with $L(M) = L(R)$

(e) There exists a DFA M with $L(M) = R$

3) Let $\Sigma = a, b, c, d$ and let $R = (c \cup d)^* d(a \cup ab)^*$. Select every true statement about $L(R)$.

(a) If $w \in L(R)$ then $|w| > 0$

(b) If $w \in L(R)$ then $|w| > 1$

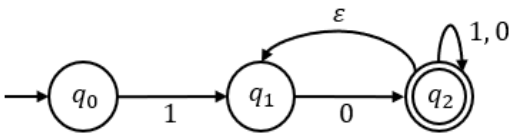
(c) If $w \in L(R)$ then w contains at least one d

(d) If $w \in L(R)$ and if w contains an a, then w contains at least one d somewhere after the occurrence of a

4) Is the language $\{110, 101\}$ a regular language? Explain.

5) Can a subset of a non-regular language be a regular language? Explain.

6) Consider the following state diagram for finite automaton M:



Describe the language recognized by M using your own words and a regular expression.

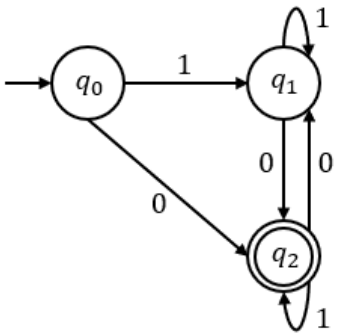
7) Consider the language $L = \{w \in \{0,1\}^* \mid w \text{ starts with } 11 \text{ and contains } 000 \text{ as a substring}\}$.

(a) Construct a DFA which recognizes L

(b) Write a regular expression which describes L

8) Create an NFA which recognizes the language described by the regular expression $(((1^*) \cup 01)^* \cup 00)1$

9) Consider the following DFA D:



Convert the DFA D to a regular expression. Show your work by drawing the state diagram for the corresponding GNFA and the state diagram after removing states q_0, q_1, and q_2. Remove the states in lexicographic order.

10) Prove that the language $L = \{0^n 1^{n+1} 0^{n+1} 0^n \mid n \geq 0\}$ is non-regular using the pumping lemma.