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## QUIZ 4

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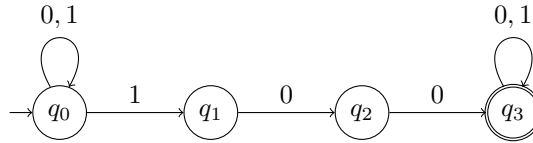


Figure 1: NFA  $N$  for problems 1 and 2

1. Consider the NFA  $N$  shown in Figure 1. Which of the following strings is *not* accepted by  $N$ ?

- (A) 001
- (B) 001100
- (C) 10011001
- (D) 1001

Correct answer is (A)

2. The language recognized by NFA  $N$  (Figure 1) is

- (A)  $\{w \in \{0,1\}^* \mid w \text{ has } 001 \text{ as a substring}\}$
- (B)  $\{w \in \{0,1\}^* \mid w \text{ has } 100 \text{ as a substring}\}$
- (C)  $\{w \in \{0,1\}^* \mid w \text{ has } 1 \text{ in the third position from the end}\}$
- (D)  $\{w \in \{0,1\}^* \mid |w| \text{ is at least } 3\}$

Correct answer is (B)

3. Let  $N = (Q, \Sigma, \delta, q_0, F)$  be an NFA. Recall that  $\hat{\delta}_N : Q \times \Sigma^* \rightarrow 2^Q$  is a function that given a state  $q$  and string  $w$  returns the set of all states the  $N$  could be in after reading  $w$  from state  $q$ . Formally,  $\hat{\delta}_N(q, w) = \{q' \mid q \xrightarrow{w}_N q'\}$ . We can say that  $N$  accepts a string  $w$  iff

- (A)  $\hat{\delta}_N(q_0, w) \in F$
- (B)  $\hat{\delta}_N(q_0, w) = F$
- (C)  $\hat{\delta}_N(q_0, w) \cap F \neq \emptyset$
- (D)  $\hat{\delta}_N(q_0, w) \subseteq F$

Correct answer is (C)

4. Let  $M$  be an NFA that accepts  $\epsilon$ . Which of the following statements is necessarily true?

- (A) The initial state of  $M$  is an accepting state.
- (B) The initial state of  $M$  is not an accepting state.
- (C) There is an NFA  $M'$  that recognizes the same language as  $M$  and has exactly one accepting state.
- (D) None of the above

Correct answer is (C)

5. Let  $L$  be recognized by a DFA  $M$  and an NFA  $N$ . Which of the following statements is necessarily true?

- (A)  $M$  and  $N$  are the exact same machines.
- (B)  $M$  and  $N$  have the same number of states.
- (C)  $N$  has transitions on  $\epsilon$ .
- (D) There is an NFA  $N'$  that recognizes  $L$  which has the same number of states as  $M$ .

Correct answer is (D)