1. Consider the set $X$ defined inductively as follows: (1) $(3, 5) \in X$, (2) if $(x, y) \in X$ then $(x + 2, y) \in X$, and (3) if $(x, y) \in X$ then $(y, x) \in X$. Which of the following pairs is a member of $X$?

(A) $(222, 402)$
(B) $(1, 7)$
(C) $(151, 1171)$

2. Let $L = \{010, 101, 001, 011\}$, and $K = \{w \mid 0w \in L\}$. Which of the following strings is a member of $K$?

(A) $0101$
(B) $01$
(C) $011$

3. Let $M$ be a DFA such that $M$ accepts the empty string $\epsilon$.

(A) The initial state of $M$ must be an accepting state.
(B) There is a DFA $N$ that recognizes the same language as $M$ and has exactly one final state.
(C) The initial state of $M$ is not an accepting state.

4. Let $M = (Q, \Sigma, \delta, q_0, F)$ be a NFA. Recall that we had defined a function $\hat{\Delta} : Q \times \Sigma^* \rightarrow 2^Q$ that given a state $q$ and string $w$ returns the states of all the active threads after reading $w$ from $q$. Using $\Delta$ we can define acceptance as $w$ is accepted by $M$ iff

(A) $\hat{\Delta}(q_0, w) \in F$
(B) $\hat{\Delta}(q_0, w) = F$
(C) $\hat{\Delta}(q_0, w) \cap F \neq \emptyset$
5. Recall that 0 is an even number. The language recognized by DFA $M$ in Figure 1 is

(A) \{$w \mid w$ has even length$\}$
(B) \{$w \mid w$ has at least one 1 and has an even number of 0s after the last 1$\}$
(C) \{$w \mid w$ has at least one 1 and has an even number of 0s$\}$

6. The language recognized by NFA $N$ in Figure 2 is

(A) \{$w \mid w$ is a string of 0s and 1s$\}$
(B) \{$w \mid w$ is a binary number that is a multiple of 4$\}$
(C) \{$w \mid w$ has a pair of 1s separated by an odd number of symbols$\}$