Quiz 5

1. Which of the following statements is true?

   (A) There are languages that can be recognized by an NFA which cannot be recognized by a DFA.

   (B) Languages recognized by NFAs cannot be recognized by DFAs because they can have infinitely many active threads at any given time.

   (C) If L is a language recognized by an NFA then there is a DFA that can recognize L.

   (D) Every language is recognized by an NFA because they are subsets of Σ^*.

   Correct answer is (C)

2. Let N be an NFA with set of states Q, and final states F. The lecture on September 11, described the construction of a DFA $\det(N)$ that is equivalent to N. The states of $\det(N)$ were subsets of Q. Which of the following describes the set of final states of $\det(N)$? Recall that 2^Q denotes the power set of Q and $\setminus$ denotes set difference.

   (A) $2^Q \cap 2^F$

   (B) $\{B \cup C \mid B \in 2^{Q \setminus F},\ C \in (2^F \setminus \{\emptyset\})\}$

   (C) $\{A \subseteq Q \mid A \subseteq F\}$

   (D) None of the above

   Correct answer is (B)

3. Let M be a DFA with m states, and N be an NFA with n states such that $\mathbf{L}(M) = \mathbf{L}(N)$. Which of the following statements is necessarily true?

   (A) $2^n \leq m$

   (B) $m < 2^n$

   (C) $n \leq m$

   (D) None of the above

   Correct answer is (D)

4. Bob claims that he has an algorithm that does the following: given an NFA N with n states, the algorithm constructs a DFA D having at most $2^{\sqrt{n}}$ states such that $\mathbf{L}(N) = \mathbf{L}(D)$. Bob's algorithm is more efficient that the construction described in class because in his algorithm, the DFA constructed does not have any states that cannot be reached from the initial state. Which of the following is true about Bob's claim?

   (A) Bob's claim is correct because there is an algorithm having the properties he claims.

   (B) Bob's claim may or may not be correct. The only way to determine its correctnes is by examining his construction and proof of correctness.

   (C) There is no way Bob's claim can be correct because there is a family of languages $L_1, L_2, \ldots, L_k, \ldots$ such that for every k, there is an NFA N_k with k states with $\mathbf{L}(N_k) = L_k$ but the smallest DFA recognizing L_k has 2^k states.

   (D) Whether Bob is correct or not really depends on which programming language he chooses to implement his algorithm in because everyone knows that C is much faster than Java.

   Correct answer is (C).