Quiz 5

1. Suppose L is a regular language. Which of the following statements is true?

   (a) The pumping lemma applies to L.

   (b) There is an integer m such that any string $w \in L$ with $|w| \geq m$ can be written as xyz, where $|y| \geq 1$ and $|xy| \leq m$, such that $xy^i z \in L$, for all $i \geq 0$.

   (c) There exists a DFA that accepts L.

   (d) All of the above.

2. Of the following strings, which one is generated by grammar:

$$S \to aaSb \mid a$$

(a) $aaaaabb$

(b) $aaaab$

(c) $aabb$

(d) $aaba$

(e) λ

3. Let $L_1 = \{a^n : n \geq 0\}$ and $L_2 = \{b^n : n \geq 0\}$. Then which of the following grammars generates the language $L_1 L_2$?

   (a) $S \to aSb \mid \lambda$

   (b) $S \to aA \mid \lambda$
   $A \to Sb$

   (c) $S \to aS \mid bS \mid \lambda$

   (d) $S \to aS \mid A$
   $A \to Ab \mid \lambda$

   (e) Both (a) and (b)

4. Which of the following languages is regular?

(a) $\{a^{n!} : n \geq 0\}$

(b) $\{a^{2^n} : n \geq 0\}$

(c) $\{a^{n^2} : n \geq 0\}$

(d) $\{a^{2n} : n \geq 0\}$

(e) None of the above

5. Consider the statement: "If n items are put into m boxes, where $n > m$, then at least one box will contain more than one item." This statement relates to which of the following?

   (a) Pumping Lemma

   (b) Pigeonhole Principle

   (c) Counting Principle

   (d) All of the above