# Quiz 4

1. Let $L$ be any language over an alphabet $\Sigma = \{a_1, \ldots, a_k\}$ such that the length of any string it contains is no more than some fixed integer $m$. Which of the following is true?

   (a) $L$ is regular.

   (b) $L$ is finite.

   (c) The complement of $L$ is regular.

   (d) All of the above.

   (e) None of the above.

2. Which of the following languages is generated by grammar:

$$S \to aSb \mid A$$
$$A \to aA \mid a$$

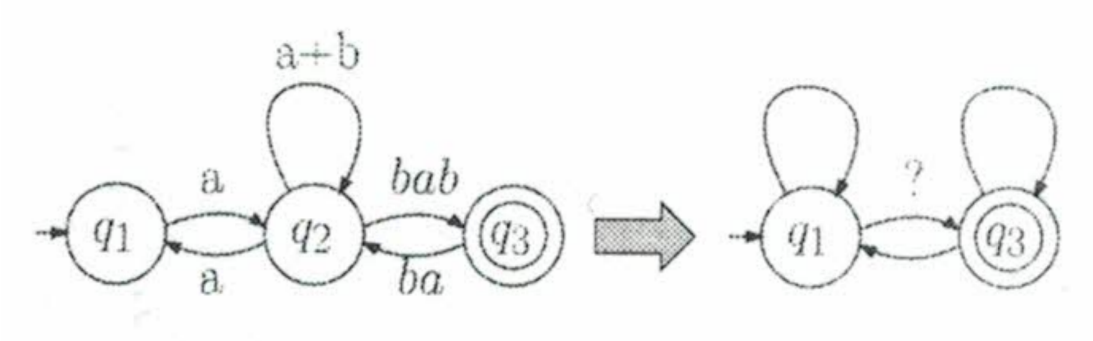
(a) $\{a^n b^n : n \geq 0\}$

(b) $\{a^n b^m : n > m\}$

(c) $\{a^n b^m : n \geq m\}$

(d) $\{a^n b^m : n, m \geq 0\}$

3. If we eliminate state $q_2$ from the Generalized Transition Diagram (GTD) on the left, then the label of the transition from $q_1$ to $q_3$ we have in the GTD on the right will be ...?




(a) $a(aa)^*(a+b+bab+ba)^*bab$

(b) $aa^*(a+b)^*(babba)^*$

(c) $a(a+b+bab)^*ba$

(d) $a(a+b)^*bab$

4. Recall the following definition for any language $L$:

$$drop(L) = \{w_1 w_2 w_3 \dots w_k : w_1 a w_2 a w_3 a \dots a w_k \in L, a \in \Sigma,$$

$$w_1, w_2, \dots w_k \in (\Sigma - \{a\})^*\}.$$

If $L = \{a^n b^n : n \geq 0\}$, then $drop(L)$ will be ...?

(a) $\{a, b\}^*$

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

(c) $\{a^m b^n : m, n \geq 0\}$

(d) All of the above

5. Recall the definition $shift(L) = \{vu : u, v \in \Sigma^*, uv \in L\}$, where $L$ is any language. For which of the following languages $L$, it holds true that $shift(L) = L$?

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

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

   (c) $\{ww^r : w \in \{a, b\}^*\}$

   (d) $\{a^m b a^n : m, n \geq 0\}$