

2. (1)

$$\begin{aligned} & \{a^i b^j a^k \mid i=j+3k, i, j, k \geq 0\} \\ &= \{a^i b^{i+3k} a^k \mid i \geq 0\} \\ &= \{(a^i b^i) (b^{3k} a^k)\}. \end{aligned}$$

设计如下文法

$$\begin{cases} S \rightarrow X\gamma \\ X \rightarrow aXb \mid \epsilon \\ \gamma \rightarrow bbb\gamma a \mid \epsilon \end{cases}$$

(2) 无法写成xx形式的CL串

故其最长为奇数，最长为偶数，但前一半与后一半不完全相同。

故

$$\begin{cases} S \rightarrow O \mid \epsilon \\ O \rightarrow O \mid I \\ -O \rightarrow C \mid CO \\ E \rightarrow OEO \mid IEI \mid OA \mid IA \\ A \rightarrow OA \mid IA \mid \epsilon \end{cases}$$