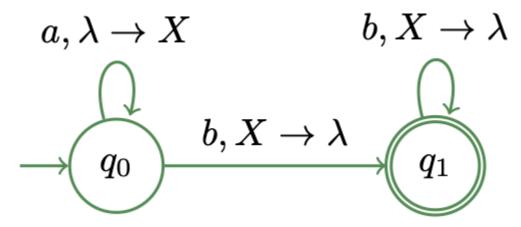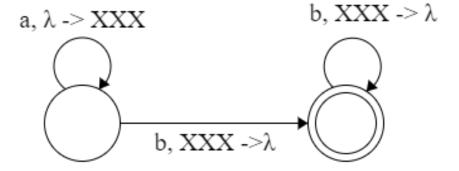1. Refer to the grammars in Examples 6–5 and 6–6 to find CFGs for the following:

a. The union of the languages in Examples 6–5 and 6–6

S-> aSa|bSb|X|XY

X->aYb|bYa|aXb|λ

Y->aY|bY|λ

b. The concatenation of the languages in Example 6–5 and 6–6, in that order

S-> aSaXY|bSbXY|XXY

X->aYbaXb|bYaaXb|aYb|bYa

Y->aYaY|bYaY|aY|bY|λ

c. The Kleene star of the language in Example 6–5.

S->SS|λ

S->aSa|bSb|X

X->aYb|bYa

Y->aY|bY|λ

2. Find a PDA for the intersection of the PDA in Figure 5–1 (repeated below) and the language of strings of a's and b's where the numbers of a's is a multiple of 3 (you can figure out that DFA).

3. Are deterministic context-free languages closed under regular difference? Why or why not? (Note: The *regular difference* with a Context free language, *C*, and a Regular language, *R*, is *C–R* or *R–C*.)

they are not due to the fact that regular difference are Regular Language and regular languages are deterministic