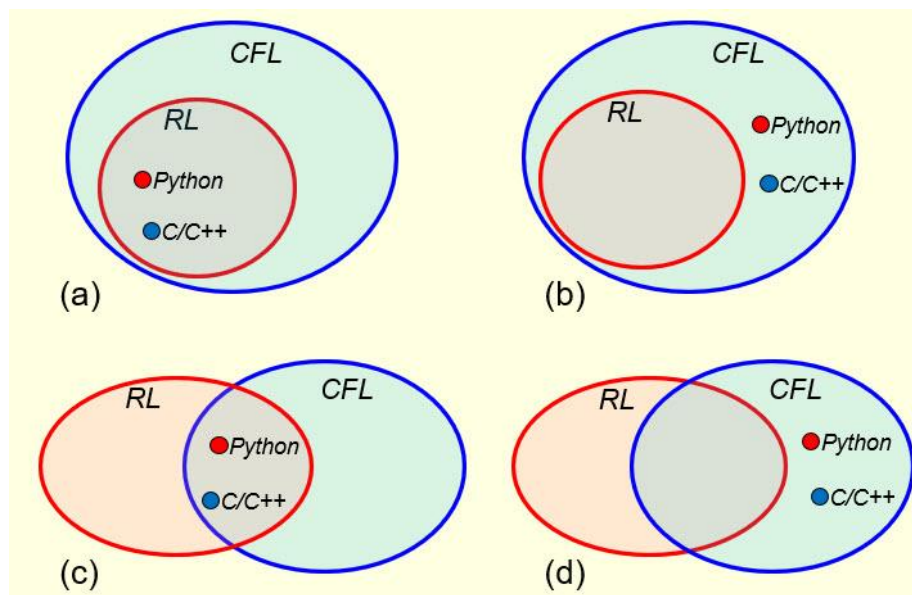


CS375 Homework Assignment 5 (40 points)

Due date: 10/16/2025

1. (2 points)

In the following four cases, which one is the correct representation of the relationship between the set of Regular Languages (RL) and the set of Context-Free Languages (CFL), and also the memberships of the Python and C/C++ programming languages with RL and CFL?

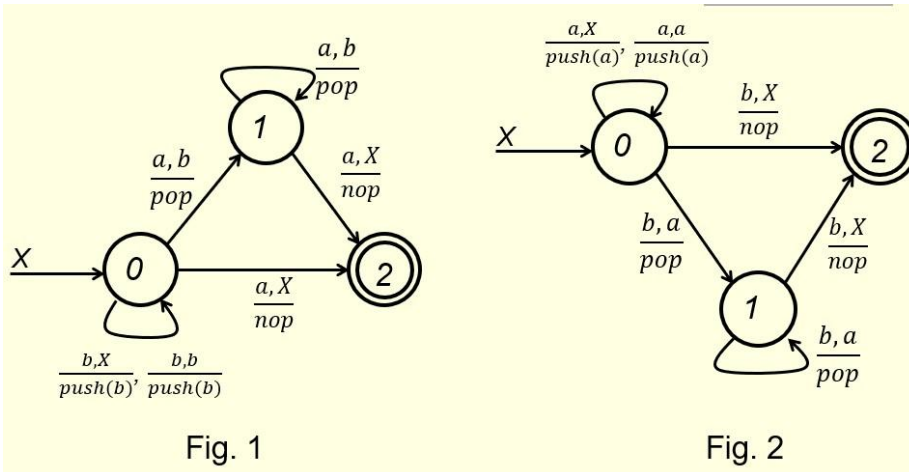


Put your answer in the following blank.

2. (4 points)

The language accepted by the final-state PDA shown in Fig. 1 below is:

(2 points)



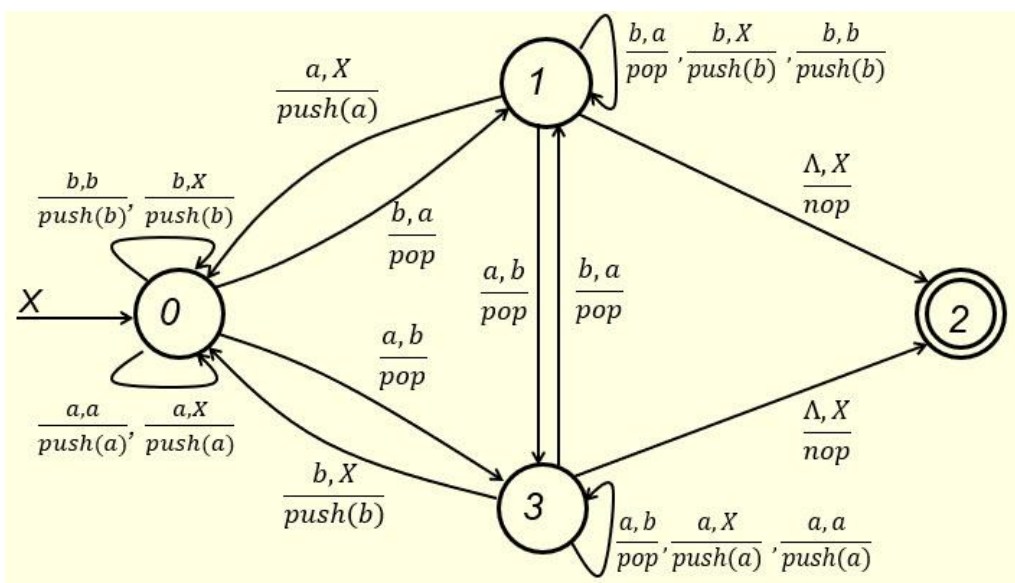
The language accepted by the final-state PDA shown in Fig. 2 is:

(2 points)

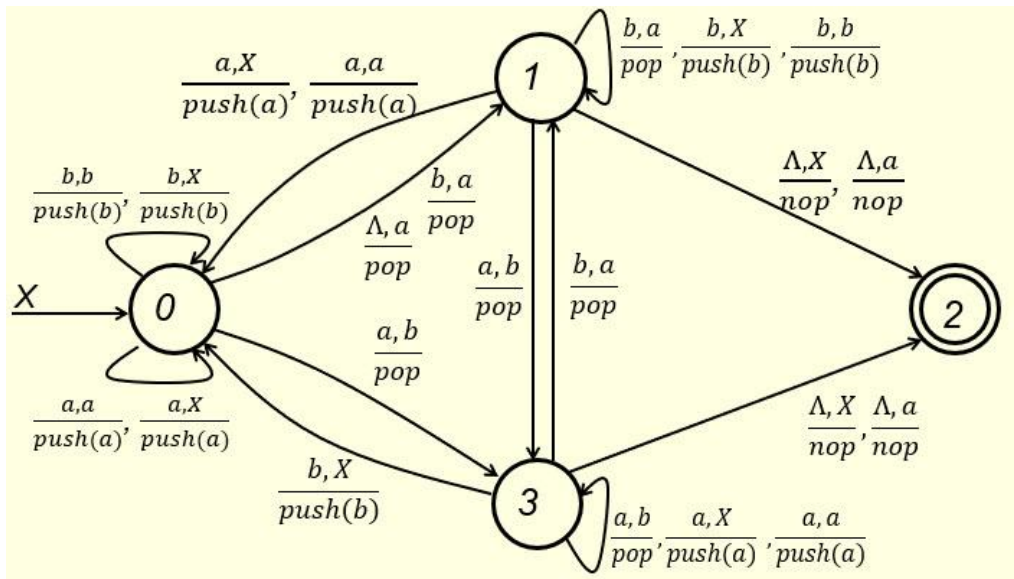
3. (4 points)

If the language accepted by the following final-state PDA is:

$$\{ w \in \{a, b\}^+ \mid N_a(w) = N_b(w) \}$$



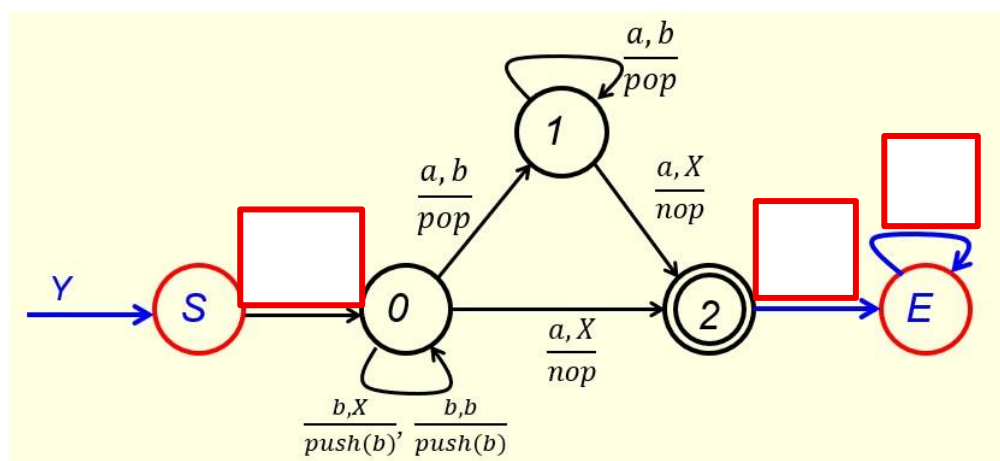
then what is the language accepted by the following final-state PDA?



Put your answer in the following text box.

4. (6 points)

To convert a final-state PDA to an empty-stack PDA, we put it between a new start state **S** and a new state **E** and define some new edges and new transition instructions for the new edges. For instance, for the final-state PDA shown in Fig. 1 of Question 2, we would get the following empty-stack PDA. Fill out the blanks in the following figure.



5. (8 points)

The language generated by the following C-F grammar

$$S \rightarrow ABC \mid d \quad A \rightarrow aA \mid \Lambda \quad B \rightarrow bB \mid \Lambda \quad C \rightarrow cC \mid \Lambda$$

is $\{a^k b^m c^n + d \mid k, m, n \in N\}$. To transform the above C-F grammar to a one-state empty-stack PDA so that the accepted language of the PDA is the same as the language generated by this C-F grammar, we need to construct a set of specific instructions for this PDA. Four instructions have already been constructed below. Construct the remaining instructions for this PDA in the following blanks. You might not need all the provided blanks.

(0, a, a, pop, 0)
 (0, b, b, pop, 0)
 (0, c, c, pop, 0)
 (0, d, d, pop, 0)

6. (16 points)

Given the following empty-stack PDA,

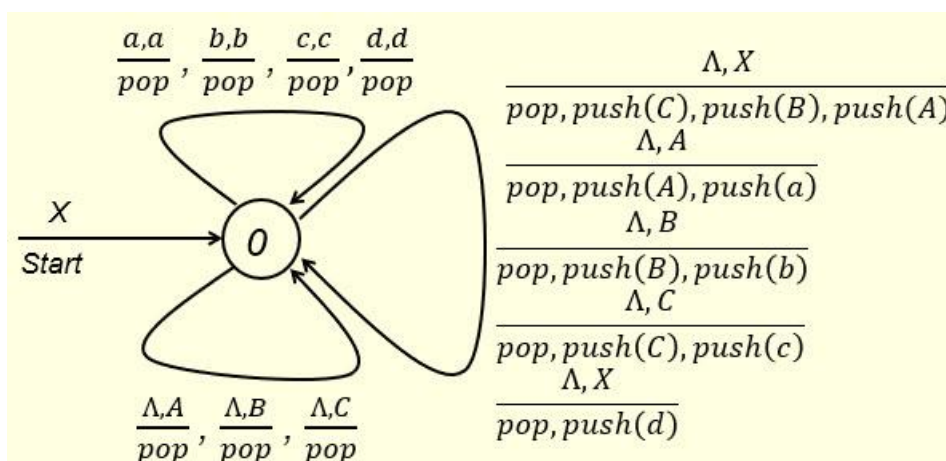


Diagram illustrating a Turing Machine tape configuration. The tape is divided into two sections. The left section contains the string $(0, \underline{ba}, X)$ in the top cell, with the 'a' underlined. The right section is empty. A red arrow points from the bottom of the left section to the top of the right section.

Diagram illustrating a Turing Machine tape configuration. The tape is divided into two sections. The left section contains the string $(0, \underline{bc}, X)$ in the top cell, with the c underlined. The right section is empty. A red arrow points from the bottom of the left section to the top of the right section.

$(0, \wedge, X)$	$(0, d, X)$

- Solutions must be typed (word processed) and submitted both as a pdf file and a word doc file to Canvas before 23:59 on 10/16/2026.
- Don't forget to name your files as
[CS375_2026f_HW5_LastName.docx](#) / [CS375_2026f_HW5_LastName.pdf](#)