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Q1 **a)** **Consider the following PDA:**

$P = (\{q0, q1, q2, q3, f\}, \{a, b, c\}, \{Z_0, A, B\}, \delta, q0, Z_0, \{f\})$

The language $L(P) = \{ wcw^R \mid w \in \{a, b\}^+ \}$

Transition functions δ are as follows:

1. $\delta(q0, a, Z_0) = (q0, AZ_0)$
2. $\delta(q0, b, Z_0) = (q0, BZ_0)$
3. $\delta(q0, a, A) = (q0, AA)$
4. $\delta(q0, b, A) = (q0, BA)$
5. $\delta(q0, a, B) = (q0, AB)$
6. $\delta(q0, b, B) = (q0, BB)$
7. $\delta(q0, c, A) = (q1, A)$
8. $\delta(q0, c, B) = (q1, B)$
9. $\delta(q1, a, A) = (q1, \varepsilon)$
10. $\delta(q1, b, B) = (q1, \varepsilon)$
11. $\delta(q1, \varepsilon, Z_0) = (f, Z_0)$

Analyze the execution of the PDA and provide the sequence of **Instantaneous Descriptions (IDs)** to demonstrate that the strings:

- "aba c aba"

b) **Using the Pumping Lemma, prove that the language**

$L = \{ a^n b^n c^n \mid n \geq 1 \}$

is not regular.