

Pushdown automata

1. The transition function δ of a pushdown automaton is given by the following table

state	input	stack	new state	stack
q_0	ε	ε	q	$\$$
q	a	$\$$	q	$A\$$
q	b	$\$$	q	$B\$$
q	a	A	q	AA
q	b	A	q	ε
q	a	B	q	ε
q	b	B	q	BB
q	ε	$\$$	q_F	ε

Let the start state be q_0 and q_F the only accept state. Explain how the automaton works. What is the accepted language?

2. Describe a pushdown automaton for the language

a) $L_1 = \{ \mathbf{a^i b^j c^k} : i + j = k \}$

b) $L_2 = \{ \mathbf{a^i b^j c^k} : j + k = i \}$

c) $L_3 = \{ \mathbf{a^i b^j c^k} : i + k = j \}$

3. Describe a pushdown automaton for the language $L = \{ \mathbf{a^i b^j c^k} : i = j \text{ or } i = k \}$

4. Describe a pushdown automaton for the language $L = \{ 0^m 1^n : 1 \leq m < n < 2m \}$