PES UNIVERSITY, Bangalore

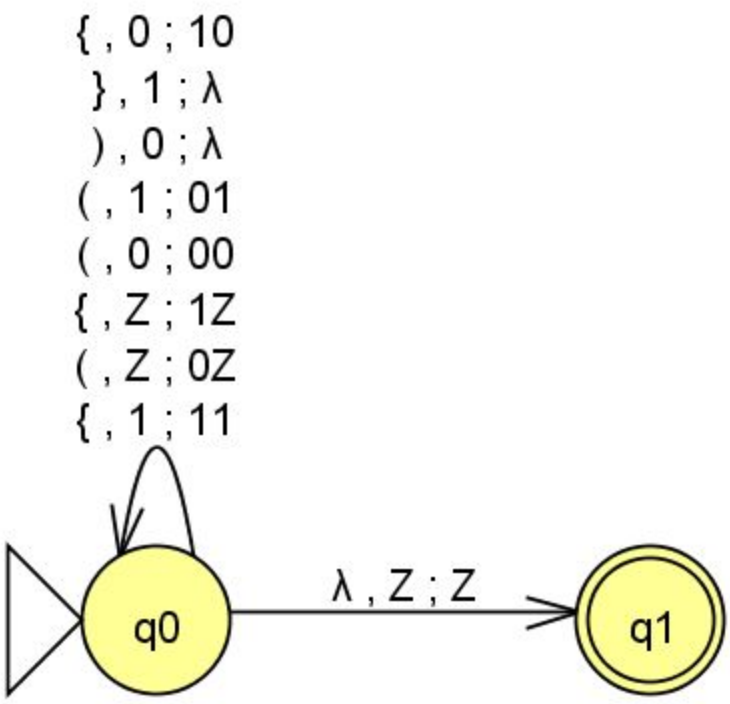
(Established under Karnataka Act No. 16 of 2013)

Department of Computer Science & Engineering

Automata Formal Languages & Logic

Q&A - Pushdown Automata

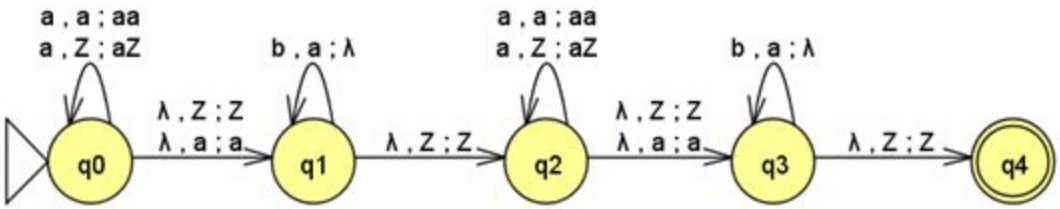
1. Proper nesting of parentheses and flower brackets. For example, {(())(){{()}{}}}. Show how it rejects {(){{()}}}.



Solution:
It can be seen that {(())(){{()}{}}} is accepted with the sequence (showing only successive stack contents):
Z, 1Z, 01Z, 001Z, 01Z, 1Z, 01Z, 1Z, 11Z, 111Z, 0111Z, 111Z, 11Z, 111Z, 11Z, 1Z, Z
The string {(){{()}}} is rejected with the sequence:
Z, 1Z, 01Z, 1Z, 11Z, 111Z, 0111Z,
At this point, there is a mismatch between the next input symbol } and the symbol 0 on the stack and the PDA halts right there, rejecting the input.

2. $a^n b^n a^m b^m$, $n \geq 0$, $m \geq 0$. Show, along with two different accepting sequences of configurations, how non-determinism works to accept the string *aaabbb* in two different ways.

Solution:



Accepting sequence 1 for aaabbb:
(q_0, aaabbb, Z), (q_0, aabbb, aZ), (q_0, abbb, aaZ), (q_0, bbb, aaaZ), (q_1, bbb, aaaZ), (q_1, bb, aaZ), (q_1, b, aZ), (q_1, λ, Z), (q_2, λ, Z), (q_3, λ, Z), (q_4, λ, Z).

Accepting sequence 2 for aaabbb:
(q_0, aaabbb, Z), (q_1, aaabbb, Z), (q_2, aaabbb, Z), (q_2, aabbb, aZ), (q_2, abbb, aaZ), (q_2, bbb, aaaZ), (q_3, bbb, aaaZ), (q_3, bb, aaZ), (q_3, b, aZ), (q_3, λ, Z), (q_4, λ, Z).

In fact, there is a third accepting sequence:
(q_0, aaabbb, Z), (q_0, aabbb, aZ), (q_0, abbb, aaZ), (q_0, bbb, aaaZ), (q_1, bbb, aaaZ), (q_2, bbb, aaaZ), (q_3, bbb, aaaZ), (q_3, bb, aaZ), (q_3, b, aZ), (q_3, λ, Z), (q_4, λ, Z).

3. $a^n bab^n$, $n > 0$. Make sure that the PDA is deterministic

Solution:

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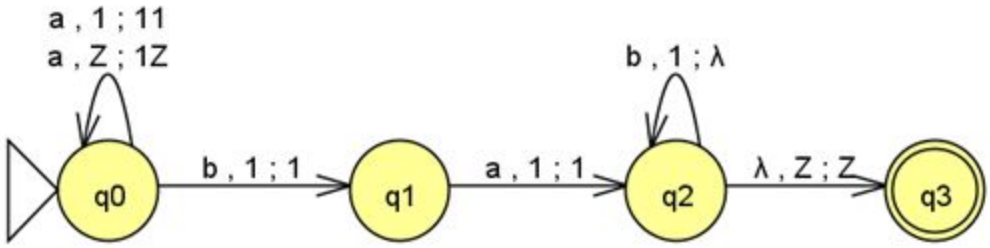
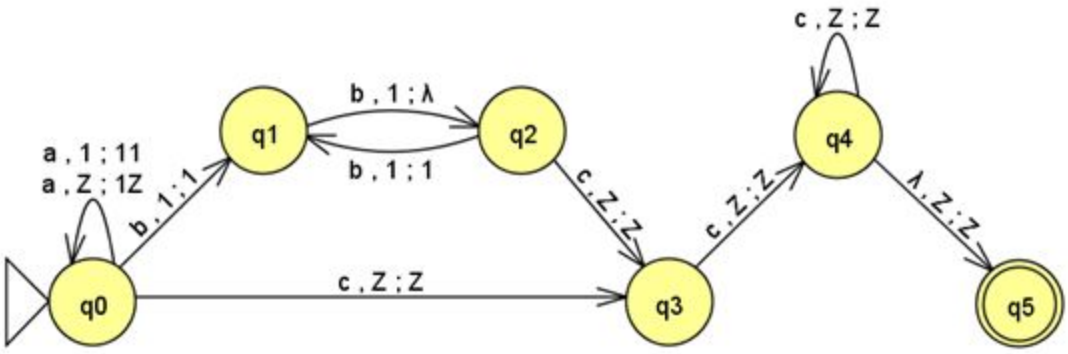


4. $a^n b^m c^k$ where $2n = m$ and $k \geq 2$. Make sure that the PDA is deterministic.

Solution:



5. Construct a PDA for the language $L = a^n b^m$ where m = n mod 3. How much stack memory do you need to handle this language?

Solution:

The stack is not needed at all; this is a regular language!

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