Branch : CSE & IT **Batch : Hinglish**

Theory of Computation

Push Down Automata

DPP 02

[MSQ]

1. Which of the following is string accepting mechanism of PDA.

(a) PDA using final state.
(b) PDA using empty stack.
(c) PDA using both empty stack and final state.
(d) PDA using transition state.

[MSQ]

2. Which of the following is correct push operation:

(a) Σ (q, a , b) = (q', ab)
(b) δ (q, a , b) = (q, ab)
(c) δ (q, a , b) = (q', ab)
(d) Σ (q, a , b) = (q', $\in$)

[NAT]

3. Consider the following statements:

(I) All DPDA are NPDA.
(II) All NPDA are DPDA.
(III) All NPDA and DPDA are equivalent.
(IV) All context free language are regular language.

The total number of correct statements are_____.

[MCQ]

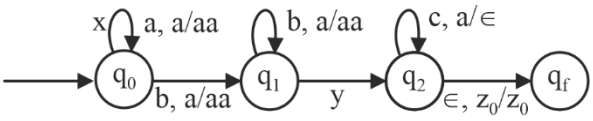
4. What does following transition means:

$\delta(q, \in, b) = (q', b)$

(a) Push b (b) Pop b
(c) Read b (d) No operation

[MCQ]

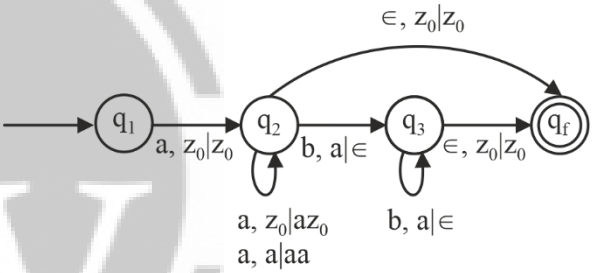
5. What are the values of x and y, if the language accepted by NPDA is $L = \{a^m b^n c^{(m+n)} \mid m, n \geq 1\}$.



(a) x = $\in$, a/a ; y = c, b/$\in$
(b) x = a, z_0/z_0 ; y = c, b/c
(c) x = a, a/aa ; y = b, c/c
(d) x = a, z_0/az_0 ; y = c, a/$\in$

[MCQ]

6. Which language is accepted by the following PDA.



(a) $L = \{a^n b^{n+1} \mid n \geq 1\}$
(b) $L = \{a^{n+1} b^m \mid n, m \geq 1\}$
(c) $L = \{a^{n+1} b^n \mid n \geq 0\}$
(d) $L = \{a^n b^{n+1} \mid n \geq 0\}$

[MSQ]

7. Which of the following languages are accepted by PDA.

(a) $L = \{a^n b^n c^m \mid m, n \geq 1\}$
(b) $L = \{a^n b^n c^m \mid m \leq n\}$
(c) $L = \{a^n b^m c^n d^m \mid m, n \geq 0\}$
(d) $L = \{a^m b^n c^n d^m \mid m, n \geq 0\}$

Answer Key

1. **(a, b, c)**
2. **(b, c)**
3. **(1)**
4. **(d)**
5. **(d)**
6. **(c)**
7. **(a, d)**

Hints & Solutions

1. (a, b, c)

PDA accepts string using final state, empty stack & both and all methods are equivalent.

2. (b, c)

$\delta(q, a, b) = (q, ab)$ is correct push operation on current state.

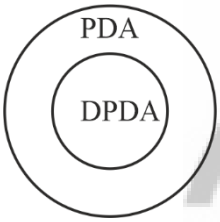
$\delta(q, a, b) = (q', ab)$ is the correct push operation

$\delta(q, a, b) = (q', ab)$

Push a

3. (1)

(I) All DPDA are PDA: correct



(II) All PDA are DPDA: incorrect

Some PDA are DPDA but all PDA are not DPDA.

(III) All PDA and DPDA care equivalent: incorrect

DPDA are subset of PDA. So all PDA and DPDA are not equivalent.

(IV) All context free language are regular language: incorrect

CFL are superset of RL. So, this statements is incorrect. However, all regular languages are context free languages.

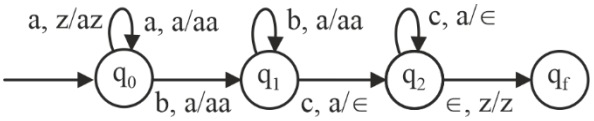
Therefore only 1 statement is correct.

4. (d)

$\delta(q, \in, b) = (q', b)$, this represents no operation is performed on stack. So, there is no change in the stack.

5. (d)

The PDA will be:



The x is to insert/push initial "a" into stack.

The y is to remove/pop an "a" for each "c".

6. (c)

$L = \{a^{n+1} b^n \mid n \geq 0\}$

$= \{a^1 \quad a^n \quad b^n \mid n \geq 0\}$

↓ ↓ ↓

Skip Push Pop

In the given PDA, first "a" is being skip. Then, for "n' number of 'a' are inserted and once 'b' starts appearing for each 'b', we will pop one "a".

Hence, option (c) is correct.

7. (a, d)

(a) $L = \{a^n b^n c^m \mid m, n \geq 1\}$

Push 'n' no of 'a'. pop 'a' for each 'b', skip 'c'.

It is accepted by PDA.

(b) $L = \{a^n b^n c^m \mid m \leq n\}$

Push 'n' no of 'a', pop 'a' for each 'b'. Since, it is given that $m \leq n$, so we can't compare number of c. Therefore, it is not acceptable using PDA.

(c) $L = \{a^n b^m c^c d^m \mid m, n \geq 0\}$

Unable to compare.

Therefore, it is not accepted by PDA.

(d) $L = \{a^m b^n c^n d^m \mid m, n \geq 0\}$

Push 'm' no. of "a". Push 'n' no. of "b".

Pop 'b' for each 'c'. Pop 'a' for each 'd'.

Hence, it is accepted by PDA.