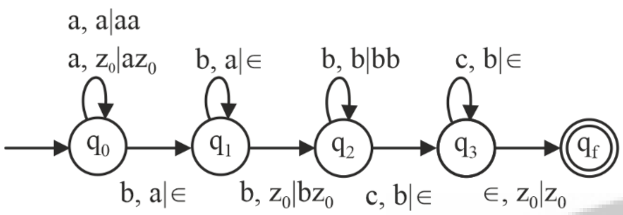
Theory of Computation

Push Down Automata

DPP 03

[MCQ]

1. The language derived by given PDA is



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

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

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

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

[NAT]

2. Consider the following statements:

(i) For every NFA N there exists a minimal DFA(N) such that L(N) = L(M).

(ii) For every DFA M there exists a DPDA P such that L(M) = L(P).

(iii) For every DPDA P there exists a NPDA N such that L(P) = L(N).

(iv) For every NPDA 'N' there exists a DPDA 'P' such that L(N) = L(P).

The number of correct statements is _____.

[MCQ]

3. Let $r_1 = (01^*)^*$ is any regular expression. Then which of the following regular expression represents r_2 such that $L(r_1) = L(r_2)$.

(a) $(10^*)^*$

(b) $(1^* + 01^*1)^*$

(c) $(0^* + 01^*1)^*$

(d) None

[MCQ]

4. Consider a, PDA M as defined below:

$M = \{\{q_0, q_1, q_2, q_3, q_4\}, \{a, b\}, \{a, b, z_0\}, \delta, q_0, \{q_4\}\}$

where δ is defined by

$\delta(q_0, a, z_0) = \{(q_1, az_0)\}$

$\delta(q_1, a, a) = \{(q_1, aa)\}$

$\delta(q_1, b, a) = \{(q_2, a)\}$

$\delta(q_2, b, a) = \{(q_2, a)\}$

$\delta(q_2, c, a) = \{(q_3, \in)\}$

$\delta(q_3, c, a) = \{(q_3, \in)\}$

$\delta(q_3, \in, z_0) = \{(q_4, \in)\}$

The above PDA accepts which language?

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

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

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

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

[MCQ]

5. Consider the following grammar G:

G:

$S \rightarrow SS \mid S$

$A \rightarrow aA$

Here, S and A are variables and a is a terminal then the language generated by above grammar G is:

(a) $L(G) = a^n$

(b) $L(G) = a^*$

(c) $L(G) = \phi$

(d) $L(G) = a^n b a^n$

[MSQ]

6. Which of the following is/are context free language.

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

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

(c) $L = \{wcw^R \mid w \in (a + b)^+\}$

(d) All strings of balanced parenthesis

[MCQ]

7. Consider the following language L:

$L = \{wcw^R \mid w \in (a + b)^*, c \in (a + b)\}$

The complement of L will be ______.

(a) Regular

(b) DCFL but not regular

(c) CFL but not DCFL

(d) None of these

[NAT]

8. Suppose, L is a language accepted by PDA.

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

(ii) $L = \{a^n \mid n \text{ is prime}\}$

(iii) $L = \{ww^R \mid w \in (a + b)^+\}$

Then how many of the following can be L________.

Answer Key

1. **(d)**
2. **(3)**
3. **(c)**
4. **(d)**
5. **(c)**
6. **(a, c, d)**
7. **(c)**
8. **(2)**

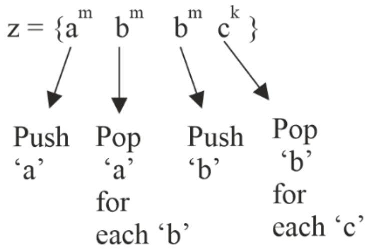
Hints & Solutions

1. (d)

The given PDA will generate language

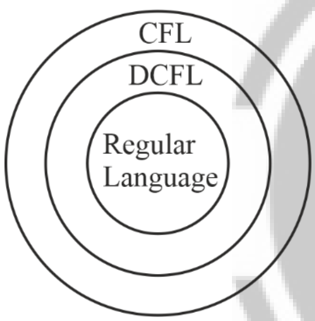
$L = \{a^m b^n c^k \mid n = m + k,\ m, n, k \geq 1\}$

$L = \{a^m b^{m+k} c^k\}$



2. (3)

(i) For every NFA N there exists a minimal DFA(N) such that L(N) = L(M). NFA and DFA are equivalent so this statement is true.



From above diagram, statement (ii) and (iii) are true.

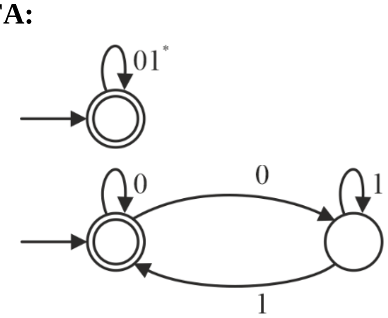
NPDA $\supseteq$ DPDA, so statement (iv) is false.

Therefore, 3 is correct answer.

3. (c)

$r_1 = (01^*)^*$

DFA:



$r_2 = (0^* + 01^*1)^*$

strings in $r_1 = \{\in, 0, 01, 011, 0101, 011011....\}$

The above expression is not producing 1, 111, ...

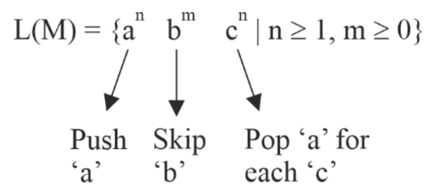
Therefore, option (a) and (b) are incorrect.

Option (c), producing all the strings produced by r_1.

$\therefore L(r_1) = L(r_2)$

4. (d)

The language accepted by above PDA is



Therefore, option (d) is correct answer.

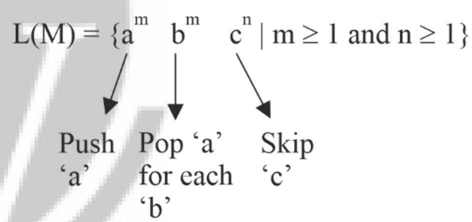
5. (c)

The production $S \rightarrow SS$ is never generating any string.

Hence, the language will be $L = \{\phi\}$.

6. (a, c, d)

(a)



(b) We cannot compare no. of a’s, b’s with no. of c’s. So not a CFL.

(c) $L = \{wcw^R \mid w \in (a + b)^+\}$ is context free language.

(d) All strings of balanced parenthesis are CFL.

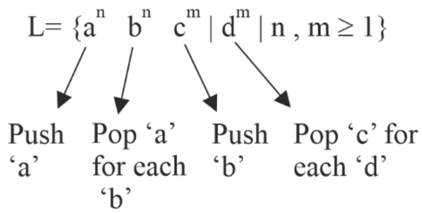
7. (c)

The complement of language L will have every even length string and it contain all odd length strings which are not in the from of wcw^R.

$\overline{L}$ is NCFL but not DCFL.

8. (4)

(i)



So, (i) is accepted by PDA

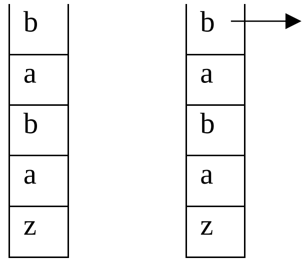
(ii) L = $\{a^n \mid n \text{ is prime}\}$

This is a non-CFL language because, we cannot pop all ‘a’s from stack.

(iii) L = $\{ww^R \mid w \in (a + b)^+\}$

Consider w = abab

So, w^R = baba



Push ‘w’ Pop ‘w’ for w^R

If TOS = symbol in string.

This can be accepted by PDA.

So, 2 is correct answer.

Any issue with DPP, please report by clicking here:- https://forms.gle/t2SzQVvQcs638c4r5

For more questions, kindly visit the library section: Link for web: https://smart.link/sdfez8ejd80if

PW Mobile APP: https://smart.link/7wwosivoicgd4