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DHARMSINH DESAI UNIVERSITY - NADIAD
FACULTY OF TECHNOLOGY
ONLINE SESSIONAL EXAMINATION

Subject : TAFL
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Question - 1

Ans - (a)

A language can be accepted by push down atomata using two approaches

1. Acceptance by final state:
PDA is said to accept its input by the final state if it enters any final state in zero or more moves after reading the entire input.

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Let $P = (Q, \Sigma, \Gamma, \delta, q_0, Z, F)$ be a PDA. The language accepted by the final state can be defined as:

$$L(PDA) = \{ w \mid (q_0, w, z) \vdash^* (p, \varepsilon, \varepsilon), q \in F \}$$

2. Acceptance by Empty stack:

On reading the input string from the ~~origin~~ intitial configuration for some PDA the stack of PDA gets empty.

[Ans - (c)]

A partial function $f: N \to N$ is said to be partially computable if there is a turing machine that partially computes it.

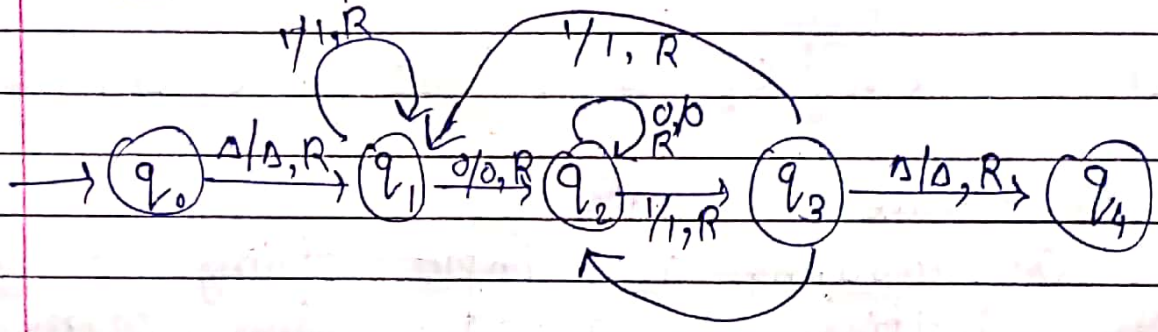
[Ans - (b)]

$L_1 = \{ a^n b^m \mid n >= m \}$
strings: a, ab, aab, aaab, aabb, aaabb

$L_2 = \{ a^m b^m \mid m >= n \}$
strings: b, ab, abb, aabb, aabbb, abbb
$L_1 \cap L_2 = \{ a^n b^m \mid n = m \}$

[Ans. - (c)]

Regular expression: $(0+1)^*01$



[Ans.- (F)]

Turing machine has infinite tape length and storage, PDA has limited stack. Turing machine can simulate any real-life world computer whereas PDA cannot.
TM is defined by 7 tuples $(Q, X, \Sigma, \delta, q_0, B, F)$
PDA is defined by 6 tuples $(Q, \Sigma, S, \delta, F, I)$

(4)

[Ans. - (E)]

The next sequence is obtained by interpreting the stored sequence on tape II as a binary number and adding 1 if the string is not consisting of all 1's. If it is so, then next no. is a string of n+1 0's where is is no. of 1's in previous string.

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Question - 3

[Ans.-(A)]

given language :

$L = \{ w \text{ belongs to } \{a, b\}^* \mid w \text{ has same number of a's and b's} \}$

$L = \{ a^n b^n \mid n >= 0 \}$

1) $L = \{ w \text{ belongs to } \{a, b\}^* \mid x \text{ is a palindro}$

rule no.	state	input	stack symbol	moves
1)	q_0	a	z_0	(q_0, az_0) (q_1, z_0)
2)	q_0	b	z_0	(q_0, bz_0) (q_1, z_0)
3)	q_0	a	a	(q_0, aa) (q_1, a)
4)	q_0	a	b	(q_0, ab) (q_1, b) ~~(q_0, bb) (q_1, b)~~
5)	q_0	b	b	(q_0, bb) (q_1, b)
6)	q_0	b	a	(q_0, ba), $(q_1, a$
7)	q_0	a	a	(q_1, Λ)

8) q_1 b b (q_1, Λ)

9) q_1 Λ z_0 (q_1, z_0)

10) q_0 Λ a (q_1, a)

11) q_0 Λ b (q_1, b)

12) q_1 Λ z_0 (q_2, z_0)

Ex:

Given: $(q_0, baab, z_0)$

(q_0, aab, bz_0) (q_1, aab, z_0) $(q_1, baab, z_0)$

(q_2, aab, z_0) $(q_2, baab, z_0)$

(q_0, ab, abz_0) (q_1, ab, bz_0) (q_1, aab, bz_0)

(q_0, ab, abz_0)

$(q_0, b, aabz_0)$ (q_1, b, abz_0) (q_1, ab, abz_0)

$(q_0, \Lambda, baabz_0)$ $(q_1, \Lambda, aabz_0)$ (q_1, b, bz_0)

$(q_1, b, aabz_0)$ (q_1, Λ, z_0)

$(q_1, \Lambda, baabz_0)$ (q_0, Λ, z_0)

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[Ans. - (5)]

(i) $E \rightarrow T+E \mid T-E \mid T$
$T \rightarrow a$

Left factoring

Replace productions
$A \rightarrow \alpha\beta_1 \mid \alpha\beta_2 \mid \ldots \mid \alpha\beta_n \mid \gamma$
with
$A \rightarrow \alpha\beta_R \mid \gamma$
$A_R \rightarrow \beta_1 \mid \beta_2 \mid \ldots \mid \beta_n$

consider the grammar:

$E \rightarrow T+E \mid T-E \mid T$
$T \rightarrow a$

Left factored grammar
$E \rightarrow T E_R$
$E_R \rightarrow TE \mid -E \mid \wedge$
$T \rightarrow a$

ii) Top-down NPDA

	state	input	stack symbol	move
1	q_0	$\wedge$	Z_0	(q_1, EZ_0)
2	q_1	$\wedge$	E	$(q_1, T+E)$ $(q_1, T-E)$ (q_1, T)
3	q_1	$\wedge$	T	(q_1, a)
4	q_1	a	a	$(q_1, \wedge)$
5	q_1	+	+	$(q_1, \wedge)$
6	q_1	-	-	$(q_1, \wedge)$
7	q_1	$\wedge$	Z_0	(q_2, Z_0)

Ex:

$(q_0, a+a, z0)$
$(q_1, a+a, EZ0)$
$(q_1, a+a, T+EZ0)$
$(q_1, a+a, T+TZ0)$
$(q_1, a+a, a+TZ0)$
$(q_1, a, TZ0)$
$(q_1, a, aZ0)$
$(q_1, \wedge, Z0)$
$(q_1, Z0)$
accepted.

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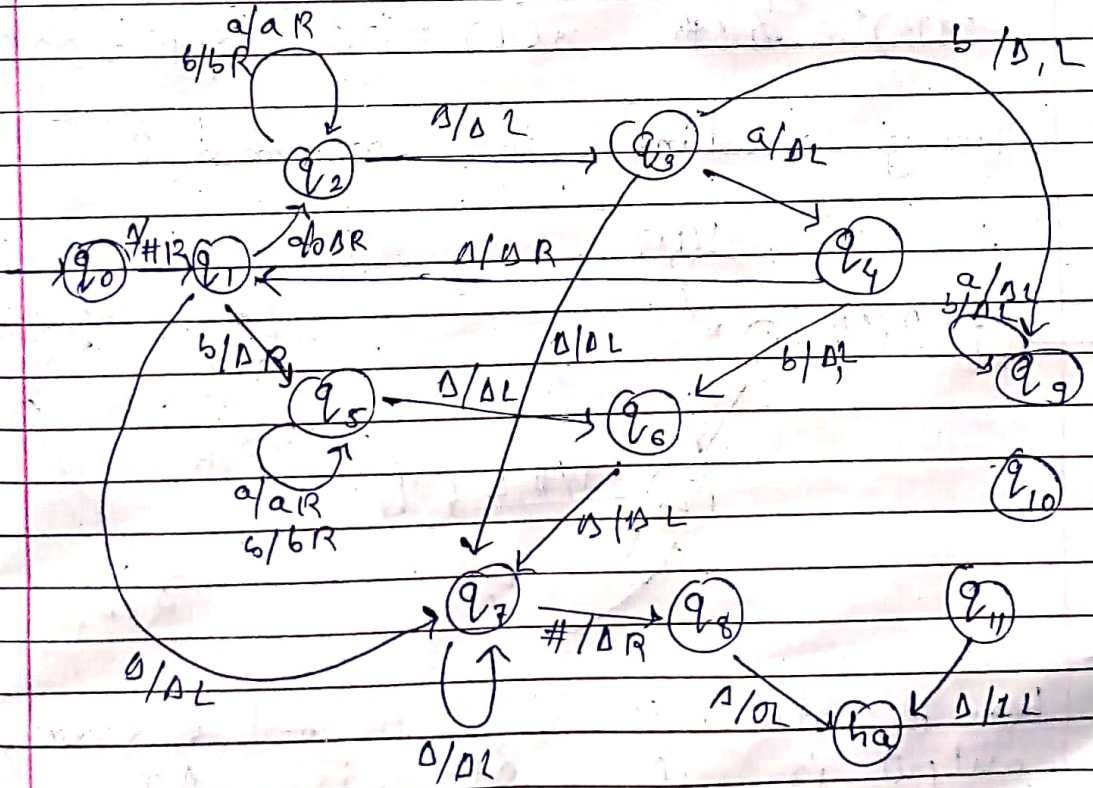
(9)

Question - 2

[Ans. - (a)]

$X_L = \begin{cases} 0 : L \text{ is palindrome} \\ 1 : L \text{ is not palindrome} \end{cases}$

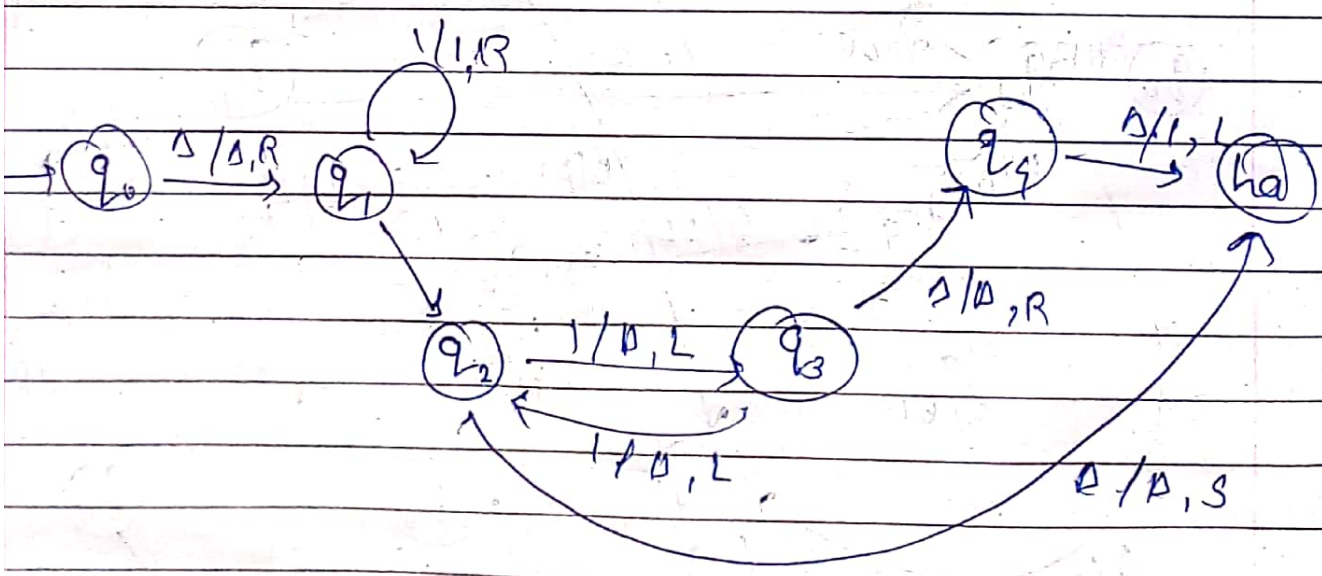


[Ans. - (b)]

Encoding function

$s(\Delta) = 0$
$s(a_i) = 0^{i+1}$
$s(ha) = 0$
$s(q_i) = 0^{i+2}$
$s(S) = 0$
$s(L) = 00$
$s(R) = 000$

Turing machine for n mod 2



here if string is of length ~~mod 2~~ even, output is Δ, otherwise Δ 1

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Each move of TM described by the formula

$$\delta(p, a) = (q, b, D)$$

in encoded by the string

$$e(m) = s(p) \cdot 1s(a) \cdot 1s(q) \cdot 1s(b) \cdot 1s(D) \cdot 1$$

and for any TM T, with initial state q_1, T is encoded by the string

$$e(T) = s(q_1) 1 e(m_1) 1 e(m_2) 1 \cdots e(m_k) 1$$

where $m_1, m_2, \cdots m_k$ are moves.

any string $z = z_1 z_2 \cdots z_k$ where $z_i \in S$. is encoded by

$$e(z) = 1s(z_1) 1s(z_2) 1 \cdots s(z_k) 1$$