TOC Assignment Turing Machine

Q-1 $L = \{ 0^n 1^n 2^n \mid n \geq 1 \}$

Here we use 3 characters 0, 1, 2. In the ~~beginning~~ beginning language has some number of 0's followed by equal no of 1's, and then followed by equal no of 2's.

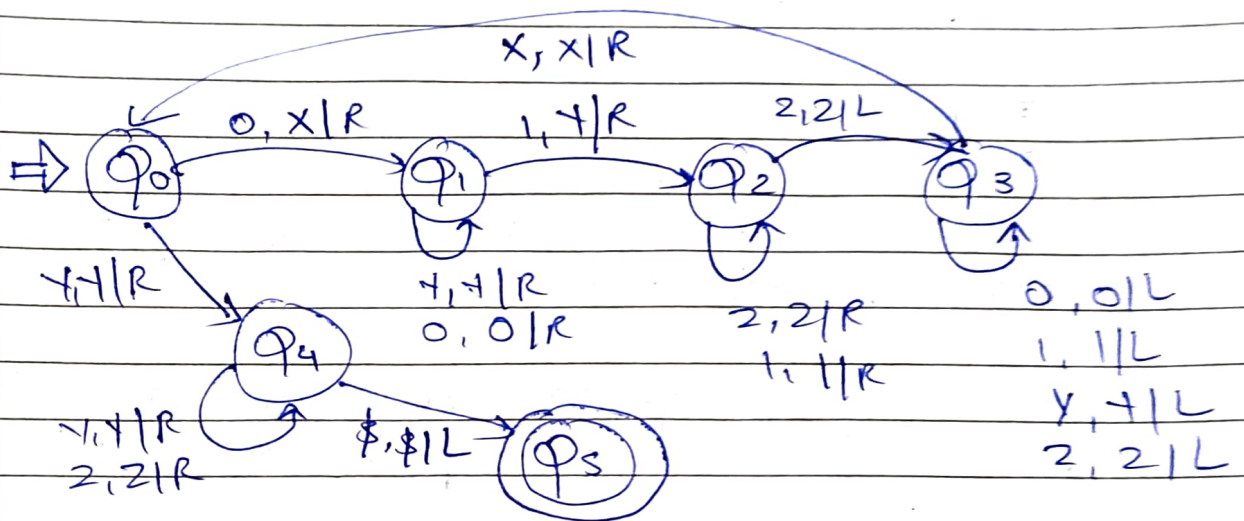Such a string will be accepted.

Example - 001122 → Accepted.

Beginning and end of string is marked by $.

Assumption - Replace 0 with X, 1 by Y, 2 by Z.

Approach → First replace a 0 from front by X, then keep moving right till you find 1 and replace it by Y. Again, keep moving right till find 2, replace by Z and move left.

Now keep moving left till you find a X. when found, move a right and repeat the above procedure.

A condition comes when we find a x immediately followed by y. At this point we keep moving right and checking that all 1's and 2's have been converted to y and z. If not string is not accepted. If we reach $ then string is accepted.

Transitions:
- X, X | R
- 0, X | R
- 1, Y | R
- 2, Z | L
- Y, Y | R
- Y, Y | R
- 0, 0 | R
- 2, Z | R
- 1, 1 | R
- 0, 0 | L
- 1, 1 | L
- Y, Y | L
- 2, Z | L
- Y, Y | R
- 2, Z | R
- $, $ | L

Q2 $L = \{ a^n b^m a^{(n+m)} \mid n, m \geq 1 \}$

Examples → ① a a b b b a a a a a

$n = 2 \qquad m = 3$

→ accepted
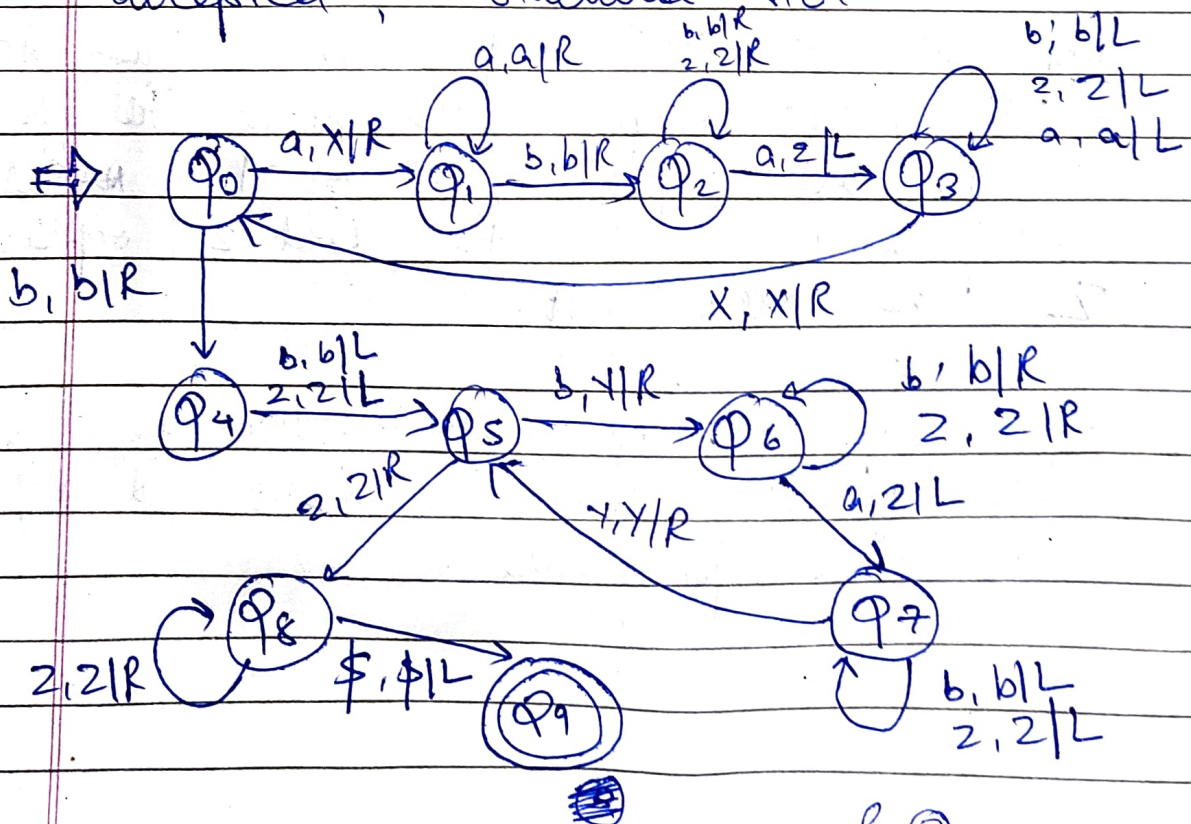
② a a b a a a a

→ Not accepted

Beginning and end of string marked by $.

Approach →

1) convert "a" in first part into "x" then move right ignoring all intermediate symbol when "a" is encountered just after "b" then convert it into "2" and move left and stop at a position just next to "x".
Repeat above procedure.

2) When all a's in first part have been converted then apply the same process on second part convert "b" into "y" and "a" into "2" in the & third part.

When entire first part and second part has been converted and if third part is also converted then string will be accepted, otherwise not.

$a, a|R$ $b, b|R$ $2, 2|R$ $b; b|L$ $2, 2|L$ $a, a|L$

$q_0 \xrightarrow{a, X|R} q_1 \xrightarrow{b, b|R} q_2 \xrightarrow{a, 2|L} q_3$

$b, b|R$

$X, X|R$

$b, b|L$ $2, 2|L$

$q_4 \xrightarrow{b, Y|R} q_5 \xrightarrow{b, Y|R} q_6$ $b, b|R$ $2, 2|R$

$2, 2|R$ $Y, Y|R$ $a, 2|L$

$2, 2|R$ $q_8 \xrightarrow{\$, \$|L} q_9$

q_7 $b, b|L$ $2, 2|L$

Pg ③

Q-3. Turing Machine has 2 states
q0, q1.

Tape Alphabet → $\{0, 1, B\}$
Input Alphabet → $\{0, 1\}$

Ans (A) M does not halt on any string
in $(0 + 1)+$

Explanation

Whenever B is given as input, turing machine halts.

This implies epsilon is only accepted when B occurs as an input.

In positive closure, epsilon is not present.

So, Turing Machine never halts in case of
~~(0+1)~~ $(0 + 1)+$.

so, option A is correct.

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