

CS & IT ENGINEERING

Theory of Computation

Turing Machine Recursively Enumerable



DPP 01 Discussion Notes



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TOPICS TO BE COVERED

01 Question

02 Discussion

Q.1

Let M be a turing machine having $Q = \{q_0, q_1, q_2, q_3, q_4\}$ a set of states, input alphabet $\{0, 1\}$. The tape alphabets $\{0, 1, B, x, y\}$. The symbol B is used to represent the end input string. The initial and final states are q_0 and q_4 respectively. The transitions are as follows:

- 1. $(q_0, 0) = (q_1, x, R)$ ✓
- 2. $(q_0, y) = (q_3, y, R)$ ✓
- 3. $(q_1, 0) = (q_1, 0, R)$ ✓
- 4. $(q_1, 1) = (q_2, y, L)$ ✓
- 5. $(q_1, y) = (q_1, y, R)$ ✓
- 6. $(q_2, 0) = (q_2, 0, L)$ ✓
- 7. $(q_2, x) = (q_0, x, R)$ ✓
- 8. $(q_2, y) = (q_2, y, L)$ ✓
- 9. $(q_3, y) = (q_3, y, R)$ ✓
- 10. $(q_3, B) = (q_4, B, R)$

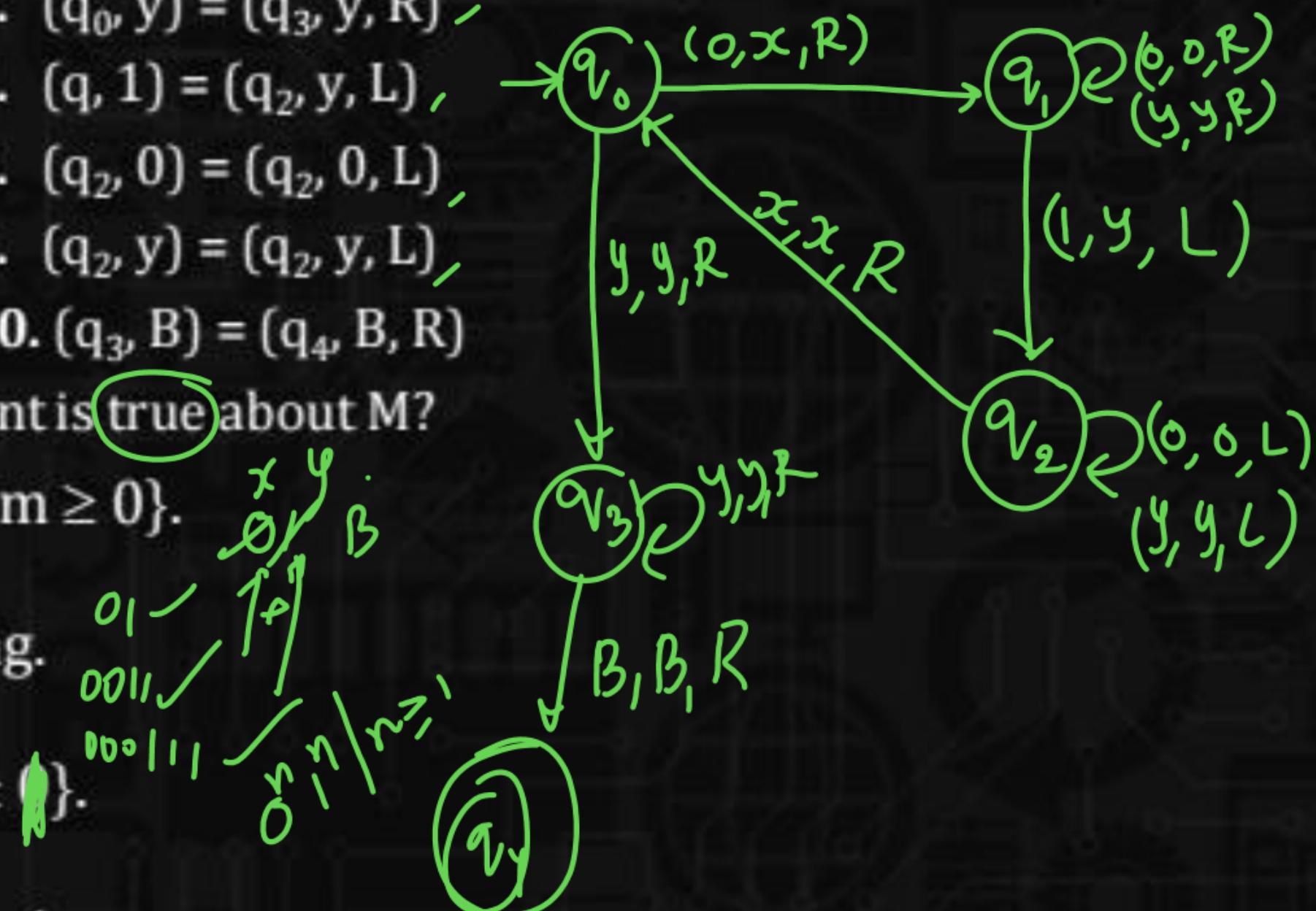
Which of the following statement is true about M?

A. M accepts on $L = \{0^n 1^m \mid n, m \geq 0\}$.

B. M accepts 010 as a substring.

C. M accepts on $L = \{0^n 1^n \mid n \geq 0\}$.

D. M accepts on 011 as a substring.



Q.2

Consider the following turing machines:

- (i) Single-tape TM
- (ii) Multi-tape TM
- (iii) Universal TM

Which of the above TM's are equivalent?

- A. (i) and (ii)
- B. (ii) and (iii)
- C. (i) and (iii)
- D. (i), (ii), and (iii)



Q.3

If the following turing machine accepts $L = \{(0 + 1)^*\}$, then what will the value of x and y?

P
W

[MSQ]

A.

$x = (1, 1, R); y = (0, 0, R)$

B.

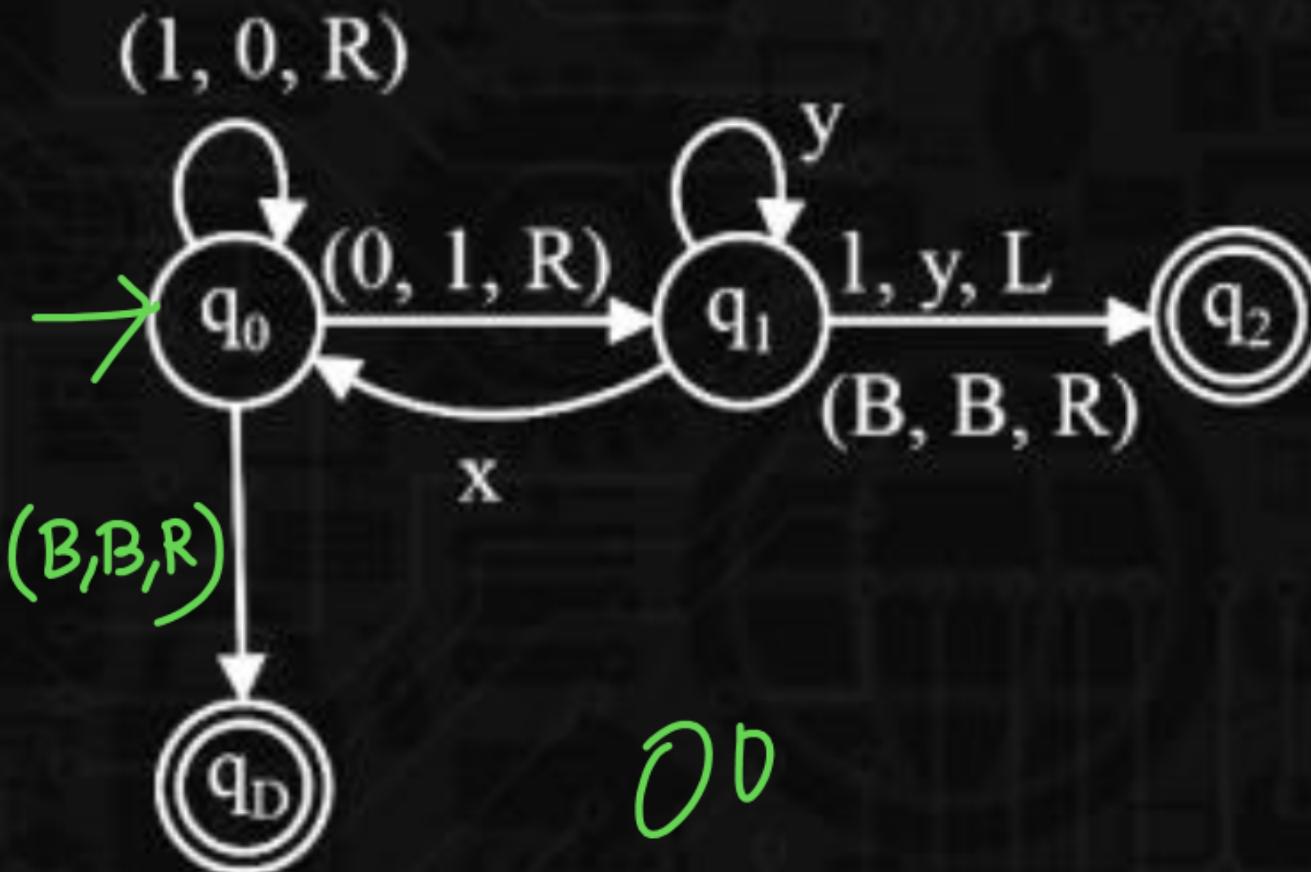
$x = (1, 0, R); y = (0, 1, R)$

C.

$x = (1, 1, R); y = (1, 1, R)$

D.

$x = (0, 1, R); y = (1, 0, R)$



OD

Q.4

Which of the following statement is/are correct regarding tuples
of turing machine

P
W

[MCQ]

- A. TM has six tuples which are $\{Q, T, \Sigma, \delta, q_0, F\}$. X
- B. Σ is the input alphabet. ✓
- C. T is the tape alphabet. ✓
- D. Q is finite set of states. ✓

B

Q.5

Consider a Turing machine with following restrictions

[MCQ]

P
W

- (i) Head can only read and cannot write.
- (ii) Head can move only in one direction.

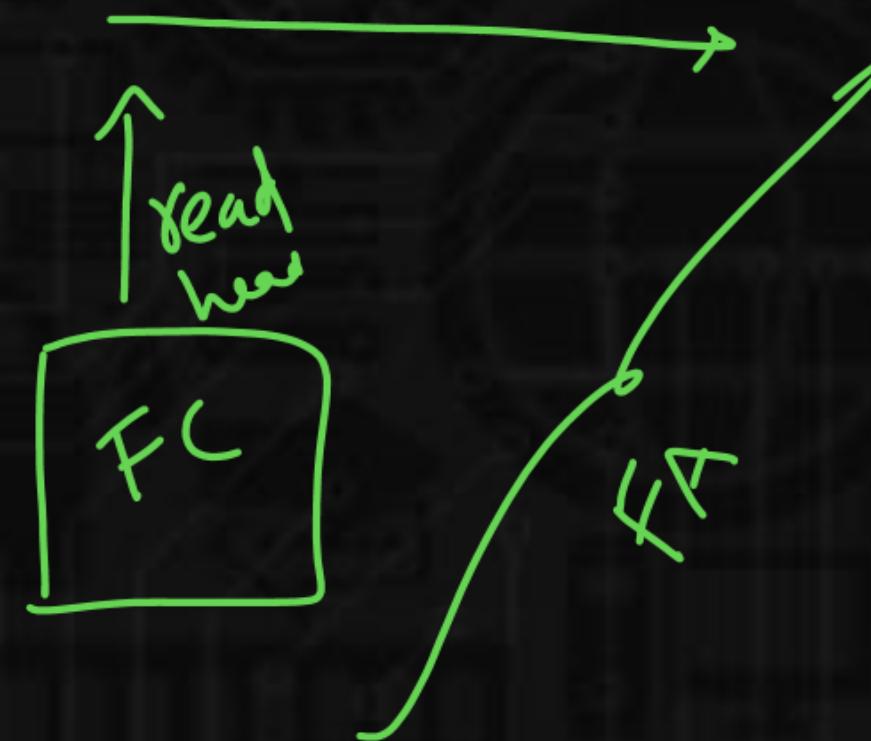
The Turing machine with above restrictions is known as _____.

A. Turing machine

B. Linear bounded automata

C. Push down automata

D. Finite Automata



Q.6

Consider the given grammar:

$$S \rightarrow aASccc \mid \epsilon$$

$$Aa \rightarrow aA$$

$$Ac \rightarrow \underline{bbc}$$

$$\underline{Ab} \rightarrow bbb$$

{ } ε

$$\begin{aligned} S &\rightarrow aASccc \\ &\Rightarrow a\underline{A}ccc \\ &\Rightarrow abbc \quad c \\ &\qquad\qquad\qquad a^1 b^2 c^3 \end{aligned}$$

Which of the following language is derived by the above grammar?

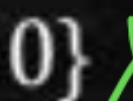
A.

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



B.

$$L = \{a^n b^{2n} c^n \mid n \geq 0\}$$



C.

$$L = \{a^n b^{2n} c^{3n} \mid n \geq 0\}$$



D.

$$L = \{a^{4n} b^{3n} c^{2n} \mid n \geq 0\}$$

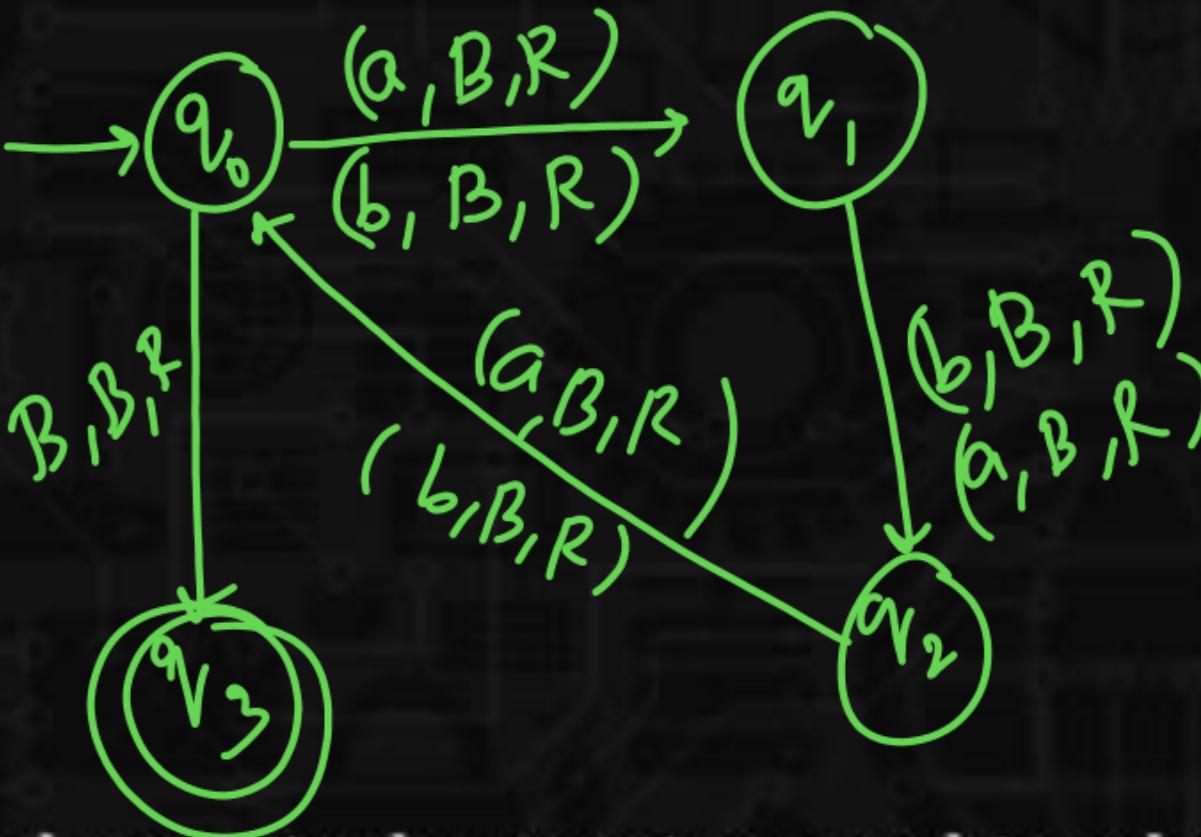
.

[MCQ]**P
W**

Q.7

Consider the following transitions of a turing machine M:

- * $\delta(q_0, a) = (q_1, B, R)$
- $\delta(q_0, b) = (q_1, B, R)$
- $\delta(q_0, B) = (q_3, B, R)$
- $\delta(q_1, b) = (q_2, B, R)$
- $\delta(q_1, a) = (q_2, B, R)$
- $\delta(q_2, a) = (q_0, B, R)$
- $\delta(q_2, b) = (q_0, B, R)$



The language derived by the equivalent turing machine defined as?

- A. $L = \{w : |w| \text{ is even}\}$
- B. $L = \{w : |w| \text{ is odd}\}$
- C. $L = \{w : |w| \text{ is multiple of 3}\}$
- D. None of these

[MCQ]

P
W

Q.8

Minimum number of stacks required by push down automata to behave like a turing machine.

P
W

[MCQ]

- A. 1
- B. 2
- C. 3
- D. None of these

2 stack PDA
 \approx
TM

