Suppose $\delta(q, X_i) = (P, Y, R)$ then

$$X_1 X_2 \ldots X_{i-1} q X_i \ldots X_n \vdash X_1 X_2 \ldots X_{i-1} Y p X_{i+1} \ldots X_n$$

The language accepted by TM

* The language accepted by M, denoted $L(M)$ is the set of words in Σ^* that cause M to enter a final state.
* Formally the language accepted by TM $M = (Q, \Sigma, \Gamma, \delta, q_0, B, F)$ is

$L(M) = \{ w \mid w$ in Σ^* and $q_0 w \vdash^* \alpha_1 p \alpha_2$ for some p in F and α_1 and α_2 in Γ

* The TM halts, (i.e) has no next move, whenever the input is accepted.
* The TM will never halt for the words which are not accepted.

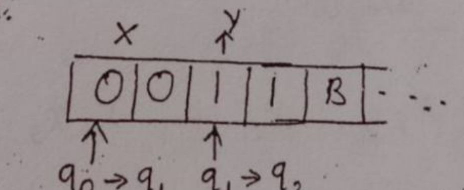
MODELS:

1. Construct a Turing Machine for $L = \{0^n 1^n \mid n \geq 1\}$

<u>Solution:</u>

* Initially the Turing Machine M contains $0^n 1^n$ followed by an infinity of Blanks.

For eg:



M repeatedly replaces the leftmost 0 by X ~~and moves right to the leftmost 1,~~ replacing it by Y, moves left to find the rightmost X, then moves one cell right to the leftmost 0 and repeats the cycle.

M =

	0	1	X	Y	B
q_0	(q_1, X, R)			(q_3, Y, R)	-
q_1	$(q_1, 0, R)$	(q_2, Y, L)		(q_1, Y, R)	-
q_2	$(q_2, 0, L)$	-	(q_0, X, R)	(q_2, Y, L)	-
q_3				(q_3, Y, R)	$(q_4, B,$
q_4	-	-	-	-	-

$M = (\{q_0, q_1, q_2, q_3, q_4\}, \{0, 1\}, \{0, 1, X, Y, B\}, \delta, q_0, B, \{q_4\})$

To verify the string $w = 0011$.

$q_0 0011 \vdash X q_1 011 \vdash X 0 q_1 11 \vdash$

$X q_2 0 Y 1 \vdash q_2 X 0 Y 1 \vdash X q_0 0 Y 1 \vdash$

$X X q_1 Y 1 \vdash X X Y q_1 1 \vdash X X q_2 Y Y \vdash$

$X q_2 X Y Y \vdash X X q_0 Y Y \vdash X X Y q_3 Y \vdash$

$X X Y Y q_3 \vdash X X Y Y B q_4$.

* The Turing Machine accepts L = {0^n 1^n | n ≥ 2