Turing Machine R_1 $|\Gamma|$ R_5 Current tape position P R_7 Current state q

R_2 $|Q|$ R_6 Current symbol a R_8 Current instruction

R_3 Turing Table $(Q-F)\times\Gamma \to \Gamma \times Q \times \{left, right\}$

R_4 Turing tape T

Starting state $s = 0$

Halting state $F = \{1\}$.

$2|Q||\Gamma|$

Read ($|\Gamma|$, Tape, Position)

Write ($|\Gamma|$, Tape, Position, New Symbol) — to write to position P on tape T

$R_4 \leftarrow 2|Q||\Gamma|$ $R_6 \leftarrow$ Read($|\Gamma|$, T, P)

$R_8 \leftarrow$ Read ($2|Q||\Gamma|$, Turing Table, $|\Gamma| \cdot R_7 q + a$) // Current entry

R_8 is of form $\gamma \cdot |Q| \cdot 2 + p \cdot 2 + \text{movement}$ where $\gamma \in \Gamma$, $p \in Q$, movement $\in \{left, right\}$

$R_{10} \leftarrow R_8 \,/\, 2R_2$

$= \left\lfloor \frac{\gamma |Q| \cdot 2 + p \cdot 2 + \text{movement}}{2|Q|} \right\rfloor$

$= \gamma \in \Gamma$ // new symbol

$R_4 \leftarrow$ Write ($|\Gamma|$, T, P, γ) // Write NewSymbol and return New Tape.

$R_7 \leftarrow \left\lfloor \frac{R_8}{2} \right\rfloor \bmod R_2 = (\gamma|Q| + p) \bmod |Q|$

$= p$ // New state

If $R_7 = 1 \in \{F$, (Halting state) then Stop.

Else ~~$R_5 \leftarrow R_5 + 2\left\lfloor \frac{R_8}{2} \right\rfloor + 1 = R_5 +$~~

$R_5 \leftarrow R_5 + 2(R_8 \bmod 2) - 1 = \begin{cases} R_5 + 2(0) - 1 = R_5 - 1 & \text{(if left)} \\ R_5 + 2(1) - 1 = R_5 + 1 & \text{(if right)} \end{cases}$

↓ movement