Mod/Div Turing Machine

Individual Coursework
F29FB, Spring 2022

Submitted by

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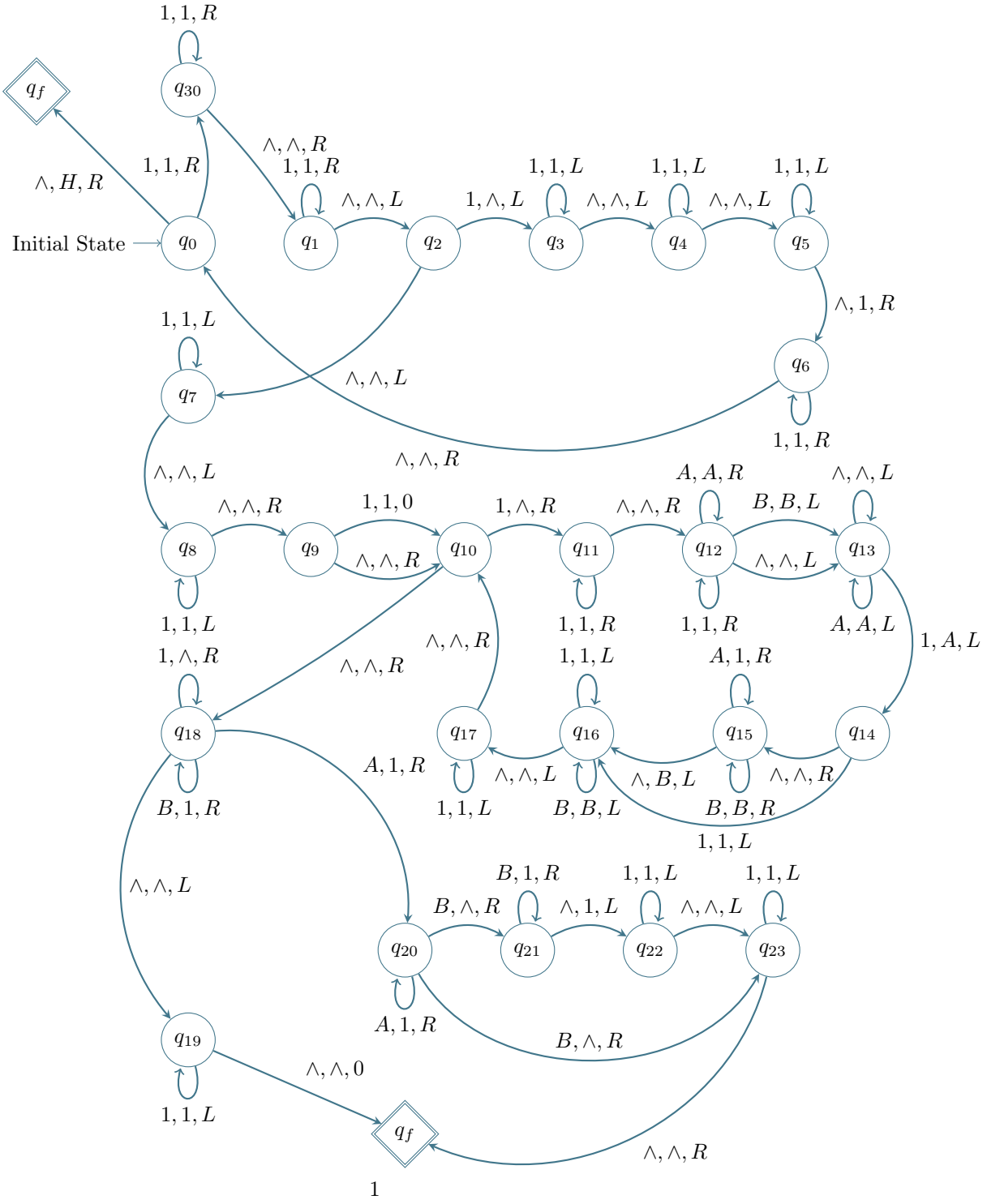
1 Graph


Initial State
q_0
q_1
q_2
q_3
q_4
q_5
q_6
q_7
q_8
q_9
q_{10}
q_{11}
q_{12}
q_{13}
q_{14}
q_{15}
q_{16}
q_{17}
q_{18}
q_{19}
q_{20}
q_{21}
q_{22}
q_{23}
q_{30}
q_f
q_f
$\wedge, H, R$
$1, 1, R$
$\wedge, \wedge, R$
$1, 1, R$
$\wedge, \wedge, L$
$1, \wedge, L$
$1, 1, L$
$\wedge, \wedge, L$
$1, 1, L$
$\wedge, \wedge, L$
$1, 1, L$
$\wedge, 1, R$
$1, 1, L$
$\wedge, \wedge, L$
$1, 1, R$
$\wedge, \wedge, R$
$\wedge, \wedge, L$
$\wedge, \wedge, R$
$1, 1, 0$
$\wedge, \wedge, R$
$1, \wedge, R$
$\wedge, \wedge, R$
A, A, R
B, B, L
$\wedge, \wedge, L$
$1, 1, L$
$1, 1, R$
$1, 1, R$
A, A, L
$1, A, L$
$1, \wedge, R$
$\wedge, \wedge, R$
$\wedge, \wedge, R$
$1, 1, L$
$A, 1, R$
$B, 1, R$
$\wedge, \wedge, L$
$\wedge, B, L$
$\wedge, \wedge, R$
$1, 1, L$
B, B, L
B, B, R
$1, 1, L$
$\wedge, \wedge, L$
$B, 1, R$
$B, \wedge, R$
$\wedge, 1, L$
$1, 1, L$
$\wedge, \wedge, L$
$1, 1, L$
$A, 1, R$
$B, \wedge, R$
$\wedge, \wedge, 0$
$1, 1, L$
$\wedge, \wedge, R$
1

2 Mathematical Notation

$s_0 \equiv \wedge, s_1 \equiv 1, s_2 \equiv A, s_3 \equiv B, s_4 \equiv H$

$$
\begin{aligned}
&M_g = \{\\
&((q_0, s_0) \to (q_f, s_4, 0)),\\
&((q_0, s_1) \to (q_{30}, s_1, R)),\\
&((q_1, s_1) \to (q_1, s_1, R)),\\
&((q_1, s_0) \to (q_2, s_0, L)),\\
&((q_{30}, s_1) \to (q_{30}, s_1, R)),\\
&((q_{30}, s_0) \to (q_1, s_0, R)),\\
&((q_2, s_0) \to (q_7, s_0, L)),\\
&((q_2, s_1) \to (q_3, s_0, L)),\\
&((q_3, s_1) \to (q_3, s_1, L)),\\
&((q_3, s_0) \to (q_4, s_0, L)),\\
&((q_4, s_1) \to (q_4, s_1, L)),\\
&((q_4, s_0) \to (q_5, s_0, L)),\\
&((q_5, s_1) \to (q_5, s_1, L)),\\
&((q_5, s_0) \to (q_6, s_1, R)),\\
&((q_6, s_1) \to (q_6, s_1, R)),\\
&((q_6, s_0) \to (q_{30}, s_0, R)),\\
&((q_7, s_1) \to (q_7, s_1, L)),\\
&((q_7, s_0) \to (q_8, s_0, L)),\\
&((q_8, s_1) \to (q_8, s_1, L)),\\
&((q_8, s_0) \to (q_9, s_0, R)),\\
&((q_9, s_1) \to (q_{10}, s_1, 0)),\\
&((q_9, s_0) \to (q_{10}, s_0, R)),\\
&((q_{10}, s_1) \to (q_{11}, s_0, R)),\\
&((q_{10}, s_0) \to (q_{18}, s_0, R)),\\
&((q_{11}, s_1) \to (q_{11}, s_1, R)),\\
&((q_{11}, s_0) \to (q_{12}, s_0, R)),\\
&((q_{12}, s_1) \to (q_{12}, s_1, R)),\\
&((q_{12}, s_2)) \to (q_{12}, s_2), R)),\\
&((q_{12}, s_3)) \to (q_{13}, s_3), L)),\\
&((q_{12}, s_0) \to (q_{13}, s_0, L)),\\
&((q_{13}, s_0) \to (q_{13}, s_0, L)),\\
&((q_{13}, s_2)) \to (q_{13}, s_2), L)),\\
&((q_{13}, s_1) \to (q_{14}, s_2), L)),\\
&((q_{14}, s_0) \to (q_{15}, s_0, R)),\\
&((q_{14}, s_1) \to (q_{16}, s_1, L)),\\
&((q_{15}, s_2)) \to (q_{15}, s_1, R)),\\
&((q_{15}, s_3)) \to (q_{15}, s_3), R)),\\
&((q_{15}, s_0) \to (q_{16}, s_3), L)),\\
&((q_{16}, s_1) \to (q_{16}, s_1, L)),\\
&((q_{16}, s_3)) \to (q_{16}, s_3), L)),\\
&((q_{16}, s_0) \to (q_{17}, s_0, L)),\\
&((q_{17}, s_1) \to (q_{17}, s_1, L)),\\
&((q_{17}, s_0) \to (q_{10}, s_0, R)),\\
&((q_{18}, s_1) \to (q_{18}, s_0, R)),\\
&((q_{18}, s_3)) \to (q_{18}, s_1, R)),\\
&((q_{18}, s_2)) \to (q_{20}, s_1, R)),\\
&((q_{18}, s_0) \to (q_{19}, s_0, L)),\\
&((q_{19}, s_1) \to (q_{19}, s_1, L)),\\
&((q_{19}, s_0) \to (q_f, s_0, 0)),\\
&((q_{20}, s_2)) \to (q_{20}, s_1, R)),\\
&((q_{20}, s_3)) \to (q_{21}, s_0, R)),\\
&((q_{20}, s_0) \to (q_{23}, s_0, L)),\\
&((q_{21}, s_3)) \to (q_{21}, s_1, R)),\\
&((q_{21}, s_0) \to (q_{22}, s_1, L)),\\
&((q_{22}, s_1) \to (q_{22}, s_1, L)),\\
&((q_{22}, s_0) \to (q_{23}, s_0, L)),\\
&((q_{23}, s_1) \to (q_{23}, s_1, L)),\\
&((q_{23}, s_0) \to (q_f, s_0, R)),\\
&\}
\end{aligned}
$$

3 Input (3, 5)

(i) The TM starts by checking if the head starts at a $\wedge$ (blank) then the divisor is 0 and the ticket is invalidated and the TM halts.
Otherwise the divisor is a natural number and the TM goes to the rightmost of the divisor until we reach a blank.

q_0: $\wedge\wedge\wedge$@111$\wedge$11111$\wedge\wedge\wedge$
q_{30}: $\wedge\wedge\wedge$1@11$\wedge$11111$\wedge\wedge\wedge$
q_{30}: $\wedge\wedge\wedge$11@1$\wedge$11111$\wedge\wedge\wedge$
q_{30}: $\wedge\wedge\wedge$111@$\wedge$11111$\wedge\wedge\wedge$

(ii) Check if there is a unary input (non blank!).