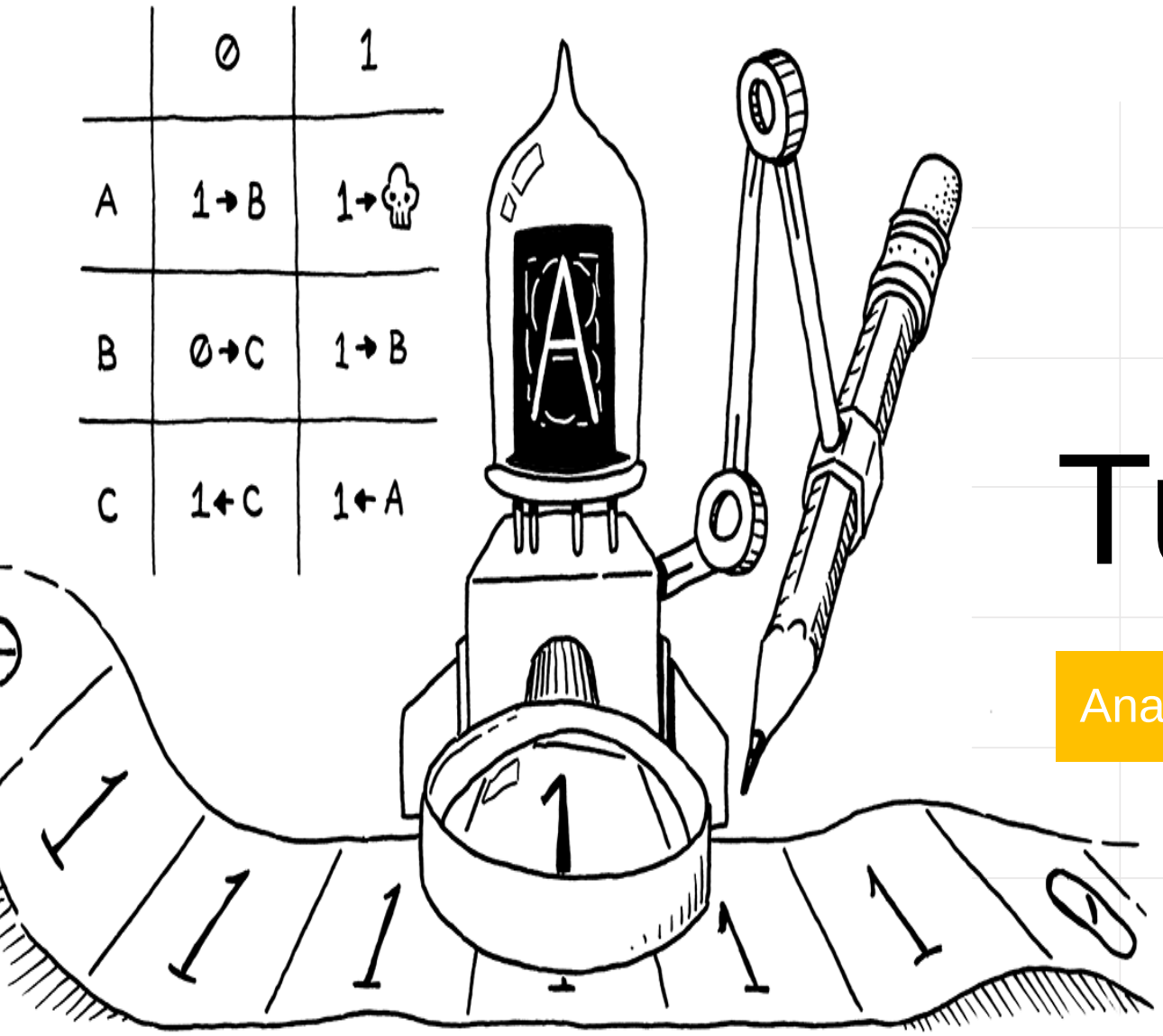


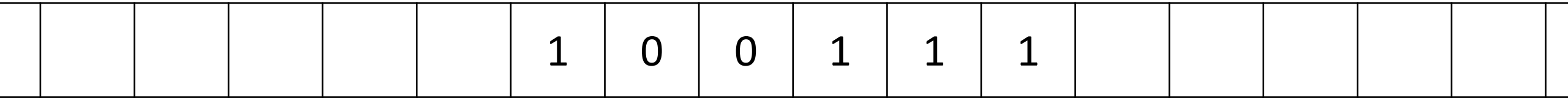
1b

Turing Machines

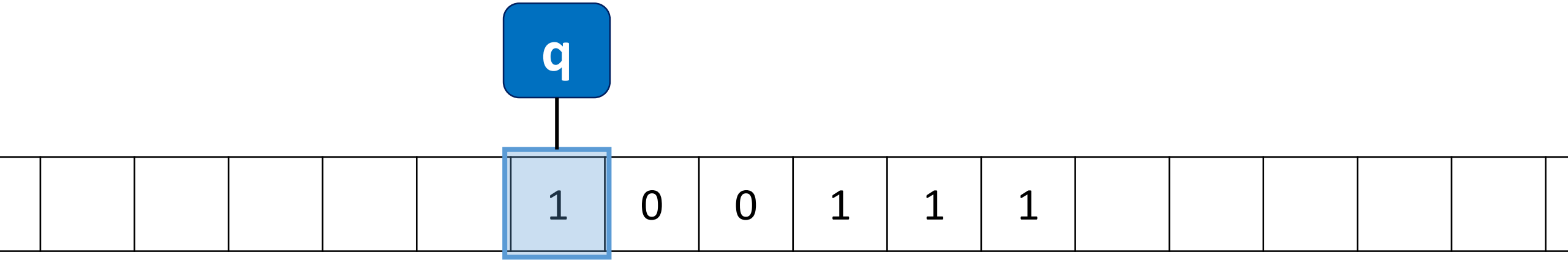
Analiza Algoritmilor

Image: https://craftinginterpreters.com/control-flow.html

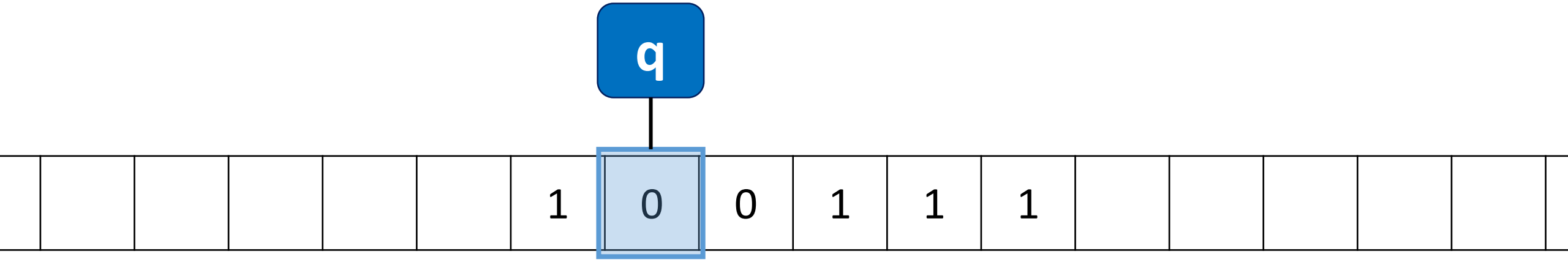
Visualization



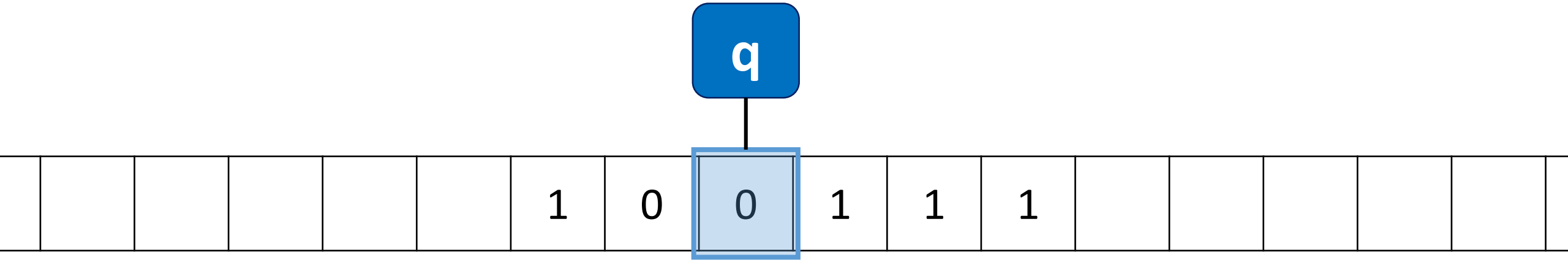
Visualization



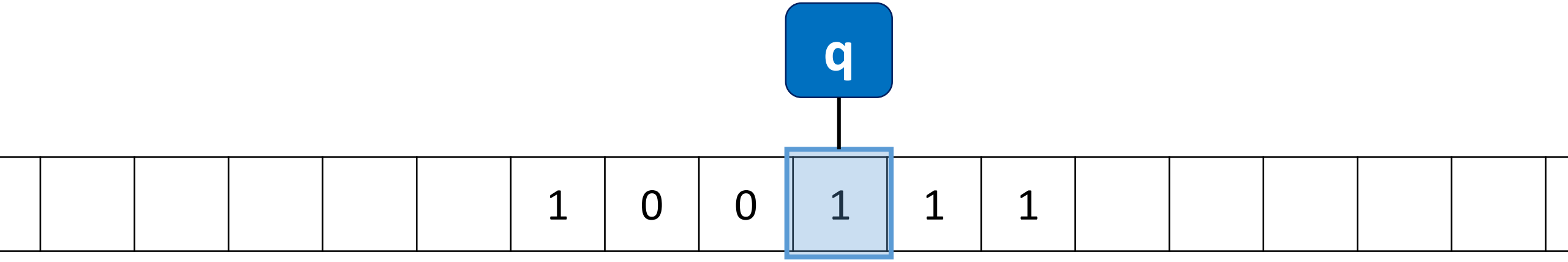
Visualization



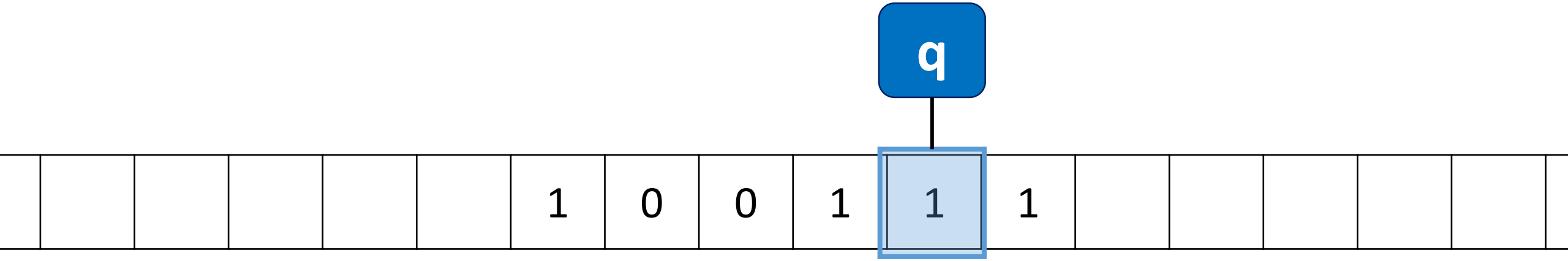
Visualization



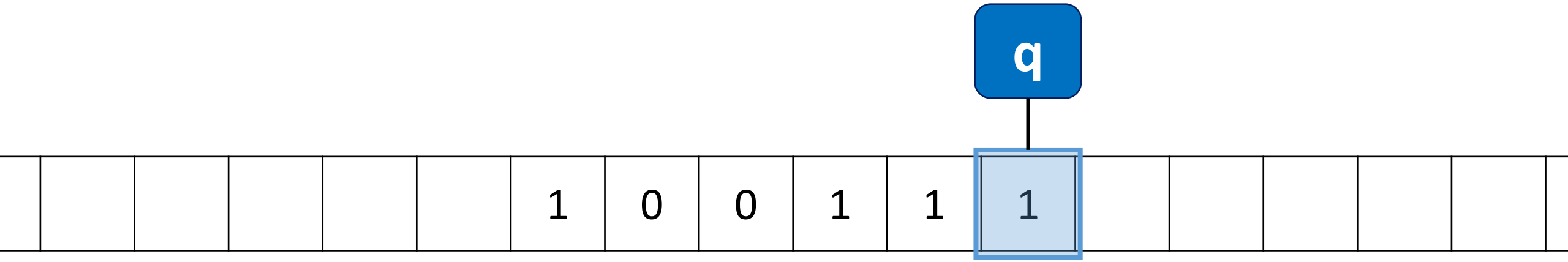
Visualization



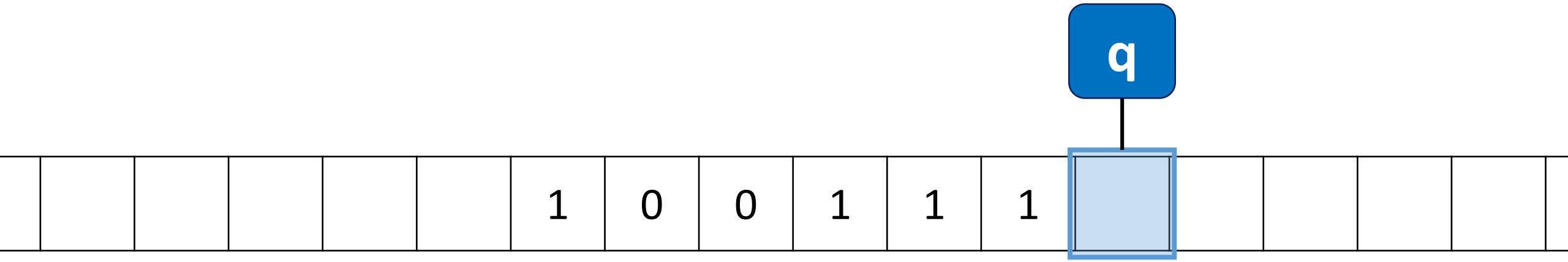
Visualization



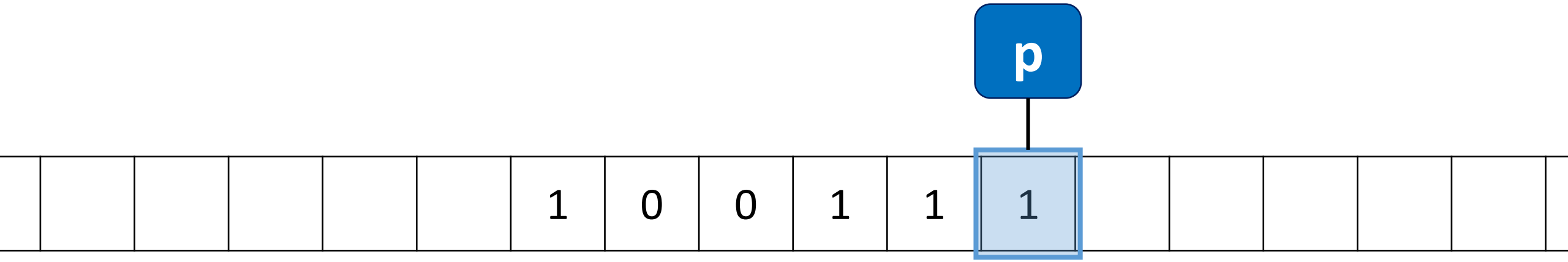
Visualization



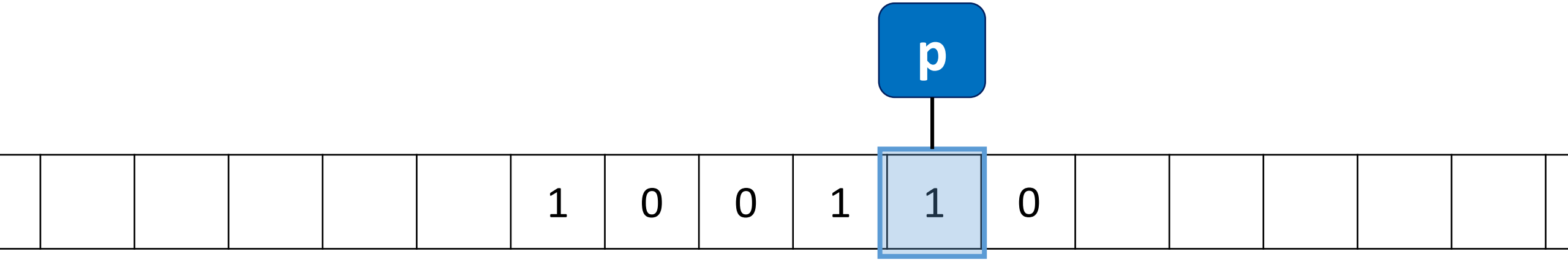
Visualization



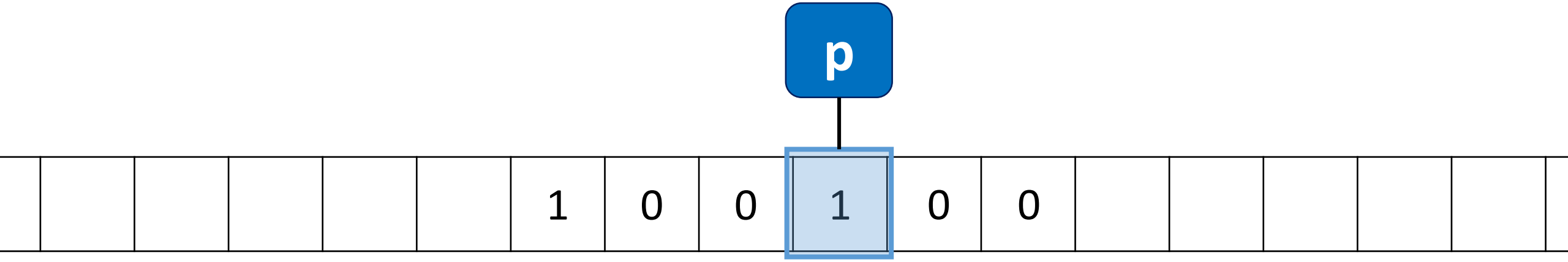
Visualization



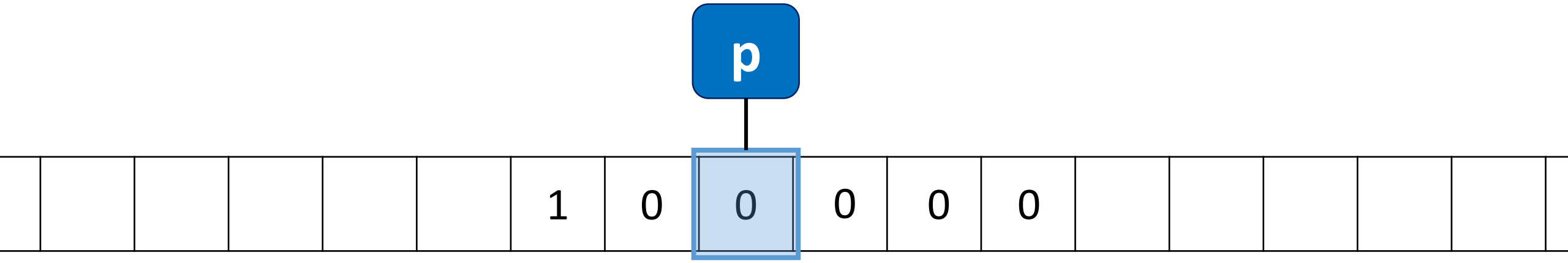
Visualization



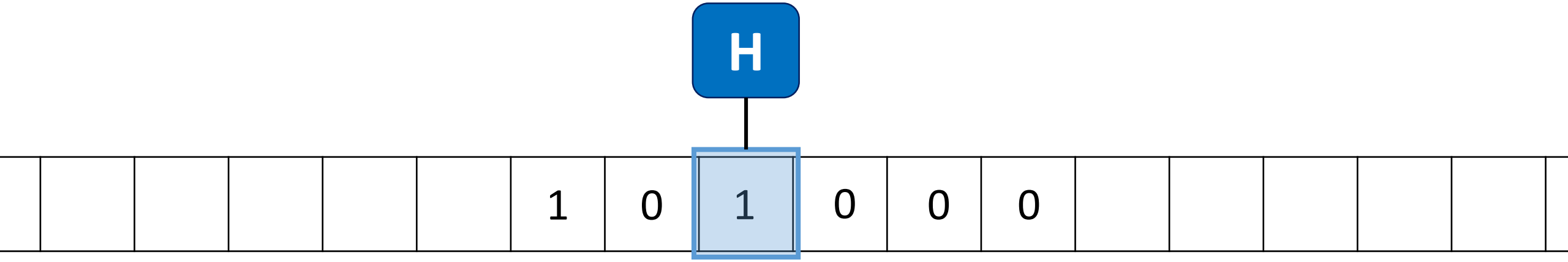
Visualization



Visualization



Visualization



Checking if a number is even

	0	**1**	□
$\boldsymbol{q_1}$	$q_1, 0, \rightarrow$	$q_1, 1, \rightarrow$	$q_2, \square, \leftarrow$
$\boldsymbol{q_2}$	$Y, 0, -$	$N, 1, -$	$N, \square, -$

Using states as memory

	0	**1**	**□**
start	$\text{mem}_0, 0, \rightarrow$	$\text{mem}_1, 1, \rightarrow$	$\text{Y}, \square, -$
mem_0	$\text{mem}_0, 0, \rightarrow$	$\text{mem}_0, 1, \rightarrow$	$\text{expect}_0, \square, \leftarrow$
mem_1	$\text{mem}_1, 0, \rightarrow$	$\text{mem}_1, 1, \rightarrow$	$\text{expect}_1, \square, \leftarrow$
expect_0	$Y, 0, -$	$N, 1, -$	$N, \square, -$
expect_1	$N, 0, -$	$Y, 1, -$	$N, \square, -$

Checking if a number is even

	0	**1**	□
q_1	$q_1, 0, \rightarrow$	$q_1, 1, \rightarrow$	$q_2, \square, \leftarrow$
q_2	$\mathrm{H}, 1, -$	$\mathrm{q}_2, 0, \leftarrow$	$\mathrm{H}, 1, -$

Checking for palindromes

	0	**1**	**□**
start	$\text{mem}_0, 0, \rightarrow$	$\text{mem}_1, 1, \rightarrow$	$\text{Y}, \square, -$
mem_0	$\text{mem}_0, 0, \rightarrow$	$\text{mem}_0, 1, \rightarrow$	$\text{expect}_0, \square, \leftarrow$
mem_1	$\text{mem}_1, 0, \rightarrow$	$\text{mem}_1, 1, \rightarrow$	$\text{expect}_1, \square, \leftarrow$
expect_0	$reset, \square, -$	$N, 1, -$	$Y, \square, -$
expect_1	$N, 0, -$	$reset, 1, -$	$Y, \square, -$
reset	$reset, 0, \leftarrow$	$reset, 1, \leftarrow$	$start, \square, \rightarrow$

Same number of 0s and 1s

	0	**1**	**□**	**X**
start	$find_1, \mathrm{X}, \rightarrow$	$find_0, \mathrm{X}, \rightarrow$	$\mathrm{Y}, \square, -$	$\mathrm{start}, \mathrm{X}, \rightarrow$
$\boldsymbol{find_0}$	$reset, \mathrm{X}, \leftarrow$	$find_0, 1, \rightarrow$	$N, \square, -$	$find_0, \mathrm{X}, \rightarrow$
$\boldsymbol{find_1}$	$find_1, 0, \rightarrow$	$reset, 1, \leftarrow$	$N, \square, -$	$find_1, \mathrm{X}, \rightarrow$
$\boldsymbol{reset}$	$reset, 0, \leftarrow$	$reset, 1, \leftarrow$	$start, \square, \rightarrow$	$reset, X, \leftarrow$

Programming challenge

Write a Turing Machine interpreter:

- **Input:** the transition table of a Turing Machine + initial tape contents
- **Output:** contents of tape after the machine finished its run
- Implement it in the language of your choice!
- **Soft deadline:** Wednesday, 16 OCT 2024, 23:55