

# TURING MACHINES

## Theory of Computation

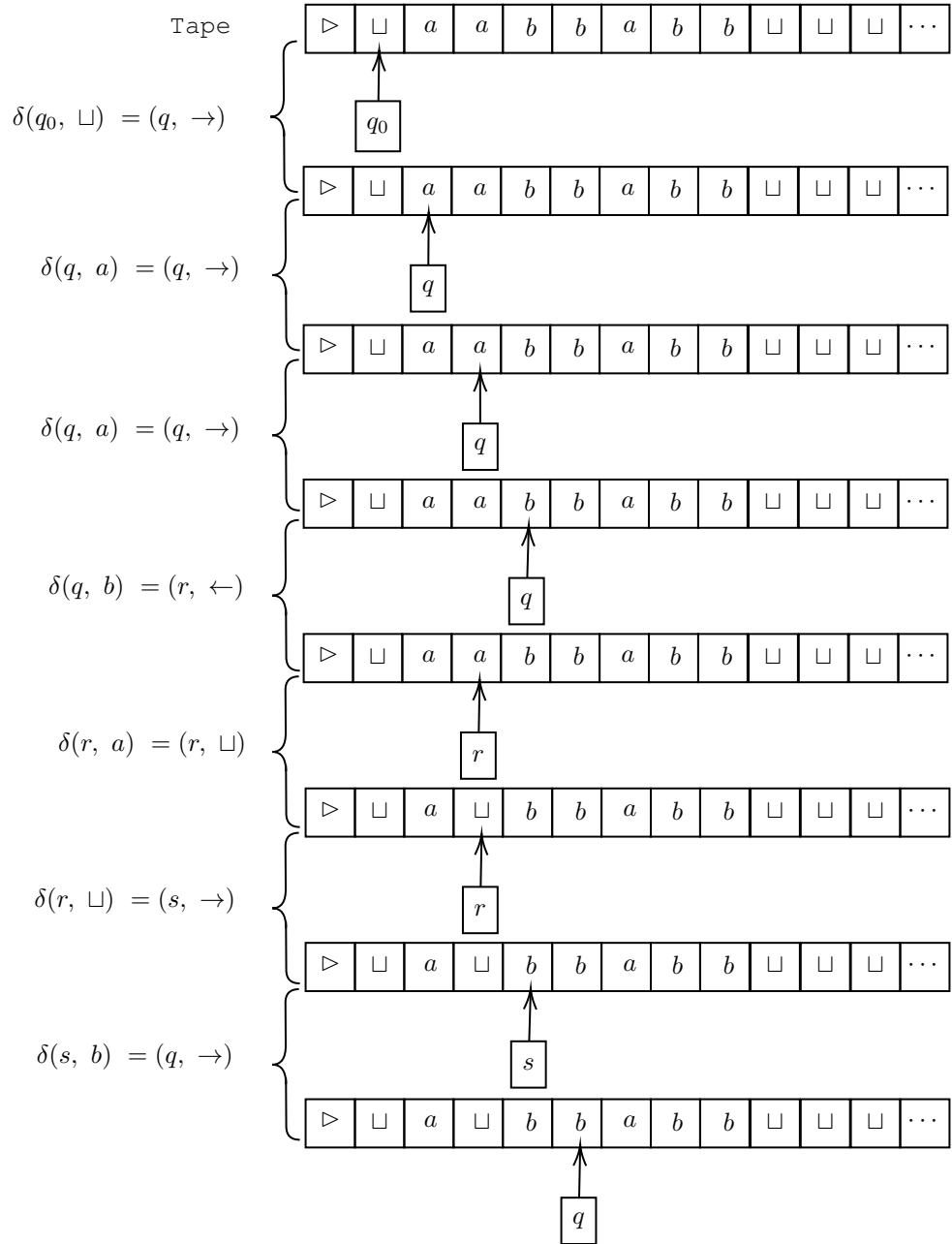
[github.com/erngv](https://github.com/erngv)

1. Consider the Turing machine  $M = (K, \Sigma, \delta, s, H)$  where  $K = \{q_0, q, r, s, h\}$ ,  $\Sigma = \{\sqcup, \triangleright, a, b\}$ ,  $s = q_0$ ,  $H = \{h\}$ , and  $\delta$  includes the following transitions:

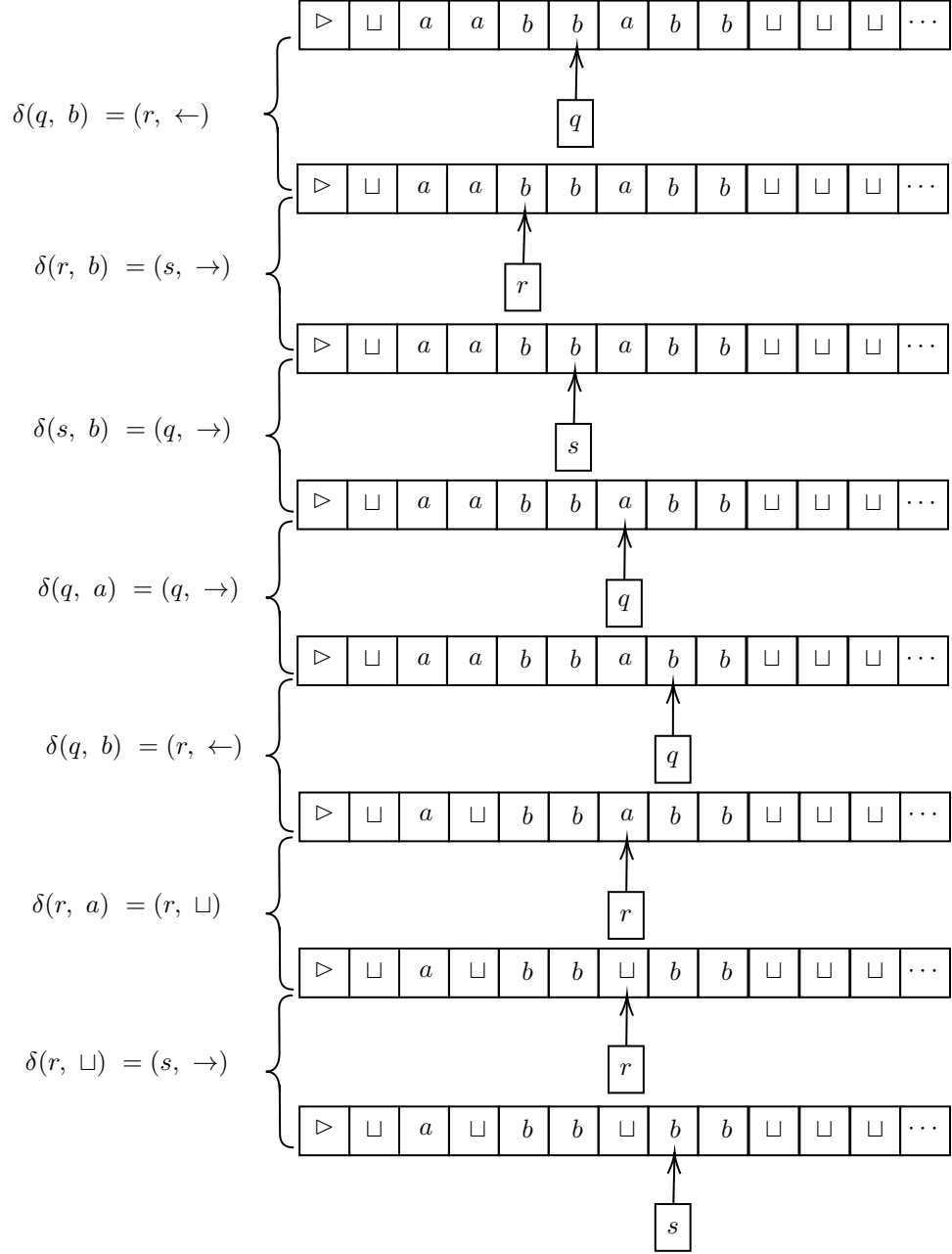
$\delta(q_0, \sqcup)$	=	$(q, \rightarrow)$
$\delta(q, a)$	=	$(q, \rightarrow)$
$\delta(q, b)$	=	$(r, \leftarrow)$
$\delta(q, \sqcup)$	=	$(h, \sqcup)$
$\delta(r, a)$	=	$(r, \sqcup)$
$\delta(r, b)$	=	$(s, \rightarrow)$
$\delta(r, \sqcup)$	=	$(s, \rightarrow)$
$\delta(s, a)$	=	$(q, \rightarrow)$
$\delta(s, b)$	=	$(q, \rightarrow)$
$\delta(s, \sqcup)$	=	$(q, \rightarrow)$

- (a) What is the final tape configuration when this machine is started on the tape  $\triangleright \sqcup aabbabb$  scanning the blank in the start state?
- (b) Describe informally what this machine does.

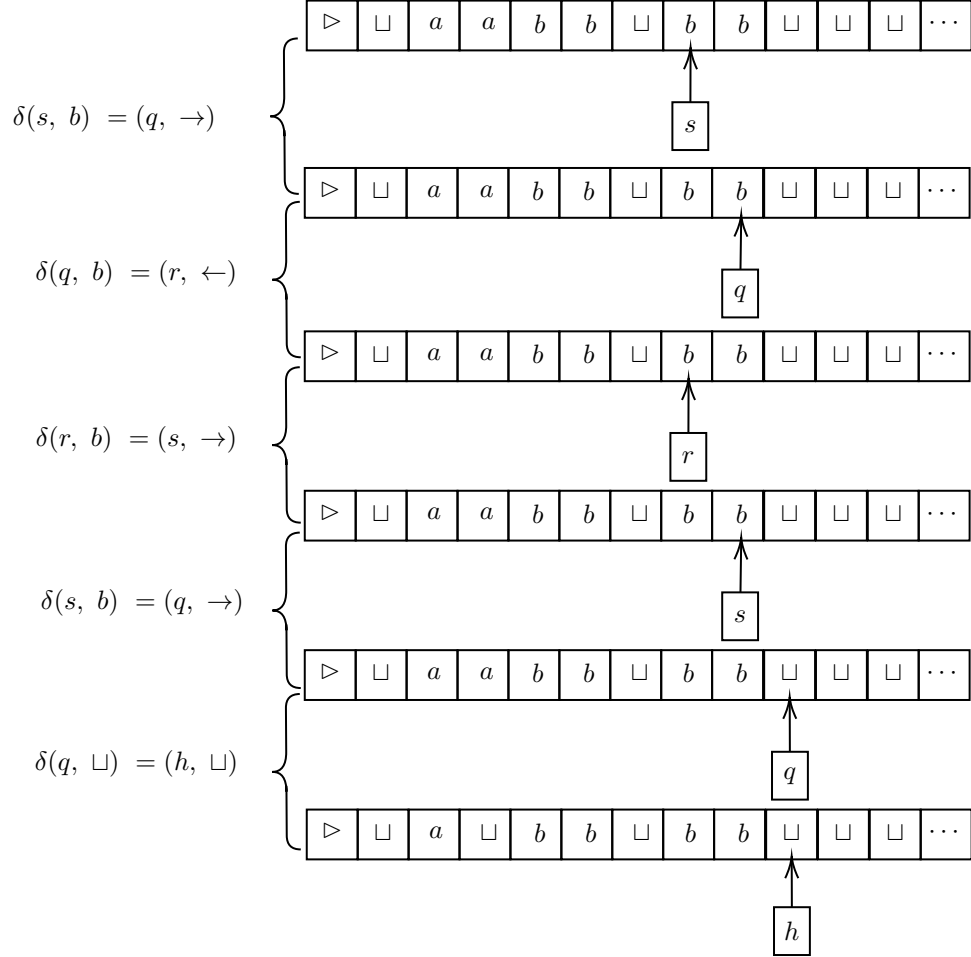
**Answer: (a)**



*Cont.*



Cont.



The final tape configuration is,

$\triangleright \square a \square bb \square bb$

**Answer: (b)**

$M$  scans the alphabet tape to the right until the tape head encounters the symbol  $b$ . Then, the machine checks for the previous symbol to  $b$ . If the previous symbol is  $a$ ,  $M$  replaces the  $a$  with the blank symbol  $\square$  and keeps scanning right. Otherwise, if the previous symbol to  $b$  is  $b$ , the machine keeps the  $b$  and scans to the right. This process is repeated until  $M$  halts.