## COSE 215:Theory of Computation

## Examples of Turing Machines (2)

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2017 Spring

Example I. Design a Turing machine that accepts $01^{*}+10^{*}$.

$$
M=\left(\left\{q_{0}, q_{1}\right\} \times\{0,1, B\},\{0,1\},\{0,1, B\}, \delta,\left(q_{0}, B\right), B,\left\{\left(q_{1}, B\right)\right\}\right)
$$

Example I. Design a Turing machine that accepts $01^{*}+10^{*}$.

$$
M=\left(\left\{q_{0}, q_{1}\right\} \times\{0,1, B\},\{0,1\},\{0,1, B\}, \delta,\left(q_{0}, B\right), B,\left\{\left(q_{1}, B\right)\right\}\right)
$$

1. $\delta\left(\left(q_{0}, B\right), a\right)=\left(\left(q_{1}, a\right), a, R\right)$ for $a=0$
2. $\delta\left(\left(q_{1}, a\right), \bar{a}\right)=\left(\left(q_{1}, a\right), \bar{a}, R\right)$
3. $\delta\left(\left(q_{1}, a\right), B\right)=\left(\left(q_{1}, B\right), B, R\right)$

4. $\delta\left(\left(q_{0}, B\right), a\right)=\left(\left(q_{1}, a\right), a, R\right)$ for $a=0$ or $a=1$
5. $\delta\left(\left(q_{1}, a\right), \bar{a}\right)=\left(\left(q_{1}, a\right), \bar{a}, R\right)$
6. $\delta\left(\left(q_{1}, a\right), B\right)=\left(\left(q_{1}, B\right), B, R\right)$

7. $\delta\left(\left(q_{0}, B\right), a\right)=\left(\left(q_{1}, a\right), a, R\right)$ for $a=0$ or $a=1$
8. $\delta\left(\left(q_{1}, a\right), \bar{a}\right)=\left(\left(q_{1}, a\right), \bar{a}, R\right)$
9. $\delta\left(\left(q_{1}, a\right), B\right)=\left(\left(q_{1}, B\right), B, R\right)$

10. $\delta\left(\left(q_{0}, B\right), a\right)=\left(\left(q_{1}, a\right), a, R\right)$ for $a=0$ or $a=1$
11. $\delta\left(\left(q_{1}, a\right), \bar{a}\right)=\left(\left(q_{1}, a\right), \bar{a}, R\right)$
12. $\delta\left(\left(q_{1}, a\right), B\right)=\left(\left(q_{1}, B\right), B, R\right)$

13. $\delta\left(\left(q_{0}, B\right), a\right)=\left(\left(q_{1}, a\right), a, R\right)$ for $a=0$ or $a=1$
14. $\delta\left(\left(q_{1}, a\right), \bar{a}\right)=\left(\left(q_{1}, a\right), \bar{a}, R\right)$
15. $\delta\left(\left(q_{1}, a\right), B\right)=\left(\left(q_{1}, B\right), B, R\right)$

16. $\delta\left(\left(q_{0}, B\right), a\right)=\left(\left(q_{1}, a\right), a, R\right)$ for $a=0$ or $a=1$
17. $\delta\left(\left(q_{1}, a\right), \bar{a}\right)=\left(\left(q_{1}, a\right), \bar{a}, R\right)$
18. $\delta\left(\left(q_{1}, a\right), B\right)=\left(\left(q_{1}, B\right), B, R\right)$

19. $\delta\left(\left(q_{0}, B\right), a\right)=\left(\left(q_{1}, a\right), a, R\right)$ for $a=0$ or $a=1$
20. $\delta\left(\left(q_{1}, a\right), \bar{a}\right)=\left(\left(q_{1}, a\right), \bar{a}, R\right)$
21. $\delta\left(\left(q_{1}, a\right), B\right)=\left(\left(q_{1}, B\right), B, R\right)$

22. $\delta\left(\left(q_{0}, B\right), a\right)=\left(\left(q_{1}, a\right), a, R\right)$ for $a=0$ or $a=1$
23. $\delta\left(\left(q_{1}, a\right), \bar{a}\right)=\left(\left(q_{1}, a\right), \bar{a}, R\right)$
24. $\delta\left(\left(q_{1}, a\right), B\right)=\left(\left(q_{1}, B\right), B, R\right)$

25. $\delta\left(\left(q_{0}, B\right), a\right)=\left(\left(q_{1}, a\right), a, R\right)$ for $a=0$ or $a=1$
26. $\delta\left(\left(q_{1}, a\right), \bar{a}\right)=\left(\left(q_{1}, a\right), \bar{a}, R\right)$
27. $\delta\left(\left(q_{1}, a\right), B\right)=\left(\left(q_{1}, B\right), B, R\right)$

28. $\delta\left(\left(q_{0}, B\right), a\right)=\left(\left(q_{1}, a\right), a, R\right)$ for $a=0$ or $a=1$
29. $\delta\left(\left(q_{1}, a\right), \bar{a}\right)=\left(\left(q_{1}, a\right), \bar{a}, R\right)$
30. $\delta\left(\left(q_{1}, a\right), B\right)=\left(\left(q_{1}, B\right), B, R\right)$

31. $\delta\left(\left(q_{0}, B\right), a\right)=\left(\left(q_{1}, a\right), a, R\right)$ for $a=0$ or $a=1$
32. $\delta\left(\left(q_{1}, a\right), \bar{a}\right)=\left(\left(q_{1}, a\right), \bar{a}, R\right)$
33. $\delta\left(\left(q_{1}, a\right), B\right)=\left(\left(q_{1}, B\right), B, R\right)$

34. $\delta\left(\left(q_{0}, B\right), a\right)=\left(\left(q_{1}, a\right), a, R\right)$ for $a=0$ or $a=1$
35. $\delta\left(\left(q_{1}, a\right), \bar{a}\right)=\left(\left(q_{1}, a\right), \bar{a}, R\right)$
36. $\delta\left(\left(q_{1}, a\right), B\right)=\left(\left(q_{1}, B\right), B, R\right)$

37. $\delta\left(\left(q_{0}, B\right), a\right)=\left(\left(q_{1}, a\right), a, R\right)$ for $a=0$ or $a=1$
38. $\delta\left(\left(q_{1}, a\right), \bar{a}\right)=\left(\left(q_{1}, a\right), \bar{a}, R\right)$
39. $\delta\left(\left(q_{1}, a\right), B\right)=\left(\left(q_{1}, B\right), B, R\right)$

Example 2. Design a Turing machine that accepts $L=\left\{w c w \mid w \in\{0,1\}^{+}\right\}$.

Example 2. Design a Turing machine that accepts $L=\left\{w c w \mid w \in\{0,1\}^{+}\right\}$.

$$
\begin{aligned}
& M=\left(Q, \Sigma, \Gamma, \delta,\left(q_{1}, B\right),(B, B),\left\{q_{9}, B\right\}\right) \\
& -\left\{q_{1}, q_{2}, \ldots, q_{9}\right\} \times\{0,1, B\} \\
& -\Gamma=\{B, *\} \times\{0,1, c, B\} \\
& -\Sigma=\{(B, 0),(B, 1),(B, c)\}
\end{aligned}
$$

$$
\begin{aligned}
& \delta\left(\left(q_{1}, B\right),(B, a)\right)=\left(\left(q_{2}, a\right),(*, a), R\right) \\
& \delta\left(\left(q_{2}, a\right),(B, b)\right)=\left(\left(q_{2}, a\right),(B, b), R\right) \\
& \delta\left(\left(q_{2}, a\right),(B, c)\right)=\left(\left(q_{3}, a\right),(B, c), R\right) \\
& \delta\left(\left(q_{3}, a\right),(*, b)\right)=\left(\left(q_{3}, a\right),(*, b), R\right) \\
& \delta\left(\left(q_{3}, a\right),(B, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) \\
& \delta\left(\left(q_{4}, B\right),(*, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) \\
& \delta\left(\left(q_{4}, B\right),(B, c)\right)=\left(\left(q_{5}, B\right),(B, c), L\right)
\end{aligned}
$$

$$
\delta\left(\left(q_{5}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right)
$$

$$
\delta\left(\left(q_{2}, a\right),(B, b)\right)=\left(\left(q_{2}, a\right),(B, b), R\right) \quad \delta\left(\left(q_{6}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right)
$$

$$
\delta\left(\left(q_{6}, B\right),(*, a)\right)=\left(\left(q_{1}, B\right),(*, a), R\right)
$$

$$
\delta\left(\left(q_{7}, B\right),(B, c)\right)=\left(\left(q_{8}, B\right),(B, c), R\right)
$$

$$
\delta\left(\left(q_{8}, B\right),(*, a)\right)=\left(\left(q_{8}, B\right),(*, a), R\right)
$$

$$
\delta\left(\left(q_{8}, B\right),(B, B)\right)=\left(\left(q_{9}, B\right),(B, B), R\right)
$$

| $\ldots$ | B | B | B | B | B | B | B | B | $\ldots$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\ldots$ | B | 0 | I | C | 0 | I | B | B | $\ldots$ |



$$
\begin{aligned}
& \delta\left(\left(q_{1}, B\right),(B, a)\right)=\left(\left(q_{2}, a\right),(*, a), R\right) \\
& \delta\left(\left(q_{2}, a\right),(B, b)\right)=\left(\left(q_{2}, a\right),(B, b), R\right) \\
& \delta\left(\left(q_{2}, a\right),(B, c)\right)=\left(\left(q_{3}, a\right),(B, c), R\right) \\
& \delta\left(\left(q_{3}, a\right),(*, b)\right)=\left(\left(q_{3}, a\right),(*, b), R\right) \\
& \delta\left(\left(q_{3}, a\right),(B, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) \\
& \delta\left(\left(q_{4}, B\right),(*, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) \\
& \delta\left(\left(q_{4}, B\right),(B, c)\right)=\left(\left(q_{5}, B\right),(B, c), L\right)
\end{aligned}
$$

$$
\begin{aligned}
& \delta\left(\left(q_{5}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right) \\
& \delta\left(\left(q_{6}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right) \\
& \delta\left(\left(q_{6}, B\right),(*, a)\right)=\left(\left(q_{1}, B\right),(*, a), R\right) \\
& \delta\left(\left(q_{5}, B\right),(*, a)\right)=\left(\left(q_{7}, B\right),(*, a), R\right) \\
& \delta\left(\left(q_{7}, B\right),(B, c)\right)=\left(\left(q_{8}, B\right),(B, c), R\right) \\
& \delta\left(\left(q_{8}, B\right),(*, a)\right)=\left(\left(q_{8}, B\right),(*, a), R\right) \\
& \delta\left(\left(q_{8}, B\right),(B, B)\right)=\left(\left(q_{9}, B\right),(B, B), R\right)
\end{aligned}
$$

| $\ldots$ | B | $*$ | B | B | B | B | B | B | $\ldots$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\ldots$ | B | 0 | I | C | 0 | I | B | B | $\ldots$ |



In q2, moves right, looking for c

$$
\begin{aligned}
& \delta\left(\left(q_{1}, B\right),(B, a)\right)=\left(\left(q_{2}, a\right),(*, a), R\right) \\
& \delta\left(\left(q_{2}, a\right),(B, b)\right)=\left(\left(q_{2}, a\right),(B, b), R\right) \\
& \delta\left(\left(q_{2}, a\right),(B, c)\right)=\left(\left(q_{3}, a\right),(B, c), R\right) \\
& \delta\left(\left(q_{3}, a\right),(*, b)\right)=\left(\left(q_{3}, a\right),(*, b), R\right) \\
& \delta\left(\left(q_{3}, a\right),(B, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) \\
& \delta\left(\left(q_{4}, B\right),(*, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) \\
& \delta\left(\left(q_{4}, B\right),(B, c)\right)=\left(\left(q_{5}, B\right),(B, c), L\right)
\end{aligned}
$$

$$
\delta\left(\left(q_{5}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right)
$$

$$
\delta\left(\left(q_{6}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right)
$$

$$
\delta\left(\left(q_{6}, B\right),(*, a)\right)=\left(\left(q_{1}, B\right),(*, a), R\right)
$$

$$
\delta\left(\left(q_{5}, B\right),(*, a)\right)=\left(\left(q_{7}, B\right),(*, a), R\right)
$$

$$
\delta\left(\left(q_{7}, B\right),(B, c)\right)=\left(\left(q_{8}, B\right),(B, c), R\right)
$$

$$
\delta\left(\left(q_{8}, B\right),(*, a)\right)=\left(\left(q_{8}, B\right),(*, a), R\right)
$$

$$
\delta\left(\left(q_{8}, B\right),(B, B)\right)=\left(\left(q_{9}, B\right),(B, B), R\right)
$$

| $\ldots$ | B | $*$ | B | B | B | B | B | B | $\ldots$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\ldots$ | B | 0 | I | C | 0 | I | B | B | $\ldots$ |



## When found,

- enter q3
- continue right

$$
\begin{array}{ll}
\delta\left(\left(q_{1}, B\right),(B, a)\right)=\left(\left(q_{2}, a\right),(*, a), R\right) & \delta\left(\left(q_{5}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right) \\
\delta\left(\left(q_{2}, a\right),(B, b)\right)=\left(\left(q_{2}, a\right),(B, b), R\right) & \delta\left(\left(q_{6}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right) \\
\delta\left(\left(q_{2}, a\right),(B, c)\right)=\left(\left(q_{3}, a\right),(B, c), R\right) & \delta\left(\left(q_{6}, B\right),(*, a)\right)=\left(\left(q_{1}, B\right),(*, a), R\right) \\
\delta\left(\left(q_{3}, a\right),(*, b)\right)=\left(\left(q_{3}, a\right),(*, b), R\right) & \delta\left(\left(q_{5}, B\right),(*, a)\right)=\left(\left(q_{7}, B\right),(*, a), R\right) \\
\delta\left(\left(q_{3}, a\right),(B, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) & \delta\left(\left(q_{7}, B\right),(B, c)\right)=\left(\left(q_{8}, B\right),(B, c), R\right) \\
\delta\left(\left(q_{4}, B\right),(*, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) & \delta\left(\left(q_{8}, B\right),(*, a)\right)=\left(\left(q_{8}, B\right),(*, a), R\right) \\
\delta\left(\left(q_{4}, B\right),(B, c)\right)=\left(\left(q_{5}, B\right),(B, c), L\right) & \delta\left(\left(q_{8}, B\right),(B, B)\right)=\left(\left(q_{9}, B\right),(B, B), R\right)
\end{array}
$$

| $\ldots$ | B | $*$ | B | B | B | B | B | B | $\ldots$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\ldots$ | B | 0 | I | C | 0 | I | B | B | $\ldots$ |



In q3,
look for the first unchecked symbol

$$
\begin{aligned}
& \delta\left(\left(q_{1}, B\right),(B, a)\right)=\left(\left(q_{2}, a\right),(*, a), R\right) \\
& \delta\left(\left(q_{2}, a\right),(B, b)\right)=\left(\left(q_{2}, a\right),(B, b), R\right) \\
& \delta\left(\left(q_{2}, a\right),(B, c)\right)=\left(\left(q_{3}, a\right),(B, c), R\right) \\
& \delta\left(\left(q_{3}, a\right),(*, b)\right)=\left(\left(q_{3}, a\right),(*, b), R\right) \\
& \delta\left(\left(q_{3}, a\right),(B, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) \\
& \delta\left(\left(q_{4}, B\right),(*, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) \\
& \delta\left(\left(q_{4}, B\right),(B, c)\right)=\left(\left(q_{5}, B\right),(B, c), L\right)
\end{aligned}
$$

$$
\begin{aligned}
& \delta\left(\left(q_{5}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right) \\
& \delta\left(\left(q_{6}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right) \\
& \delta\left(\left(q_{6}, B\right),(*, a)\right)=\left(\left(q_{1}, B\right),(*, a), R\right) \\
& \delta\left(\left(q_{5}, B\right),(*, a)\right)=\left(\left(q_{7}, B\right),(*, a), R\right) \\
& \delta\left(\left(q_{7}, B\right),(B, c)\right)=\left(\left(q_{8}, B\right),(B, c), R\right) \\
& \delta\left(\left(q_{8}, B\right),(*, a)\right)=\left(\left(q_{8}, B\right),(*, a), R\right) \\
& \delta\left(\left(q_{8}, B\right),(B, B)\right)=\left(\left(q_{9}, B\right),(B, B), R\right)
\end{aligned}
$$

| $\ldots$ | B | $*$ | B | B | $*$ | B | B | B | $\ldots$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\ldots$ | B | 0 | I | C | 0 | I | B | B | $\ldots$ |



$$
\begin{array}{ll}
\delta\left(\left(q_{1}, B\right),(B, a)\right)=\left(\left(q_{2}, a\right),(*, a), R\right) & \delta\left(\left(q_{5}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right) \\
\delta\left(\left(q_{2}, a\right),(B, b)\right)=\left(\left(q_{2}, a\right),(B, b), R\right) & \delta\left(\left(q_{6}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right) \\
\delta\left(\left(q_{2}, a\right),(B, c)\right)=\left(\left(q_{3}, a\right),(B, c), R\right) & \delta\left(\left(q_{6}, B\right),(*, a)\right)=\left(\left(q_{1}, B\right),(*, a), R\right) \\
\delta\left(\left(q_{3}, a\right),(*, b)\right)=\left(\left(q_{3}, a\right),(*, b), R\right) & \delta\left(\left(q_{5}, B\right),(*, a)\right)=\left(\left(q_{7}, B\right),(*, a), R\right) \\
\delta\left(\left(q_{3}, a\right),(B, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) & \delta\left(\left(q_{7}, B\right),(B, c)\right)=\left(\left(q_{8}, B\right),(B, c), R\right) \\
\delta\left(\left(q_{4}, B\right),(*, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) & \delta\left(\left(q_{8}, B\right),(*, a)\right)=\left(\left(q_{8}, B\right),(*, a), R\right) \\
\delta\left(\left(q_{4}, B\right),(B, c)\right)=\left(\left(q_{5}, B\right),(B, c), L\right) & \delta\left(\left(q_{8}, B\right),(B, B)\right)=\left(\left(q_{9}, B\right),(B, B), R\right.
\end{array}
$$

- In q4, move left until it finds c
- When found, enter q5

| $\ldots$ | B | $*$ | B | B | $*$ | B | B | B | $\ldots$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\ldots$ | B | 0 | I | C | 0 | I | B | B | $\ldots$ |



- If there is some unchecked symbol, enter q6

$$
\begin{aligned}
& \delta\left(\left(q_{1}, B\right),(B, a)\right)=\left(\left(q_{2}, a\right),(*, a), R\right) \\
& \delta\left(\left(q_{2}, a\right),(B, b)\right)=\left(\left(q_{2}, a\right),(B, b), R\right) \\
& \delta\left(\left(q_{2}, a\right),(B, c)\right)=\left(\left(q_{3}, a\right),(B, c), R\right) \\
& \delta\left(\left(q_{3}, a\right),(*, b)\right)=\left(\left(q_{3}, a\right),(*, b), R\right) \\
& \delta\left(\left(q_{3}, a\right),(B, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) \\
& \delta\left(\left(q_{4}, B\right),(*, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) \\
& \delta\left(\left(q_{4}, B\right),(B, c)\right)=\left(\left(q_{5}, B\right),(B, c), L\right)
\end{aligned}
$$

$$
\begin{aligned}
& \delta\left(\left(q_{5}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right) \\
& \delta\left(\left(q_{6}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right) \\
& \delta\left(\left(q_{6}, B\right),(*, a)\right)=\left(\left(q_{1}, B\right),(*, a), R\right) \\
& \delta\left(\left(q_{5}, B\right),(*, a)\right)=\left(\left(q_{7}, B\right),(*, a), R\right) \\
& \delta\left(\left(q_{7}, B\right),(B, c)\right)=\left(\left(q_{8}, B\right),(B, c), R\right) \\
& \delta\left(\left(q_{8}, B\right),(*, a)\right)=\left(\left(q_{8}, B\right),(*, a), R\right) \\
& \delta\left(\left(q_{8}, B\right),(B, B)\right)=\left(\left(q_{9}, B\right),(B, B), R\right)
\end{aligned}
$$

| $\ldots$ | B | $*$ | B | B | $*$ | B | B | B | $\ldots$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\ldots$ | B | 0 | I | C | 0 | I | B | B | $\ldots$ |



- In q6, move left and look for the first checked symbol

$$
\begin{aligned}
& \delta\left(\left(q_{1}, B\right),(B, a)\right)=\left(\left(q_{2}, a\right),(*, a), R\right) \\
& \delta\left(\left(q_{2}, a\right),(B, b)\right)=\left(\left(q_{2}, a\right),(B, b), R\right) \\
& \delta\left(\left(q_{2}, a\right),(B, c)\right)=\left(\left(q_{3}, a\right),(B, c), R\right) \\
& \delta\left(\left(q_{3}, a\right),(*, b)\right)=\left(\left(q_{3}, a\right),(*, b), R\right) \\
& \delta\left(\left(q_{3}, a\right),(B, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) \\
& \delta\left(\left(q_{4}, B\right),(*, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) \\
& \delta\left(\left(q_{4}, B\right),(B, c)\right)=\left(\left(q_{5}, B\right),(B, c), L\right)
\end{aligned}
$$

$$
\begin{aligned}
& \delta\left(\left(q_{5}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right) \\
& \delta\left(\left(q_{6}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right) \\
& \delta\left(\left(q_{6}, B\right),(*, a)\right)=\left(\left(q_{1}, B\right),(*, a), R\right) \\
& \delta\left(\left(q_{5}, B\right),(*, a)\right)=\left(\left(q_{7}, B\right),(*, a), R\right) \\
& \delta\left(\left(q_{7}, B\right),(B, c)\right)=\left(\left(q_{8}, B\right),(B, c), R\right) \\
& \delta\left(\left(q_{8}, B\right),(*, a)\right)=\left(\left(q_{8}, B\right),(*, a), R\right) \\
& \delta\left(\left(q_{8}, B\right),(B, B)\right)=\left(\left(q_{9}, B\right),(B, B), R\right)
\end{aligned}
$$

| $\ldots$ | B | $*$ | B | B | $*$ | B | B | B | $\ldots$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\ldots$ | B | 0 | I | C | 0 | I | B | B | $\ldots$ |



- Repeat the cycle

$$
\begin{aligned}
& \delta\left(\left(q_{1}, B\right),(B, a)\right)=\left(\left(q_{2}, a\right),(*, a), R\right) \\
& \delta\left(\left(q_{2}, a\right),(B, b)\right)=\left(\left(q_{2}, a\right),(B, b), R\right) \\
& \delta\left(\left(q_{2}, a\right),(B, c)\right)=\left(\left(q_{3}, a\right),(B, c), R\right) \\
& \delta\left(\left(q_{3}, a\right),(*, b)\right)=\left(\left(q_{3}, a\right),(*, b), R\right) \\
& \delta\left(\left(q_{3}, a\right),(B, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) \\
& \delta\left(\left(q_{4}, B\right),(*, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) \\
& \delta\left(\left(q_{4}, B\right),(B, c)\right)=\left(\left(q_{5}, B\right),(B, c), L\right)
\end{aligned}
$$

$$
\delta\left(\left(q_{5}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right)
$$

$$
\delta\left(\left(q_{6}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right)
$$

$$
\delta\left(\left(q_{6}, B\right),(*, a)\right)=\left(\left(q_{1}, B\right),(*, a), R\right)
$$

$$
\delta\left(\left(q_{5}, B\right),(*, a)\right)=\left(\left(q_{7}, B\right),(*, a), R\right)
$$

$$
\delta\left(\left(q_{7}, B\right),(B, c)\right)=\left(\left(q_{8}, B\right),(B, c), R\right)
$$

$$
\delta\left(\left(q_{8}, B\right),(*, a)\right)=\left(\left(q_{8}, B\right),(*, a), R\right)
$$

$$
\delta\left(\left(q_{8}, B\right),(B, B)\right)=\left(\left(q_{9}, B\right),(B, B), R\right)
$$

| $\ldots$ | B | $*$ | $*$ | B | $*$ | B | B | B | $\ldots$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\ldots$ | B | 0 | I | C | 0 | I | B | B | $\ldots$ |



$$
\begin{array}{ll}
\delta\left(\left(q_{1}, B\right),(B, a)\right)=\left(\left(q_{2}, a\right),(*, a), R\right) & \delta\left(\left(q_{5}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right) \\
\delta\left(\left(q_{2}, a\right),(B, b)\right)=\left(\left(q_{2}, a\right),(B, b), R\right) & \delta\left(\left(q_{6}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right) \\
\delta\left(\left(q_{2}, a\right),(B, c)\right)=\left(\left(q_{3}, a\right),(B, c), R\right) & \delta\left(\left(q_{6}, B\right),(*, a)\right)=\left(\left(q_{1}, B\right),(*, a), R\right) \\
\delta\left(\left(q_{3}, a\right),(*, b)\right)=\left(\left(q_{3}, a\right),(*, b), R\right) & \delta\left(\left(q_{5}, B\right),(*, a)\right)=\left(\left(q_{7}, B\right),(*, a), R\right) \\
\delta\left(\left(q_{3}, a\right),(B, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) & \delta\left(\left(q_{7}, B\right),(B, c)\right)=\left(\left(q_{8}, B\right),(B, c), R\right) \\
\delta\left(\left(q_{4}, B\right),(*, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) & \delta\left(\left(q_{8}, B\right),(*, a)\right)=\left(\left(q_{8}, B\right),(*, a), R\right) \\
\delta\left(\left(q_{4}, B\right),(B, c)\right)=\left(\left(q_{5}, B\right),(B, c), L\right) & \delta\left(\left(q_{8}, B\right),(B, B)\right)=\left(\left(q_{9}, B\right),(B, B), R\right)
\end{array}
$$

| $\ldots$ | B | $*$ | $*$ | B | $*$ | B | B | B | $\ldots$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\ldots$ | B | 0 | I | C | 0 | I | B | B | $\ldots$ |



$$
\begin{aligned}
& \delta\left(\left(q_{1}, B\right),(B, a)\right)=\left(\left(q_{2}, a\right),(*, a), R\right) \\
& \delta\left(\left(q_{2}, a\right),(B, b)\right)=\left(\left(q_{2}, a\right),(B, b), R\right) \\
& \delta\left(\left(q_{2}, a\right),(B, c)\right)=\left(\left(q_{3}, a\right),(B, c), R\right) \\
& \delta\left(\left(q_{3}, a\right),(*, b)\right)=\left(\left(q_{3}, a\right),(*, b), R\right) \\
& \delta\left(\left(q_{3}, a\right),(B, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) \\
& \delta\left(\left(q_{4}, B\right),(*, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) \\
& \delta\left(\left(q_{4}, B\right),(B, c)\right)=\left(\left(q_{5}, B\right),(B, c), L\right)
\end{aligned}
$$

$$
\delta\left(\left(q_{5}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right)
$$

$$
\delta\left(\left(q_{6}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right)
$$

$$
\delta\left(\left(q_{6}, B\right),(*, a)\right)=\left(\left(q_{1}, B\right),(*, a), R\right)
$$

$$
\delta\left(\left(q_{5}, B\right),(*, a)\right)=\left(\left(q_{7}, B\right),(*, a), R\right)
$$

$$
\delta\left(\left(q_{7}, B\right),(B, c)\right)=\left(\left(q_{8}, B\right),(B, c), R\right)
$$

$$
\delta\left(\left(q_{8}, B\right),(*, a)\right)=\left(\left(q_{8}, B\right),(*, a), R\right)
$$

$$
\delta\left(\left(q_{8}, B\right),(B, B)\right)=\left(\left(q_{9}, B\right),(B, B), R\right)
$$

| $\ldots$ | B | $*$ | $*$ | B | $*$ | B | B | B | $\ldots$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\ldots$ | B | 0 | I | C | 0 | I | B | B | $\ldots$ |



$$
\begin{aligned}
& \delta\left(\left(q_{1}, B\right),(B, a)\right)=\left(\left(q_{2}, a\right),(*, a), R\right) \\
& \delta\left(\left(q_{2}, a\right),(B, b)\right)=\left(\left(q_{2}, a\right),(B, b), R\right) \\
& \delta\left(\left(q_{2}, a\right),(B, c)\right)=\left(\left(q_{3}, a\right),(B, c), R\right) \\
& \delta\left(\left(q_{3}, a\right),(*, b)\right)=\left(\left(q_{3}, a\right),(*, b), R\right) \\
& \delta\left(\left(q_{3}, a\right),(B, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) \\
& \delta\left(\left(q_{4}, B\right),(*, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) \\
& \delta\left(\left(q_{4}, B\right),(B, c)\right)=\left(\left(q_{5}, B\right),(B, c), L\right)
\end{aligned}
$$

$$
\begin{aligned}
& \delta\left(\left(q_{5}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right) \\
& \delta\left(\left(q_{6}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right) \\
& \delta\left(\left(q_{6}, B\right),(*, a)\right)=\left(\left(q_{1}, B\right),(*, a), R\right) \\
& \delta\left(\left(q_{5}, B\right),(*, a)\right)=\left(\left(q_{7}, B\right),(*, a), R\right) \\
& \delta\left(\left(q_{7}, B\right),(B, c)\right)=\left(\left(q_{8}, B\right),(B, c), R\right) \\
& \delta\left(\left(q_{8}, B\right),(*, a)\right)=\left(\left(q_{8}, B\right),(*, a), R\right) \\
& \delta\left(\left(q_{8}, B\right),(B, B)\right)=\left(\left(q_{9}, B\right),(B, B), R\right)
\end{aligned}
$$

| $\ldots$ | B | $*$ | $*$ | B | $*$ | $*$ | B | B | $\ldots$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\ldots$ | B | 0 | I | C | 0 | I | B | B | $\ldots$ |



$$
\begin{aligned}
& \delta\left(\left(q_{1}, B\right),(B, a)\right)=\left(\left(q_{2}, a\right),(*, a), R\right) \\
& \delta\left(\left(q_{2}, a\right),(B, b)\right)=\left(\left(q_{2}, a\right),(B, b), R\right) \\
& \delta\left(\left(q_{2}, a\right),(B, c)\right)=\left(\left(q_{3}, a\right),(B, c), R\right) \\
& \delta\left(\left(q_{3}, a\right),(*, b)\right)=\left(\left(q_{3}, a\right),(*, b), R\right) \\
& \delta\left(\left(q_{3}, a\right),(B, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) \\
& \delta\left(\left(q_{4}, B\right),(*, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) \\
& \delta\left(\left(q_{4}, B\right),(B, c)\right)=\left(\left(q_{5}, B\right),(B, c), L\right)
\end{aligned}
$$

$$
\delta\left(\left(q_{5}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right)
$$

$$
\delta\left(\left(q_{6}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right)
$$

$$
\delta\left(\left(q_{6}, B\right),(*, a)\right)=\left(\left(q_{1}, B\right),(*, a), R\right)
$$

$$
\delta\left(\left(q_{5}, B\right),(*, a)\right)=\left(\left(q_{7}, B\right),(*, a), R\right)
$$

$$
\delta\left(\left(q_{7}, B\right),(B, c)\right)=\left(\left(q_{8}, B\right),(B, c), R\right)
$$

$$
\delta\left(\left(q_{8}, B\right),(*, a)\right)=\left(\left(q_{8}, B\right),(*, a), R\right)
$$

$$
\delta\left(\left(q_{8}, B\right),(B, B)\right)=\left(\left(q_{9}, B\right),(B, B), R\right)
$$

| $\ldots$ | B | $*$ | $*$ | B | $*$ | $*$ | B | B | $\ldots$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\ldots$ | B | 0 | I | C | 0 | I | B | B | $\ldots$ |



$$
\begin{array}{ll}
\delta\left(\left(q_{1}, B\right),(B, a)\right)=\left(\left(q_{2}, a\right),(*, a), R\right) & \delta\left(\left(q_{5}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right) \\
\delta\left(\left(q_{2}, a\right),(B, b)\right)=\left(\left(q_{2}, a\right),(B, b), R\right) & \delta\left(\left(q_{6}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right) \\
\delta\left(\left(q_{2}, a\right),(B, c)\right)=\left(\left(q_{3}, a\right),(B, c), R\right) & \delta\left(\left(q_{6}, B\right),(*, a)\right)=\left(\left(q_{1}, B\right),(*, a), R\right) \\
\delta\left(\left(q_{3}, a\right),(*, b)\right)=\left(\left(q_{3}, a\right),(*, b), R\right) & \delta\left(\left(q_{5}, B\right),(*, a)\right)=\left(\left(q_{7}, B\right),(*, a), R\right) \\
\delta\left(\left(q_{3}, a\right),(B, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) & \delta\left(\left(q_{7}, B\right),(B, c)\right)=\left(\left(q_{8}, B\right),(B, c), R\right) \\
\delta\left(\left(q_{4}, B\right),(*, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) & \delta\left(\left(q_{8}, B\right),(*, a)\right)=\left(\left(q_{8}, B\right),(*, a), R\right) \\
\delta\left(\left(q_{4}, B\right),(B, c)\right)=\left(\left(q_{5}, B\right),(B, c), L\right) & \delta\left(\left(q_{8}, B\right),(B, B)\right)=\left(\left(q_{9}, B\right),(B, B), R\right)
\end{array}
$$

| $\ldots$ | B | $*$ | $*$ | B | $*$ | $*$ | B | B | $\ldots$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\ldots$ | B | 0 | I | C | 0 | I | B | B | $\ldots$ |



- If every symbols are checked, move right and enter q7

$$
\begin{array}{ll}
\delta\left(\left(q_{1}, B\right),(B, a)\right)=\left(\left(q_{2}, a\right),(*, a), R\right) & \delta\left(\left(q_{5}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right) \\
\delta\left(\left(q_{2}, a\right),(B, b)\right)=\left(\left(q_{2}, a\right),(B, b), R\right) & \delta\left(\left(q_{6}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right) \\
\delta\left(\left(_{2}, a\right),(B, c)\right)=\left(\left(q_{3}, a\right),(B, c), R\right) & \delta\left(\left(q_{6}, B\right),(*, a)\right)=\left(\left(q_{1}, B\right),(*, a), R\right) \\
\delta\left(\left(q_{3}, a\right),(*, b)\right)=\left(\left(q_{3}, a\right),(*, b), R\right) & \delta\left(\left(q_{5}, B\right),(*, a)\right)=\left(\left(q_{7}, B\right),(*, a), R\right) \\
\delta\left(\left(q_{3}, a\right),(B, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) & \delta\left(\left(q_{7}, B\right),(B, c)\right)=\left(\left(q_{8}, B\right),(B, c), R\right) \\
\delta\left(\left(q 4_{4}, B\right),(*, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) & \delta\left(\left(q_{8}, B\right),(*, a)\right)=\left(\left(q_{8}, B\right),(*, a), R\right) \\
\delta\left(\left(q_{4}, B\right),(B, c)\right)=\left(\left(q_{5}, B\right),(B, c), L\right) & \delta\left(\left(q_{8}, B\right),(B, B)\right)=\left(\left(q_{9}, B\right),(B, B), R\right.
\end{array}
$$



| $\ldots$ | B | $*$ | $*$ | B | $*$ | $*$ | B | B | $\ldots$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\ldots$ | B | 0 | I | C | 0 | I | B | B | $\ldots$ |



- If c is found, enter q 8

$$
\begin{aligned}
& \delta\left(\left(q_{1}, B\right),(B, a)\right)=\left(\left(q_{2}, a\right),(*, a), R\right) \\
& \delta\left(\left(q_{2}, a\right),(B, b)\right)=\left(\left(q_{2}, a\right),(B, b), R\right) \\
& \delta\left(\left(q_{2}, a\right),(B, c)\right)=\left(\left(q_{3}, a\right),(B, c), R\right) \\
& \delta\left(\left(q_{3}, a\right),(*, b)\right)=\left(\left(q_{3}, a\right),(*, b), R\right) \\
& \delta\left(\left(q_{3}, a\right),(B, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) \\
& \delta\left(\left(q_{4}, B\right),(*, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) \\
& \delta\left(\left(q_{4}, B\right),(B, c)\right)=\left(\left(q_{5}, B\right),(B, c), L\right)
\end{aligned}
$$

$$
\delta\left(\left(q_{5}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right)
$$

$$
\delta\left(\left(q_{6}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right)
$$

$$
\delta\left(\left(q_{6}, B\right),(*, a)\right)=\left(\left(q_{1}, B\right),(*, a), R\right)
$$

$$
\delta\left(\left(q_{5}, B\right),(*, a)\right)=\left(\left(q_{7}, B\right),(*, a), R\right)
$$

$$
\delta\left(\left(q_{7}, B\right),(B, c)\right)=\left(\left(q_{8}, B\right),(B, c), R\right)
$$

$$
\delta\left(\left(q_{8}, B\right),(*, a)\right)=\left(\left(q_{8}, B\right),(*, a), R\right)
$$

$$
\delta\left(\left(q_{8}, B\right),(B, B)\right)=\left(\left(q_{9}, B\right),(B, B), R\right)
$$

| $\ldots$ | B | $*$ | $*$ | B | $*$ | $*$ | B | B | $\ldots$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\ldots$ | B | 0 | I | C | 0 | I | B | B | $\ldots$ |



- move right until it finds $B$

$$
\begin{aligned}
& \delta\left(\left(q_{1}, B\right),(B, a)\right)=\left(\left(q_{2}, a\right),(*, a), R\right) \\
& \delta\left(\left(q_{2}, a\right),(B, b)\right)=\left(\left(q_{2}, a\right),(B, b), R\right) \\
& \delta\left(\left(q_{2}, a\right),(B, c)\right)=\left(\left(q_{3}, a\right),(B, c), R\right) \\
& \delta\left(\left(q_{3}, a\right),(*, b)\right)=\left(\left(q_{3}, a\right),(*, b), R\right) \\
& \delta\left(\left(q_{3}, a\right),(B, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) \\
& \delta\left(\left(q_{4}, B\right),(*, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) \\
& \delta\left(\left(q_{4}, B\right),(B, c)\right)=\left(\left(q_{5}, B\right),(B, c), L\right)
\end{aligned}
$$

$$
\delta\left(\left(q_{5}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right)
$$

$$
\delta\left(\left(q_{6}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right)
$$

$$
\delta\left(\left(q_{6}, B\right),(*, a)\right)=\left(\left(q_{1}, B\right),(*, a), R\right)
$$

$$
\delta\left(\left(q_{5}, B\right),(*, a)\right)=\left(\left(q_{7}, B\right),(*, a), R\right)
$$

$$
\delta\left(\left(q_{7}, B\right),(B, c)\right)=\left(\left(q_{8}, B\right),(B, c), R\right)
$$

$$
\delta\left(\left(q_{8}, B\right),(*, a)\right)=\left(\left(q_{8}, B\right),(*, a), R\right)
$$

$$
\delta\left(\left(q_{8}, B\right),(B, B)\right)=\left(\left(q_{9}, B\right),(B, B), R\right)
$$

| $\ldots$ | B | $*$ | $*$ | B | $*$ | $*$ | B | B | $\ldots$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\ldots$ | B | 0 | I | C | 0 | I | B | B | $\ldots$ |



$$
\begin{aligned}
& \delta\left(\left(q_{1}, B\right),(B, a)\right)=\left(\left(q_{2}, a\right),(*, a), R\right) \\
& \delta\left(\left(q_{2}, a\right),(B, b)\right)=\left(\left(q_{2}, a\right),(B, b), R\right) \\
& \delta\left(\left(q_{2}, a\right),(B, c)\right)=\left(\left(q_{3}, a\right),(B, c), R\right) \\
& \delta\left(\left(q_{3}, a\right),(*, b)\right)=\left(\left(q_{3}, a\right),(*, b), R\right) \\
& \delta\left(\left(q_{3}, a\right),(B, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) \\
& \delta\left(\left(q_{4}, B\right),(*, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) \\
& \delta\left(\left(q_{4}, B\right),(B, c)\right)=\left(\left(q_{5}, B\right),(B, c), L\right)
\end{aligned}
$$

$$
\delta\left(\left(q_{5}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right)
$$

$$
\delta\left(\left(q_{6}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right)
$$

$$
\delta\left(\left(q_{6}, B\right),(*, a)\right)=\left(\left(q_{1}, B\right),(*, a), R\right)
$$

$$
\delta\left(\left(q_{5}, B\right),(*, a)\right)=\left(\left(q_{7}, B\right),(*, a), R\right)
$$

$$
\delta\left(\left(q_{7}, B\right),(B, c)\right)=\left(\left(q_{8}, B\right),(B, c), R\right)
$$

$$
\delta\left(\left(q_{8}, B\right),(*, a)\right)=\left(\left(q_{8}, B\right),(*, a), R\right)
$$

$$
\delta\left(\left(q_{8}, B\right),(B, B)\right)=\left(\left(q_{9}, B\right),(B, B), R\right)
$$

| $\ldots$ | B | $*$ | $*$ | B | $*$ | $*$ | B | B | $\ldots$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\ldots$ | B | 0 | I | C | 0 | I | B | B | $\ldots$ |



$$
\begin{aligned}
& \delta\left(\left(q_{1}, B\right),(B, a)\right)=\left(\left(q_{2}, a\right),(*, a), R\right) \\
& \delta\left(\left(q_{2}, a\right),(B, b)\right)=\left(\left(q_{2}, a\right),(B, b), R\right) \\
& \delta\left(\left(q_{2}, a\right),(B, c)\right)=\left(\left(q_{3}, a\right),(B, c), R\right) \\
& \delta\left(\left(q_{3}, a\right),(*, b)\right)=\left(\left(q_{3}, a\right),(*, b), R\right) \\
& \delta\left(\left(q_{3}, a\right),(B, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) \\
& \delta\left(\left(q_{4}, B\right),(*, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) \\
& \delta\left(\left(q_{4}, B\right),(B, c)\right)=\left(\left(q_{5}, B\right),(B, c), L\right)
\end{aligned}
$$

$$
\delta\left(\left(q_{5}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right)
$$

$$
\delta\left(\left(q_{6}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right)
$$

$$
\delta\left(\left(q_{6}, B\right),(*, a)\right)=\left(\left(q_{1}, B\right),(*, a), R\right)
$$

$$
\delta\left(\left(q_{5}, B\right),(*, a)\right)=\left(\left(q_{7}, B\right),(*, a), R\right)
$$

$$
\delta\left(\left(q_{7}, B\right),(B, c)\right)=\left(\left(q_{8}, B\right),(B, c), R\right)
$$

$$
\delta\left(\left(q_{8}, B\right),(*, a)\right)=\left(\left(q_{8}, B\right),(*, a), R\right)
$$

$$
\delta\left(\left(q_{4}, B\right),(B, c)\right)=\left(\left(q_{5}, B\right),(B, c), L\right) \quad \delta\left(\left(q_{8}, B\right),(B, B)\right)=\left(\left(q_{9}, B\right),(B, B), R\right)
$$

| $\ldots$ | B | $*$ | $*$ | B | $*$ | $*$ | B | B | $\ldots$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\ldots$ | B | 0 | I | C | 0 | I | B | B | $\ldots$ |



$$
\begin{aligned}
& \delta\left(\left(q_{1}, B\right),(B, a)\right)=\left(\left(q_{2}, a\right),(*, a), R\right) \\
& \delta\left(\left(q_{2}, a\right),(B, b)\right)=\left(\left(q_{2}, a\right),(B, b), R\right) \\
& \delta\left(\left(q_{2}, a\right),(B, c)\right)=\left(\left(q_{3}, a\right),(B, c), R\right) \\
& \delta\left(\left(q_{3}, a\right),(*, b)\right)=\left(\left(q_{3}, a\right),(*, b), R\right) \\
& \delta\left(\left(q_{3}, a\right),(B, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) \\
& \delta\left(\left(q_{4}, B\right),(*, a)\right)=\left(\left(q_{4}, B\right),(*, a), L\right) \\
& \delta\left(\left(q_{4}, B\right),(B, c)\right)=\left(\left(q_{5}, B\right),(B, c), L\right)
\end{aligned}
$$

$$
\delta\left(\left(q_{5}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right)
$$

$$
\delta\left(\left(q_{6}, B\right),(B, a)\right)=\left(\left(q_{6}, B\right),(B, a), L\right)
$$

$$
\delta\left(\left(q_{6}, B\right),(*, a)\right)=\left(\left(q_{1}, B\right),(*, a), R\right)
$$

$$
\delta\left(\left(q_{5}, B\right),(*, a)\right)=\left(\left(q_{7}, B\right),(*, a), R\right)
$$

$$
\delta\left(\left(q_{7}, B\right),(B, c)\right)=\left(\left(q_{8}, B\right),(B, c), R\right)
$$

$$
\delta\left(\left(q_{8}, B\right),(*, a)\right)=\left(\left(q_{8}, B\right),(*, a), R\right)
$$

$$
\delta\left(\left(q_{8}, B\right),(B, B)\right)=\left(\left(q_{9}, B\right),(B, B), R\right)
$$

