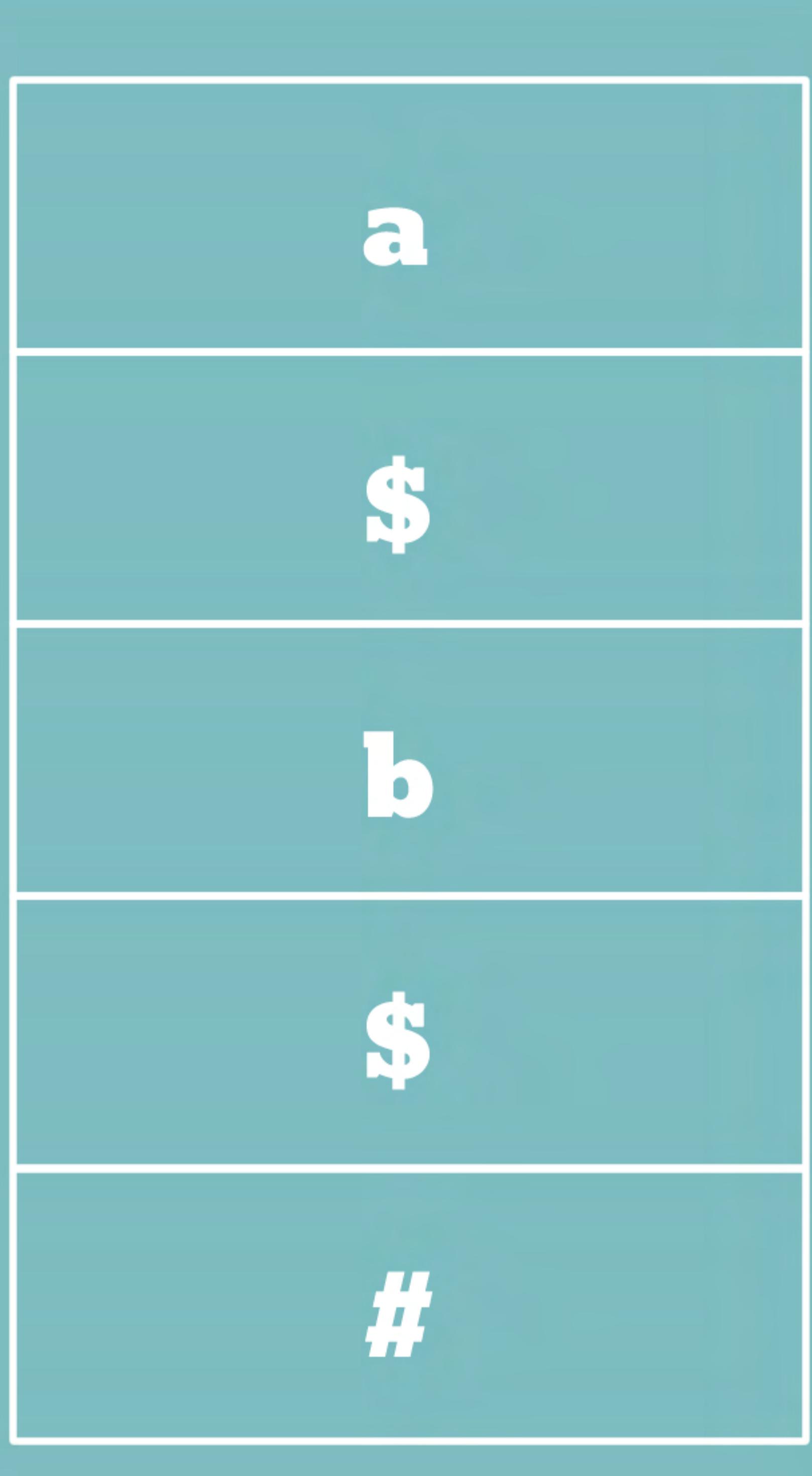


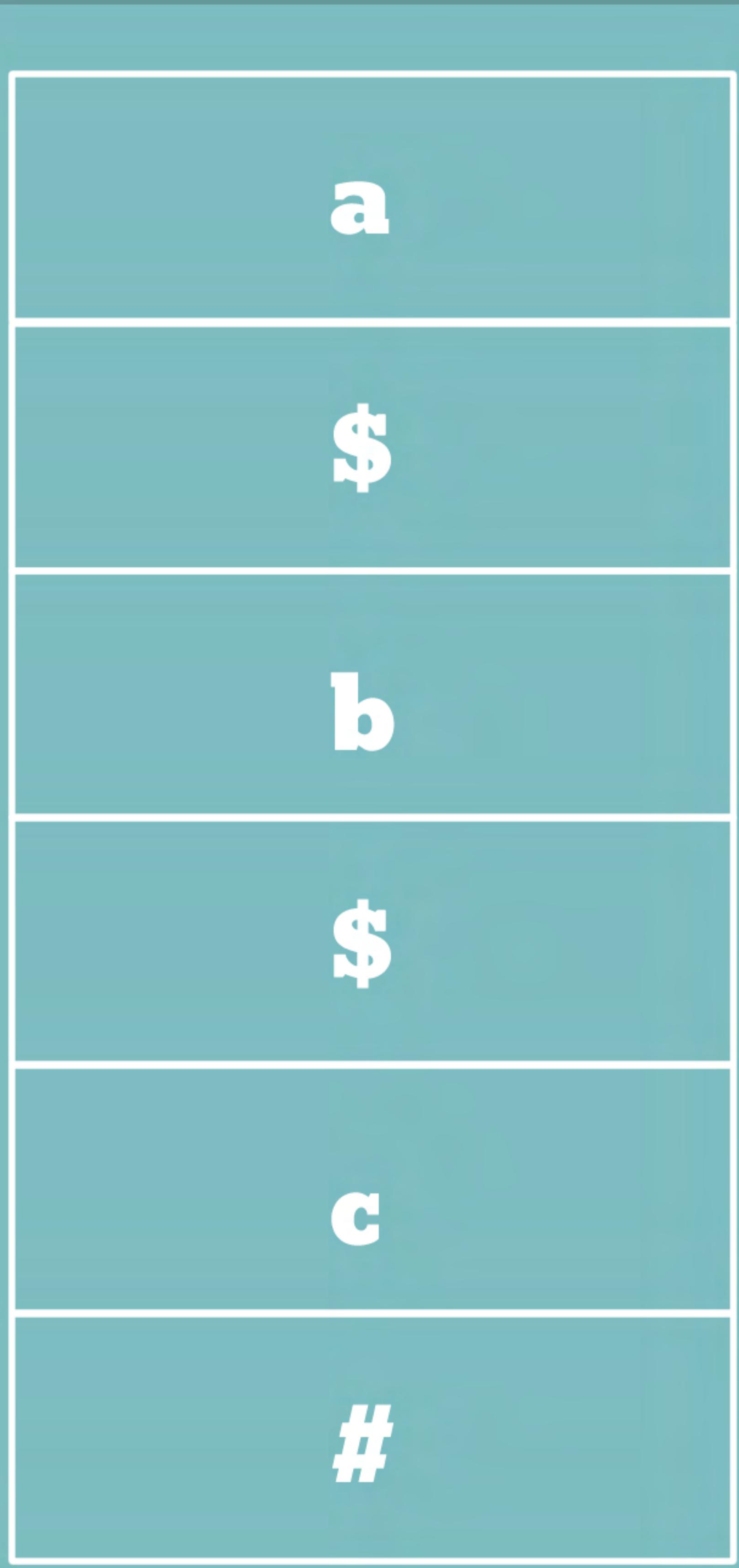
REDUCTION OF FINITELY EXPANDABLE DEEP PUSHDOWN AUTOMATA



$1<\mathbf{q;AA}>\$ \rightarrow <\mathbf{t;AA}>a\b



$2<\mathbf{t;AA}>\$ \rightarrow <\mathbf{q;AA}>\c



$$L = \{ \mathbf{a}^n \mathbf{b}^n \mathbf{c}^n : n > 0 \}$$

Context sensitive language

Deep Pushdown Automaton

$$M = (\{s, q, t\}, \{a, b, c\}, \{a, b, c, A, S, \#\}, R, s, S, \{f\})$$

$$\begin{aligned} R = \{ & 1sS \rightarrow qAA, \\ & 1qA \rightarrow fab, \\ & 1fA \rightarrow fc, \\ & 1qA \rightarrow taAb, \\ & 2tA \rightarrow qAc \} \end{aligned}$$

Construction

States in Q_R include not only the states corresponding to the states in Q but also strings of non-input symbols. Whenever M pushes a non-input symbol onto the pushdown, M_R records this information within its current state and pushes $\$$ onto the pushdown instead.

Reduced Deep Pushdown Automaton

$$M_R = (Q_R, \{a, b, c\}, \{a, b, c, \$, \#\}, R_R, <s;S>, \$, F_R)$$

$$Q_R = \{<s;S>, <q;AA>, <f;A>, <f;C>, <t;AA>\}$$

$$F_R = \{<f;A>, <f;C>\}$$

$$\begin{aligned} R_R = \{ & 1<s;S>\$ \rightarrow <q;AA>\$\$, \\ & 1<q;AA>\$ \rightarrow <f;A>ab, \\ & 1<f;A>\$ \rightarrow <f;C>c, \\ & 1<q;AA>\$ \rightarrow <t;AA>a\$b, \\ & 2<t;AA>\$ \rightarrow <q;AA>\$c \} \end{aligned}$$

Example $a^2b^2c^2$

$$\begin{aligned} <s;S>, aabbcc, \$\#) & \vdash_e (<q;AA>, aabbcc, \$\$ \$\#) \\ & \vdash_e (<t;AA>, aabbcc, a\$b\$ \$\#) \\ & \vdash_p (<t;AA>, abbcc, \$b\$ \$\#) \\ & \vdash_e (<q;AA>, abbcc, a\$b\$c\$ \$\#) \\ & \vdash_e (<f;A>, abbcc, abb\$c\$ \$\#) \\ & \vdash_p (<f;A>, cc, \$c\$ \$\#) \\ & \vdash_e (<f;C>, cc, cc\$ \$\#) \\ & \vdash_p (<f;C>, \$, \$\#) \end{aligned}$$