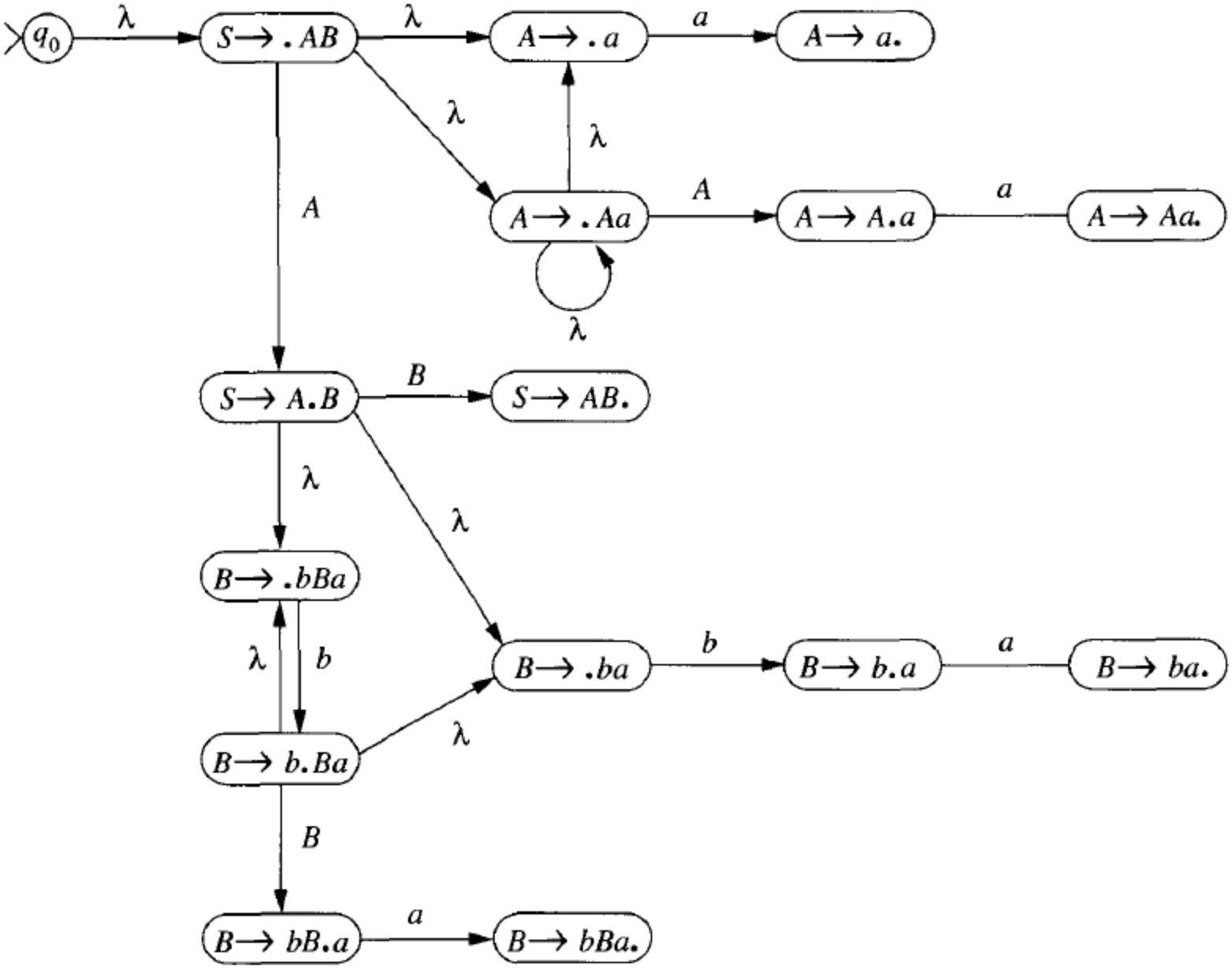
# Compiler Constructions

# Chapter 17 - LR(K) Grammar

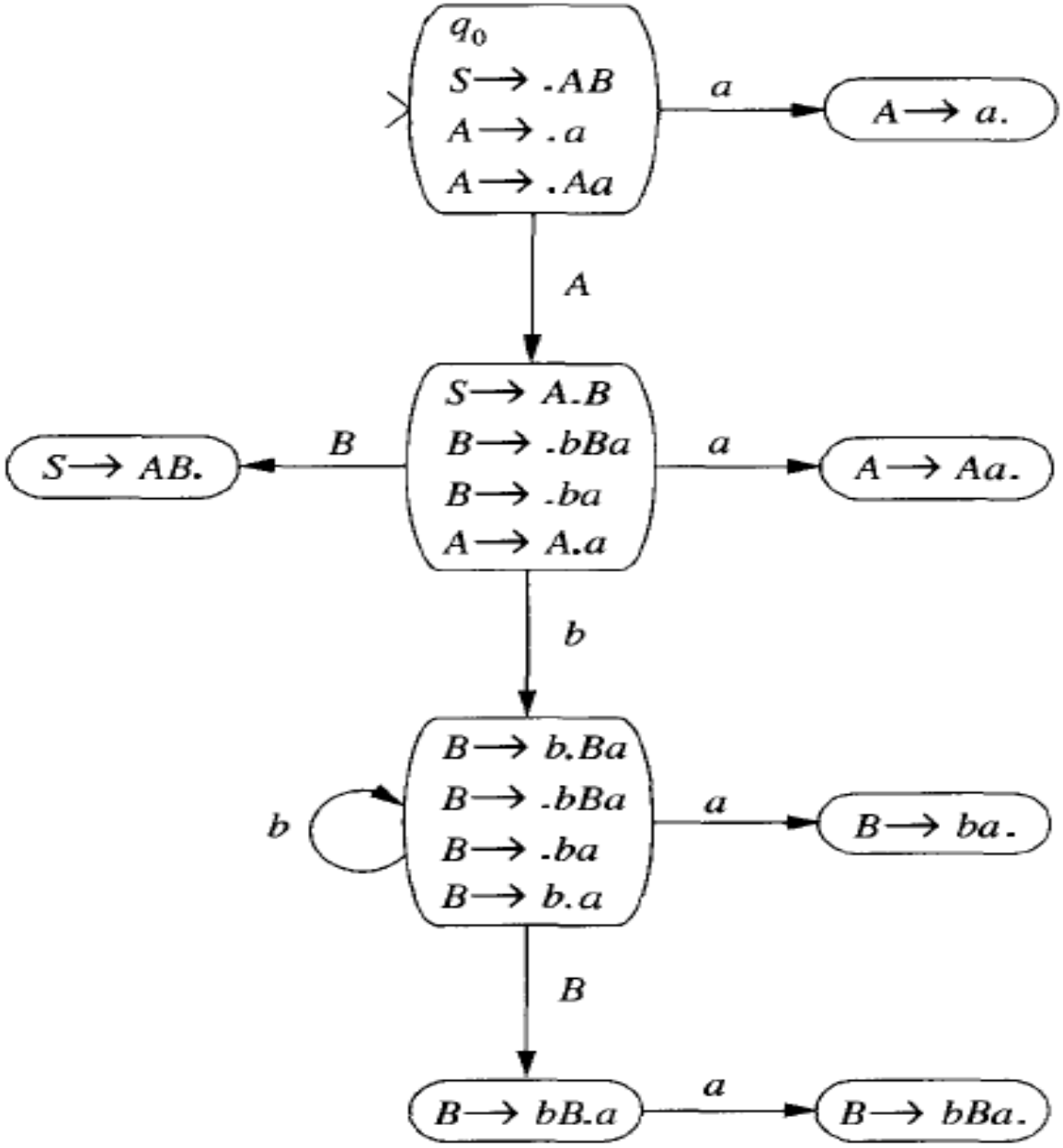
# Part 2

**Dr. Doaa Shebl**
**Faculty of Computers and Artificial Intelligence**
**Beni-Suef University**

| Rule | LR(0) Items | LR(0) Contexts |
|---|---|---|
| $S \rightarrow AB$ | $S \rightarrow .AB$ | $\{AB\}$ |
| | $S \rightarrow A.B$ | |
| | $S \rightarrow AB.$ | |
| $A \rightarrow Aa$ | $A \rightarrow .Aa$ | $\{Aa\}$ |
| | $A \rightarrow A.a$ | |
| | $A \rightarrow Aa.$ | |
| $A \rightarrow a$ | $A \rightarrow .a$ | $\{a\}$ |
| | $A \rightarrow a.$ | |
| $B \rightarrow bBa$ | $B \rightarrow .bBa$ | $\{Ab^i Ba \mid i > 0\}$ |
| | $B \rightarrow b.Ba$ | |
| | $B \rightarrow bB.a$ | |
| | $B \rightarrow bBa.$ | |
| $B \rightarrow ba$ | $B \rightarrow .ba$ | $\{Ab^i ba \mid i \geq 0\}$ |
| | $B \rightarrow b.a$ | |
| | $B \rightarrow ba.$ | |

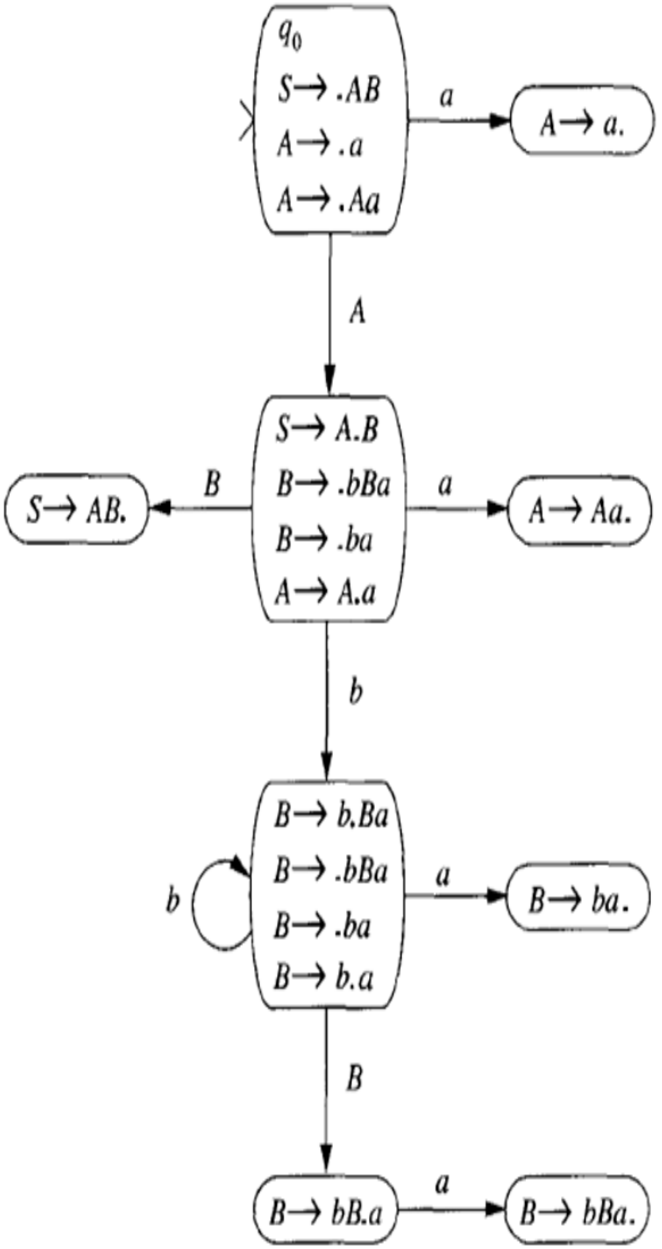



**Non deterministic LR(0) machine**

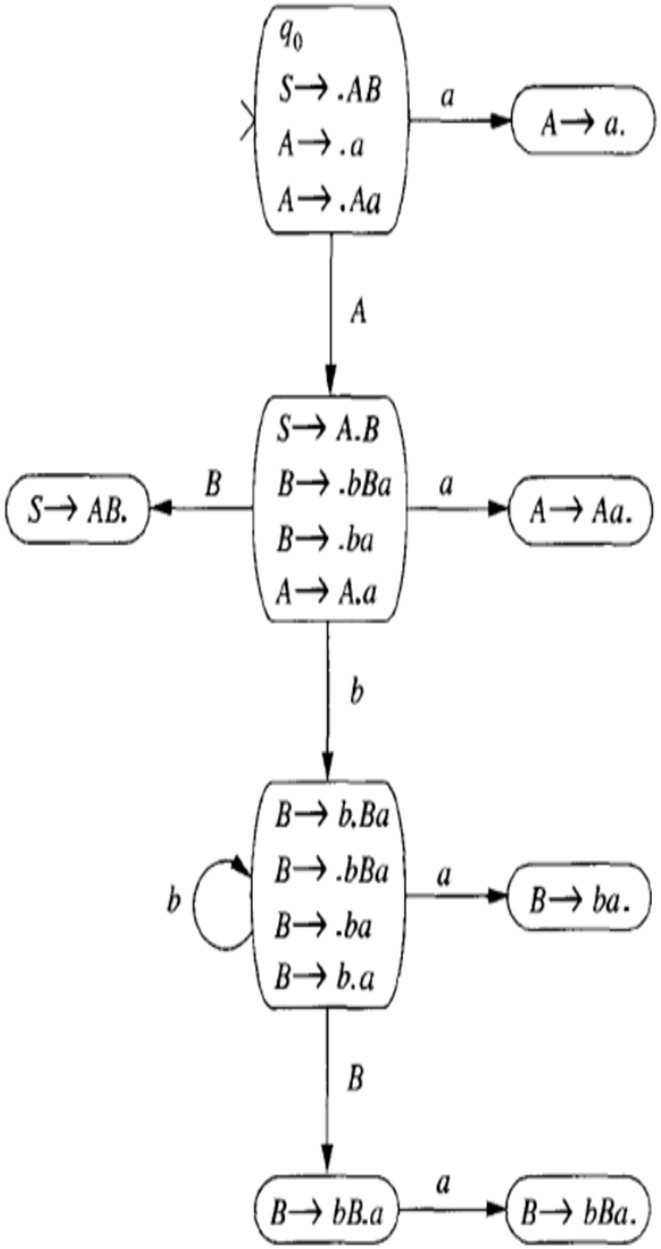



Deterministic LR(0) machine of G.

| $u$ | $v$ | Computation | | Action |
|---|---|---|---|---|
| $\lambda$ | $aabbaa$ | $\hat{\delta}(q_s, \lambda) =$ | $\{S \to .AB,$ | shift |
| | | | $A \to .a,$ | |
| | | | $A \to .Aa\}$ | |
| $a$ | $abbaa$ | $\hat{\delta}(q_s, a) =$ | $\{A \to a.\}$ | reduce |
| $A$ | $abbaa$ | $\hat{\delta}(q_s, A) =$ | $\{A \to A.a,$ | shift |
| | | | $S \to A.B,$ | |
| | | | $B \to .bBa,$ | |
| | | | $B \to .ba\}$ | |
| $Aa$ | $bbaa$ | $\hat{\delta}(q_s, Aa) =$ | $\{A \to Aa.\}$ | reduce |
| $A$ | $bbaa$ | $\hat{\delta}(q_s, A) =$ | $\{A \to A.a,$ | shift |
| | | | $S \to A.B,$ | |
| | | | $B \to .bBa,$ | |
| | | | $B \to .ba\}$ | |
| $Ab$ | $baa$ | $\hat{\delta}(q_s, Ab) =$ | $\{B \to .bBa,$ | shift |
| | | | $B \to b.Ba,$ | |
| | | | $B \to .ba,$ | |
| | | | $B \to b.a\}$ | |



| | | | | |
|---|---|---|---|---|
| $Abb$ | $aa$ | $\hat{\delta}(q_s, Abb) =$ | $\{B \to .bBa,$ | shift |
| | | | $B \to b.Ba,$ | |
| | | | $B \to .ba,$ | |
| | | | $B \to b.a\}$ | |
| $Abba$ | $a$ | $\hat{\delta}(q_s, Abba) =$ | $\{B \to ba.\}$ | reduce |
| $AbB$ | $a$ | $\hat{\delta}(q_s, AbB) =$ | $\{B \to bB.a\}$ | shift |
| $AbBa$ | $\lambda$ | $\hat{\delta}(q_s, AbBa) =$ | $\{B \to bBa.\}$ | reduce |
| $AB$ | $\lambda$ | $\hat{\delta}(q_s, AB) =$ | $\{S \to AB.\}$ | reduce |
| $S$ | | | | |

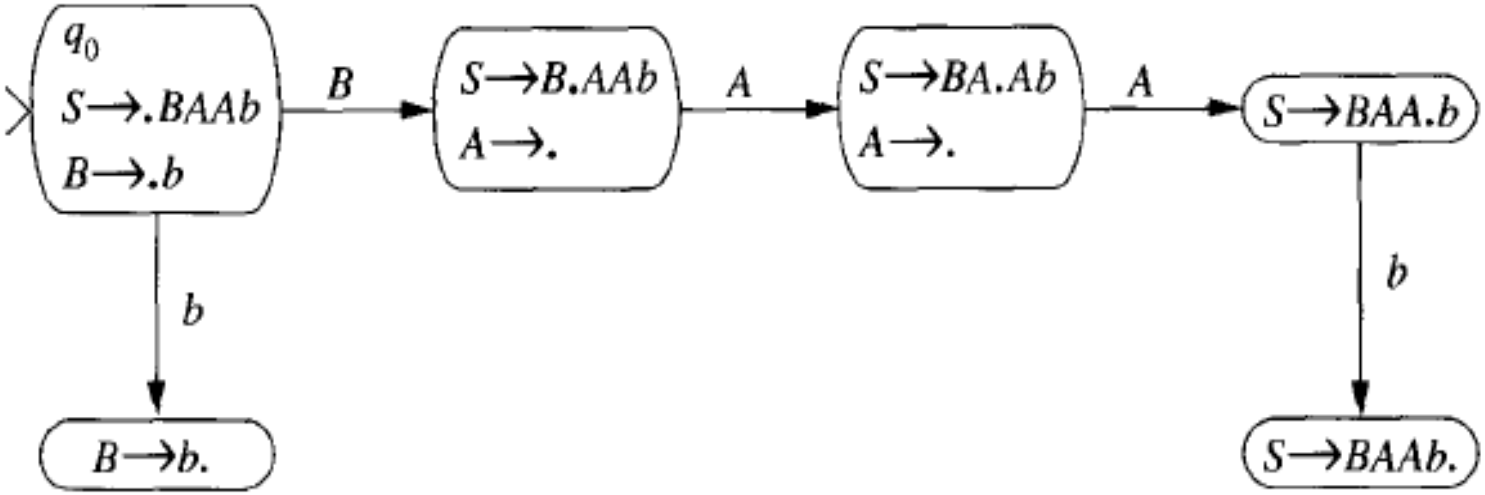


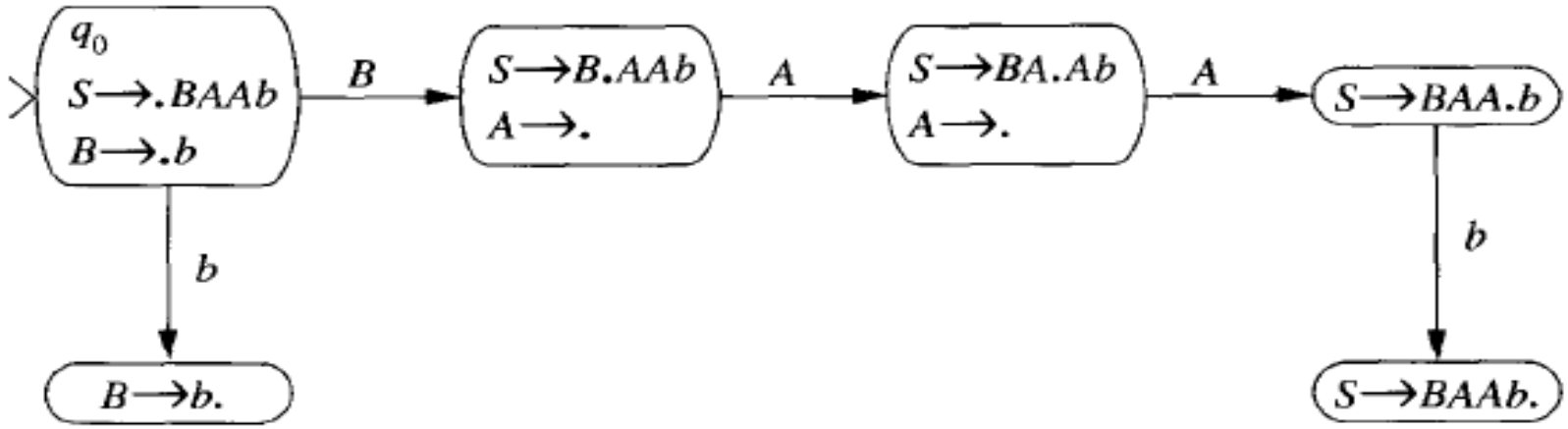
**Example**

The deterministic LR(0) machine for the grammar

$$\text{G: } S \to BAAb$$
$$A \to \lambda$$
$$B \to b$$

is given below. The analysis of the string $bb$ is traced using the computations of the machine to specify the actions of the parser.






| $u$ | $v$ | **Computation** | | **Action** |
|---|---|---|---|---|
| $\lambda$ | $bb$ | $\hat{\delta}(q_s, \lambda) =$ | $\{S \rightarrow .BAAb$ | shift |
| | | | $B \rightarrow .b\}$ | |
| $b$ | $b$ | $\hat{\delta}(q_s, b) =$ | $\{B \rightarrow b.\}$ | reduce |
| $B$ | $b$ | $\hat{\delta}(q_s, B) =$ | $\{S \rightarrow B.AAb$ | reduce |
| | | | $A \rightarrow .\}$ | |
| $BA$ | $b$ | $\hat{\delta}(q_s, BA) =$ | $\{S \rightarrow BA.Ab$ | reduce |
| | | | $A \rightarrow .\}$ | |
| $BAA$ | $b$ | $\hat{\delta}(q_s, BAA) =$ | $\{S \rightarrow BAA.b\}$ | shift |
| $BAAb$ | $\lambda$ | $\hat{\delta}(q_s, BAAb) =$ | $\{S \rightarrow BAAb.\}$ | reduce |
| $S$ | | | | |