

Die qualitativen Gruppen der 360 Regeln semiotischer CAs

1. Auf der Grundlage der umfassenden Darstellung einer polykontexturalen Semiotik in Toth (2019a) wurden in Toth (2019b-g) die ersten Grundlagen zu einer zukünftigen Theorie semiotischer zellulärer Automaten (CAs) geschaffen. Semiotische CAs sind ihrer Natur gemäß qualitativ, denn das Zeichen ist nach Peirce eine triadische Relation, die nicht nur über einen Mittelbezug, sondern auch über einen Objekt- und einen Interpretantenbezug verfügt, d.h. das Zeichen, wie es von Bense (1981, S. 17 ff.) als Zeichenzahl eingeführt wurde, rechnet auch mit Sinn und Bedeutung. Wie im folgenden gezeigt wird, korrespondieren den $2^8 = 256$ Regeln der quantitativen CAs (vgl. Gardner 1970) 360 Regeln der qualitativen (semiotischen) CAs. Diese lassen sich, wie ebenfalls gezeigt wird, in Paare gleicher Outputs für jede der 15 Gruppen zu je 24 CAs subgruppieren.

2. Kategoriethoretische Notation der 360 Regeln semiotischer CAs

2.1. $R = (0, 00, 01, 000)$

$$(\gamma \rightarrow \beta^\circ \gamma^\circ) \rightarrow \alpha^\circ \beta^\circ \gamma^\circ$$

$$(\gamma \beta \rightarrow \gamma^\circ) \rightarrow \alpha^\circ \beta^\circ \gamma^\circ$$

$$(\beta \rightarrow \gamma) \rightarrow \alpha^\circ \beta^\circ$$

$$(\gamma^\circ \rightarrow \beta^\circ) \rightarrow \alpha^\circ \beta^\circ$$

$$(\gamma \beta \alpha \rightarrow \gamma^\circ) \rightarrow \beta^\circ \gamma^\circ$$

$$(\gamma \rightarrow \alpha^\circ \beta^\circ \gamma^\circ) \rightarrow \beta^\circ \gamma^\circ$$

$$(\beta \alpha \rightarrow \gamma) \rightarrow \beta^\circ$$

$$(\gamma^\circ \rightarrow \alpha^\circ \beta^\circ) \rightarrow \beta^\circ$$

$$(\beta^\circ \rightarrow \gamma \beta) \rightarrow \alpha^\circ$$

$$(\beta^\circ \gamma^\circ \rightarrow \beta) \rightarrow \alpha^\circ$$

$$(\alpha^\circ \rightarrow \gamma \beta \alpha) \rightarrow \beta \alpha$$

$$(\alpha^\circ \beta^\circ \gamma^\circ \rightarrow \alpha) \rightarrow \beta \alpha$$

$$(\alpha \rightarrow \gamma\beta) \rightarrow \beta$$

$$(\beta^\circ\gamma^\circ \rightarrow \alpha^\circ) \rightarrow \beta$$

$$(\alpha^\circ\beta^\circ \rightarrow \gamma\beta\alpha) \rightarrow \alpha$$

$$(\alpha^\circ\beta^\circ\gamma^\circ \rightarrow \beta\alpha) \rightarrow \alpha$$

$$(\alpha^\circ \rightarrow \beta\alpha) \rightarrow \gamma\beta\alpha$$

$$(\alpha^\circ\beta^\circ \rightarrow \alpha) \rightarrow \gamma\beta\alpha$$

$$(\alpha \rightarrow \beta) \rightarrow \gamma\beta$$

$$(\beta^\circ \rightarrow \alpha^\circ) \rightarrow \gamma\beta$$

$$(\gamma\beta\alpha \rightarrow \beta^\circ\gamma^\circ) \rightarrow \gamma^\circ$$

$$(\gamma\beta \rightarrow \alpha^\circ\beta^\circ\gamma^\circ) \rightarrow \gamma^\circ$$

$$(\beta\alpha \rightarrow \beta^\circ) \rightarrow \gamma$$

$$(\beta \rightarrow \alpha^\circ\beta^\circ) \rightarrow \gamma$$

$$2.2. R = (0, 00, 01, 001)$$

$$(\delta\gamma\beta \rightarrow \gamma^\circ\delta^\circ) \rightarrow \alpha^\circ\beta^\circ\gamma^\circ\delta^\circ$$

$$(\delta\gamma \rightarrow \beta^\circ\gamma^\circ\delta^\circ) \rightarrow \alpha^\circ\beta^\circ\gamma^\circ\delta^\circ$$

$$(\beta \rightarrow \delta\gamma) \rightarrow \alpha^\circ\beta^\circ$$

$$(\gamma^\circ\delta^\circ \rightarrow \beta^\circ) \rightarrow \alpha^\circ\beta^\circ$$

$$(\beta^\circ \rightarrow \delta\gamma\beta) \rightarrow \alpha^\circ$$

$$(\beta^\circ\gamma^\circ\delta^\circ \rightarrow \beta) \rightarrow \alpha^\circ$$

$$(\delta\gamma\beta\alpha \rightarrow \gamma^\circ\delta^\circ) \rightarrow \beta^\circ\gamma^\circ\delta^\circ$$

$$(\delta\gamma \rightarrow \alpha^\circ\beta^\circ\gamma^\circ\delta^\circ) \rightarrow \beta^\circ\gamma^\circ\delta^\circ$$

$$(\beta\alpha \rightarrow \delta\gamma) \rightarrow \beta^\circ$$

$$(\gamma^\circ\delta^\circ \rightarrow \alpha^\circ\beta^\circ) \rightarrow \beta^\circ$$

$$(\delta\gamma\beta\alpha \rightarrow \beta^\circ\gamma^\circ\alpha^\circ) \rightarrow \gamma^\circ\delta^\circ$$

$$(\delta\gamma\beta \rightarrow \alpha^\circ\beta^\circ\gamma^\circ\delta^\circ) \rightarrow \gamma^\circ\delta^\circ$$

$$(\alpha^\circ \rightarrow \delta\gamma\beta\alpha) \rightarrow \beta\alpha$$

$$(\alpha^\circ\beta^\circ\gamma^\circ\delta^\circ \rightarrow \alpha) \rightarrow \beta\alpha$$

$$(\alpha \rightarrow \delta\gamma\beta) \rightarrow \beta$$

$$(\beta^\circ\gamma^\circ\alpha^\circ \rightarrow \alpha^\circ) \rightarrow \beta$$

$$(\alpha^\circ\beta^\circ \rightarrow \delta\gamma\beta\alpha) \rightarrow \alpha$$

$$(\alpha^\circ\beta^\circ\gamma^\circ\delta^\circ \rightarrow \beta\alpha) \rightarrow \alpha$$

$$(\alpha^\circ \rightarrow \beta\alpha) \rightarrow \delta\gamma\beta\alpha$$

$$(\alpha^\circ\beta^\circ \rightarrow \alpha) \rightarrow \delta\gamma\beta\alpha$$

$$(\alpha \rightarrow \beta) \rightarrow \delta\gamma\beta$$

$$(\beta^\circ \rightarrow \alpha^\circ) \rightarrow \delta\gamma\beta$$

$$(\beta\alpha \rightarrow \beta^\circ) \rightarrow \delta\gamma$$

$$(\beta \rightarrow \alpha^\circ\beta^\circ) \rightarrow \delta\gamma$$

$$2.3. R = (0, 00, 01, 012)$$

$$(\varepsilon\delta\gamma\beta \rightarrow \gamma^\circ\delta^\circ\varepsilon^\circ) \rightarrow \alpha^\circ\beta^\circ\gamma^\circ\delta^\circ\varepsilon^\circ$$

$$(\varepsilon\delta\gamma \rightarrow \beta^\circ\gamma^\circ\delta^\circ\varepsilon^\circ) \rightarrow \alpha^\circ\beta^\circ\gamma^\circ\delta^\circ\varepsilon^\circ$$

$$(\varepsilon\delta\gamma\beta\alpha \rightarrow \gamma^\circ\delta^\circ\varepsilon^\circ) \rightarrow \beta^\circ\gamma^\circ\delta^\circ\varepsilon^\circ$$

$$(\varepsilon\delta\gamma \rightarrow \alpha^\circ\beta^\circ\gamma^\circ\delta^\circ\varepsilon^\circ) \rightarrow \beta^\circ\gamma^\circ\delta^\circ\varepsilon^\circ$$

$$(\varepsilon\delta\gamma\beta\alpha \rightarrow \beta^\circ\gamma^\circ\delta^\circ\varepsilon^\circ) \rightarrow \gamma^\circ\delta^\circ\varepsilon^\circ$$

$$(\varepsilon\delta\gamma\beta \rightarrow \alpha^\circ\beta^\circ\gamma^\circ\delta^\circ\varepsilon^\circ) \rightarrow \gamma^\circ\delta^\circ\varepsilon^\circ$$

$$(\beta \rightarrow \varepsilon\delta\gamma) \rightarrow \alpha^\circ\beta^\circ$$

$$(\gamma^\circ\delta^\circ\varepsilon^\circ \rightarrow \beta^\circ) \rightarrow \alpha^\circ\beta^\circ$$

$$(\beta\alpha \rightarrow \varepsilon\delta\gamma) \rightarrow \beta^\circ$$

$$(\gamma^\circ\delta^\circ\varepsilon^\circ \rightarrow \alpha^\circ\beta^\circ) \rightarrow \beta^\circ$$

$$\begin{aligned}
&(\beta^\circ \rightarrow \varepsilon\delta\gamma\beta) \rightarrow \alpha^\circ \\
&(\alpha^\circ\beta^\circ\gamma^\circ\delta^\circ\varepsilon^\circ \rightarrow \beta) \rightarrow \alpha^\circ \\
&(\alpha^\circ \rightarrow \varepsilon\delta\gamma\alpha) \rightarrow \beta\alpha \\
&(\alpha^\circ\beta^\circ\gamma^\circ\delta^\circ\varepsilon^\circ \rightarrow \alpha) \rightarrow \beta\alpha \\
&(\alpha \rightarrow \varepsilon\delta\gamma\beta) \rightarrow \beta \\
&(\beta^\circ\gamma^\circ\delta^\circ\varepsilon^\circ \rightarrow \alpha^\circ) \rightarrow \beta \\
&(\alpha^\circ\beta^\circ \rightarrow \varepsilon\delta\gamma\beta\alpha) \rightarrow \alpha \\
&(\alpha^\circ\beta^\circ\gamma^\circ\delta^\circ\varepsilon^\circ \rightarrow \beta\alpha) \rightarrow \alpha \\
&(\alpha^\circ \rightarrow \beta\alpha) \rightarrow \varepsilon\delta\gamma\beta\alpha \\
&(\alpha^\circ\beta^\circ \rightarrow \alpha) \rightarrow \varepsilon\delta\gamma\beta\alpha \\
&(\alpha \rightarrow \beta) \rightarrow \varepsilon\delta\gamma\beta \\
&(\beta^\circ \rightarrow \alpha^\circ) \rightarrow \varepsilon\delta\gamma\beta \\
&(\beta\alpha \rightarrow \beta^\circ) \rightarrow \varepsilon\delta\gamma \\
&(\beta \rightarrow \alpha^\circ\beta^\circ) \rightarrow \varepsilon\delta\gamma
\end{aligned}$$

2.4. $R = (0, 00, 000, 001)$

$$\begin{aligned}
&(\delta\gamma\beta \rightarrow \delta^\circ) \rightarrow \alpha^\circ\beta^\circ\gamma^\circ\delta^\circ \\
&(\delta \rightarrow \beta^\circ\gamma^\circ\delta^\circ) \rightarrow \alpha^\circ\beta^\circ\gamma^\circ\delta^\circ \\
&(\gamma\beta \rightarrow \delta) \rightarrow \alpha^\circ\beta^\circ\gamma^\circ \\
&(\delta^\circ \rightarrow \beta^\circ\gamma^\circ) \rightarrow \alpha^\circ\beta^\circ\gamma^\circ \\
&(\delta\gamma\beta\alpha \rightarrow \delta^\circ) \rightarrow \beta^\circ\gamma^\circ\delta^\circ \\
&(\delta \rightarrow \alpha^\circ\beta^\circ\gamma^\circ\delta^\circ) \rightarrow \beta^\circ\gamma^\circ\delta^\circ \\
&(\gamma\beta\alpha \rightarrow \delta) \rightarrow \beta^\circ\gamma^\circ \\
&(\delta^\circ \rightarrow \alpha^\circ\beta^\circ\gamma^\circ) \rightarrow \beta^\circ\gamma^\circ \\
&(\beta^\circ\gamma^\circ \rightarrow \delta\gamma\beta) \rightarrow \alpha^\circ
\end{aligned}$$

$$\begin{aligned}
&(\beta^\circ \gamma^\circ \delta^\circ \rightarrow \gamma \beta) \rightarrow \alpha^\circ \\
&(\alpha^\circ \beta^\circ \gamma^\circ \rightarrow \delta \gamma \beta \alpha) \rightarrow \alpha \\
&(\alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \rightarrow \gamma \beta \alpha) \rightarrow \alpha \\
&(\alpha^\circ \rightarrow \gamma \beta \alpha) \rightarrow \delta \gamma \beta \alpha \\
&(\alpha^\circ \beta^\circ \gamma^\circ \rightarrow \alpha) \rightarrow \delta \gamma \beta \alpha \\
&(\alpha \rightarrow \gamma \beta) \rightarrow \delta \gamma \beta \\
&(\beta^\circ \gamma^\circ \rightarrow \alpha^\circ) \rightarrow \delta \gamma \beta \\
&(\alpha^\circ \rightarrow \delta \gamma \beta \alpha) \rightarrow \gamma \beta \alpha \\
&(\alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \rightarrow \alpha) \rightarrow \gamma \beta \alpha \\
&(\alpha \rightarrow \delta \gamma \beta) \rightarrow \gamma \beta \\
&(\beta^\circ \gamma^\circ \delta^\circ \rightarrow \alpha^\circ) \rightarrow \gamma \beta \\
&(\delta \gamma \beta \alpha \rightarrow \beta^\circ \gamma^\circ \delta^\circ) \rightarrow \delta^\circ \\
&(\delta \gamma \beta \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \delta^\circ) \rightarrow \delta^\circ \\
&(\gamma \beta \alpha \rightarrow \beta^\circ \gamma^\circ) \rightarrow \delta \\
&(\gamma \beta \rightarrow \alpha^\circ \beta^\circ \gamma^\circ) \rightarrow \delta
\end{aligned}$$

2.5. $R = (0, 00, 000, 012)$

$$\begin{aligned}
&(\varepsilon \delta \gamma \beta \rightarrow \delta^\circ \varepsilon^\circ) \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ \\
&(\varepsilon \delta \rightarrow \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ) \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ \\
&(\gamma \beta \rightarrow \varepsilon \delta) \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \\
&(\delta^\circ \varepsilon^\circ \rightarrow \beta^\circ \gamma^\circ) \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \\
&(\varepsilon \delta \gamma \beta \alpha \rightarrow \delta^\circ \varepsilon^\circ) \rightarrow \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ \\
&(\varepsilon \delta \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ) \rightarrow \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ \\
&(\gamma \beta \alpha \rightarrow \varepsilon \delta) \rightarrow \beta^\circ \gamma^\circ \\
&(\delta^\circ \varepsilon^\circ \rightarrow \alpha^\circ \beta^\circ \gamma^\circ) \rightarrow \beta^\circ \gamma^\circ
\end{aligned}$$

$$\begin{aligned}
&(\beta^\circ \gamma^\circ \rightarrow \varepsilon \delta \gamma \beta) \rightarrow \alpha^\circ \\
&(\beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ \rightarrow \gamma \beta) \rightarrow \alpha^\circ \\
&(\alpha^\circ \rightarrow \varepsilon \delta \gamma \beta \alpha) \rightarrow \gamma \beta \alpha \\
&(\alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ \rightarrow \alpha) \rightarrow \gamma \beta \alpha \\
&(\alpha \rightarrow \varepsilon \delta \gamma \beta) \rightarrow \gamma \beta \\
&(\beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ \rightarrow \alpha^\circ) \rightarrow \gamma \beta \\
&(\alpha^\circ \beta^\circ \gamma^\circ \rightarrow \varepsilon \delta \gamma \beta \alpha) \rightarrow \alpha \\
&(\alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ \rightarrow \gamma \beta \alpha) \rightarrow \alpha \\
&(\varepsilon \delta \gamma \beta \alpha \rightarrow \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ) \rightarrow \delta^\circ \varepsilon^\circ \\
&(\varepsilon \delta \gamma \beta \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ) \rightarrow \delta^\circ \varepsilon^\circ \\
&(\alpha^\circ \rightarrow \gamma \beta \alpha) \rightarrow \varepsilon \delta \gamma \beta \alpha \\
&(\alpha^\circ \beta^\circ \gamma^\circ \rightarrow \alpha) \rightarrow \varepsilon \delta \gamma \beta \alpha \\
&(\alpha, \gamma \beta) \rightarrow \varepsilon \delta \gamma \beta \\
&(\beta^\circ \gamma^\circ \rightarrow \alpha^\circ) \rightarrow \varepsilon \delta \gamma \beta \\
&(\gamma \beta \alpha \rightarrow \beta^\circ \gamma^\circ) \rightarrow \varepsilon \delta \\
&(\gamma \beta \rightarrow \alpha^\circ \beta^\circ \gamma^\circ) \rightarrow \varepsilon \delta
\end{aligned}$$

2.6. $R = (0, 00, 001, 012)$

$$\begin{aligned}
&(\varepsilon \delta \gamma \beta \rightarrow \varepsilon^\circ) \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ \\
&(\varepsilon \rightarrow \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ) \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ \\
&(\delta \gamma \beta \rightarrow \varepsilon) \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \\
&(\varepsilon^\circ \rightarrow \beta^\circ \gamma^\circ \delta^\circ) \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \\
&(\varepsilon \delta \gamma \beta \alpha \rightarrow \varepsilon^\circ) \rightarrow \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ \\
&(\varepsilon \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ) \rightarrow \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ \\
&(\delta \gamma \beta \alpha \rightarrow \varepsilon) \rightarrow \beta^\circ \gamma^\circ \delta^\circ
\end{aligned}$$

$$\begin{aligned}
&(\varepsilon^\circ \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \delta^\circ) \rightarrow \beta^\circ \gamma^\circ \delta^\circ \\
&(\beta^\circ \gamma^\circ \delta^\circ \rightarrow \varepsilon \delta \gamma \beta) \rightarrow \alpha^\circ \\
&(\beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ \rightarrow \delta \gamma \beta) \rightarrow \alpha^\circ \\
&(\alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \rightarrow \varepsilon \delta \gamma \beta \alpha) \rightarrow \alpha \\
&(\alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ \rightarrow \delta \gamma \beta \alpha) \rightarrow \alpha \\
&(\alpha^\circ \rightarrow \delta \gamma \beta \alpha) \rightarrow \varepsilon \delta \gamma \beta \alpha \\
&(\alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \rightarrow \alpha) \rightarrow \varepsilon \delta \gamma \beta \alpha \\
&(\alpha \rightarrow \delta \gamma \beta) \rightarrow \varepsilon \delta \gamma \beta \\
&(\beta^\circ \gamma^\circ \delta^\circ \rightarrow \alpha^\circ) \rightarrow \varepsilon \delta \gamma \beta \\
&(\alpha^\circ \rightarrow \varepsilon \delta \gamma \beta \alpha) \rightarrow \delta \gamma \beta \alpha \\
&(\alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ \rightarrow \alpha) \rightarrow \delta \gamma \beta \alpha \\
&(\alpha \rightarrow \varepsilon \delta \gamma \beta) \rightarrow \delta \gamma \beta \\
&(\beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ \rightarrow \alpha^\circ) \rightarrow \delta \gamma \beta \\
&(\varepsilon \delta \gamma \beta \alpha \rightarrow \varepsilon \delta \gamma \beta) \rightarrow \varepsilon^\circ \\
&(\varepsilon \delta \gamma \beta \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ) \rightarrow \varepsilon^\circ \\
&(\delta \gamma \beta \alpha \rightarrow \beta^\circ \gamma^\circ \delta^\circ) \rightarrow \varepsilon \\
&(\delta \gamma \beta \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \delta^\circ) \rightarrow \varepsilon
\end{aligned}$$

2.7. $R = (0, 01, 000, 001)$

$$\begin{aligned}
&(\delta \gamma \rightarrow \delta^\circ) \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \\
&(\delta \rightarrow \gamma^\circ \delta^\circ) \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \\
&(\gamma \rightarrow \delta) \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \\
&(\delta^\circ \rightarrow \gamma^\circ) \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \\
&(\gamma^\circ \rightarrow \delta \gamma) \rightarrow \alpha^\circ \beta^\circ \\
&(\gamma^\circ \delta^\circ \rightarrow \gamma) \rightarrow \alpha^\circ \beta^\circ
\end{aligned}$$

$$\begin{aligned}
&(\delta\gamma\beta\alpha \rightarrow \delta^\circ) \rightarrow \gamma^\circ\delta^\circ \\
&(\delta \rightarrow \alpha^\circ\beta^\circ\gamma^\circ\delta^\circ) \rightarrow \gamma^\circ\delta^\circ \\
&(\gamma\beta\alpha \rightarrow \delta) \rightarrow \gamma^\circ \\
&(\delta^\circ \rightarrow \alpha^\circ\beta^\circ\gamma^\circ) \rightarrow \gamma^\circ \\
&(\alpha^\circ\beta^\circ \rightarrow \gamma\beta\alpha) \rightarrow \delta\gamma\beta\alpha \\
&(\alpha^\circ\beta^\circ\gamma^\circ \rightarrow \beta\alpha) \rightarrow \delta\gamma\beta\alpha \\
&(\beta\alpha \rightarrow \gamma) \rightarrow \delta\gamma \\
&(\gamma^\circ \rightarrow \alpha^\circ\beta^\circ) \rightarrow \delta\gamma \\
&(\alpha^\circ\beta^\circ\gamma^\circ\delta^\circ \rightarrow \beta\alpha) \rightarrow \gamma\beta\alpha \\
&(\alpha^\circ\beta^\circ \rightarrow \delta\gamma\beta\alpha) \rightarrow \gamma\beta\alpha \\
&(\alpha^\circ\beta^\circ\gamma^\circ \rightarrow \delta\gamma\beta\alpha) \rightarrow \beta\alpha \\
&(\alpha^\circ\beta^\circ\gamma^\circ\delta^\circ \rightarrow \gamma\beta\alpha) \rightarrow \beta\alpha \\
&(\beta\alpha \rightarrow \delta\gamma) \rightarrow \gamma \\
&(\gamma^\circ\delta^\circ \rightarrow \alpha^\circ\beta^\circ) \rightarrow \gamma \\
&(\delta\gamma\beta\alpha \rightarrow \gamma^\circ\delta^\circ) \rightarrow \delta^\circ \\
&(\delta\gamma \rightarrow \alpha^\circ\beta^\circ\gamma^\circ\delta^\circ) \rightarrow \delta^\circ \\
&(\gamma\beta\alpha \rightarrow \gamma^\circ) \rightarrow \delta \\
&(\gamma \rightarrow \alpha^\circ\beta^\circ\gamma^\circ) \rightarrow \delta
\end{aligned}$$

2.8. $R = (0, 01, 000, 012)$

$$\begin{aligned}
&(\varepsilon\delta\gamma \rightarrow \delta^\circ\varepsilon^\circ) \rightarrow \alpha^\circ\beta^\circ\gamma^\circ\delta^\circ\varepsilon^\circ \\
&(\varepsilon\delta \rightarrow \gamma^\circ\delta^\circ\varepsilon^\circ) \rightarrow \alpha^\circ\beta^\circ\gamma^\circ\delta^\circ\varepsilon^\circ \\
&(\gamma \rightarrow \varepsilon\delta) \rightarrow \alpha^\circ\beta^\circ\gamma^\circ \\
&(\delta^\circ\varepsilon^\circ \rightarrow \gamma^\circ) \rightarrow \alpha^\circ\beta^\circ\gamma^\circ \\
&(\gamma^\circ \rightarrow \varepsilon\delta\gamma) \rightarrow \alpha^\circ\beta^\circ
\end{aligned}$$

$$\begin{aligned}
&(\gamma^\circ \delta^\circ \varepsilon^\circ \rightarrow \gamma) \rightarrow \alpha^\circ \beta^\circ \\
&(\varepsilon \delta \gamma \beta \alpha \rightarrow \delta^\circ \varepsilon^\circ) \rightarrow \gamma^\circ \delta^\circ \varepsilon \\
&(\varepsilon \delta \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ) \rightarrow \gamma^\circ \delta^\circ \varepsilon^\circ \\
&(\gamma \beta \alpha \rightarrow \varepsilon \delta) \rightarrow \gamma^\circ \\
&(\delta^\circ \varepsilon^\circ \rightarrow \alpha^\circ \beta^\circ \gamma^\circ) \rightarrow \gamma^\circ \\
&(\alpha^\circ \beta^\circ \rightarrow \varepsilon \delta \gamma \beta \alpha) \rightarrow \gamma \beta \alpha \\
&(\delta^\circ \varepsilon^\circ \rightarrow \beta \alpha) \rightarrow \gamma \beta \alpha \\
&(\alpha^\circ \beta^\circ \gamma^\circ \rightarrow \varepsilon \delta \gamma \beta \alpha) \rightarrow \beta \alpha \\
&(\alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ \rightarrow \gamma \beta \alpha) \rightarrow \beta \alpha \\
&(\beta \alpha \rightarrow \varepsilon \delta \gamma) \rightarrow \gamma \\
&(\gamma^\circ \delta^\circ \varepsilon^\circ \rightarrow \alpha^\circ \beta^\circ) \rightarrow \gamma \\
&(\varepsilon \delta \gamma \beta \alpha \rightarrow \gamma^\circ \delta^\circ \varepsilon^\circ) \rightarrow \delta^\circ \varepsilon^\circ \\
&(\varepsilon \delta \gamma \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ) \rightarrow \delta^\circ \varepsilon^\circ \\
&(\alpha^\circ \beta^\circ \rightarrow \gamma \beta \alpha) \rightarrow \varepsilon \delta \gamma \beta \alpha \\
&(\alpha^\circ \beta^\circ \gamma^\circ \rightarrow \beta \alpha) \rightarrow \varepsilon \delta \gamma \beta \alpha \\
&(\beta \alpha \rightarrow \gamma) \rightarrow \varepsilon \delta \gamma \\
&(\gamma \rightarrow \alpha^\circ \beta^\circ) \rightarrow \varepsilon \delta \gamma \\
&(\gamma \beta \alpha \rightarrow \gamma^\circ) \rightarrow \varepsilon \delta \\
&(\gamma \rightarrow \alpha^\circ \beta^\circ \gamma^\circ) \rightarrow \varepsilon \delta
\end{aligned}$$

2.9. $R = (0, 01, 001, 012)$

$$\begin{aligned}
&(\varepsilon \delta \gamma \rightarrow \varepsilon^\circ) \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ \\
&(\varepsilon \rightarrow \gamma^\circ \delta^\circ \varepsilon^\circ) \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ \\
&(\delta \gamma \rightarrow \varepsilon) \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \\
&(\varepsilon^\circ \rightarrow \gamma^\circ \delta^\circ) \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \delta^\circ
\end{aligned}$$

$$\begin{aligned}
&(\gamma^\circ \delta^\circ \rightarrow \varepsilon \delta \gamma) \rightarrow \alpha^\circ \beta^\circ \\
&(\alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ \rightarrow \delta \gamma) \rightarrow \alpha^\circ \beta^\circ \\
&(\varepsilon \delta \gamma \beta \alpha \rightarrow \varepsilon^\circ) \rightarrow \gamma^\circ \delta^\circ \varepsilon^\circ \\
&(\varepsilon \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ) \rightarrow \gamma^\circ \delta^\circ \varepsilon^\circ \\
&(\delta \gamma \beta \alpha \rightarrow \varepsilon) \rightarrow \gamma^\circ \delta^\circ \\
&(\varepsilon^\circ \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \delta^\circ) \rightarrow \gamma^\circ \delta^\circ \\
&(\varepsilon \delta \gamma \beta \alpha \rightarrow \gamma^\circ \delta^\circ \varepsilon^\circ) \rightarrow \varepsilon^\circ \\
&(\varepsilon \delta \gamma \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ) \rightarrow \varepsilon^\circ \\
&(\alpha^\circ \beta^\circ \rightarrow \delta \gamma \beta \alpha) \rightarrow \varepsilon \delta \gamma \beta \alpha \\
&(\delta \gamma \beta \alpha \rightarrow \beta \alpha) \rightarrow \varepsilon \delta \gamma \beta \alpha \\
&(\beta \alpha \rightarrow \delta \gamma) \rightarrow \varepsilon \delta \gamma \\
&(\gamma^\circ \delta^\circ \rightarrow \alpha^\circ \beta^\circ) \rightarrow \varepsilon \delta \gamma \\
&(\beta \alpha \rightarrow \varepsilon \delta \gamma) \rightarrow \delta \gamma \\
&(\gamma^\circ \delta^\circ \varepsilon^\circ \rightarrow \alpha^\circ \beta^\circ) \rightarrow \delta \gamma \\
&(\alpha^\circ \beta^\circ \rightarrow \varepsilon \delta \gamma \beta \alpha) \rightarrow \delta \gamma \beta \alpha \\
&(\alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ \rightarrow \beta \alpha) \rightarrow \delta \gamma \beta \alpha \\
&(\alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \rightarrow \varepsilon \delta \gamma \beta \alpha) \rightarrow \beta \alpha \\
&(\alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ \rightarrow \delta \gamma \beta \alpha) \rightarrow \beta \alpha \\
&(\delta \gamma \beta \alpha \rightarrow \gamma^\circ \delta^\circ) \rightarrow \varepsilon \\
&(\delta \gamma \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \delta^\circ) \rightarrow \varepsilon
\end{aligned}$$

$$2.10. R = (0, 000, 001, 012)$$

$$\begin{aligned}
&(\varepsilon \delta \rightarrow \varepsilon^\circ) \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ \\
&(\varepsilon \rightarrow \delta^\circ \varepsilon^\circ) \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ \\
&(\delta \rightarrow \varepsilon) \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \delta^\circ
\end{aligned}$$

$$\begin{aligned}
&(\varepsilon^\circ \rightarrow \delta^\circ) \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \\
&(\delta^\circ \rightarrow \varepsilon \delta) \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \\
&(\delta^\circ \varepsilon^\circ \rightarrow \delta^\circ) \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \\
&(\varepsilon \delta \gamma \beta \alpha \rightarrow \varepsilon^\circ) \rightarrow \delta^\circ \varepsilon^\circ \\
&(\varepsilon \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ) \rightarrow \delta^\circ \varepsilon^\circ \\
&(\delta \gamma \beta \alpha \rightarrow \varepsilon) \rightarrow \delta^\circ \\
&(\varepsilon^\circ \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \delta^\circ) \rightarrow \delta^\circ \\
&(\varepsilon \delta \gamma \beta \alpha \rightarrow \delta^\circ \varepsilon^\circ) \rightarrow \varepsilon^\circ \\
&(\varepsilon \delta \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ) \rightarrow \varepsilon^\circ \\
&(\alpha^\circ \beta^\circ \gamma^\circ \rightarrow \delta \gamma \beta \alpha) \rightarrow \varepsilon \delta \gamma \beta \alpha \\
&(\alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \rightarrow \gamma \beta \alpha) \rightarrow \varepsilon \delta \gamma \beta \alpha \\
&(\alpha^\circ \beta^\circ \gamma^\circ \rightarrow \varepsilon \delta \gamma \beta \alpha) \rightarrow \delta \gamma \beta \alpha \\
&(\alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ \rightarrow \gamma \beta \alpha) \rightarrow \delta \gamma \beta \alpha \\
&(\alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \rightarrow \varepsilon \delta \gamma \beta \alpha) \rightarrow \gamma \beta \alpha \\
&(\alpha^\circ \beta^\circ \gamma^\circ \delta^\circ \varepsilon^\circ \rightarrow \delta \gamma \beta \alpha) \rightarrow \gamma \beta \alpha \\
&(\gamma \beta \alpha \rightarrow \delta) \rightarrow \varepsilon \delta \\
&(\delta^\circ \rightarrow \alpha^\circ \beta^\circ \gamma^\circ) \rightarrow \varepsilon \delta \\
&(\gamma \beta \alpha \rightarrow \varepsilon \delta) \rightarrow \delta \\
&(\delta^\circ \varepsilon^\circ \rightarrow \alpha^\circ \beta^\circ \gamma^\circ) \rightarrow \delta \\
&(\delta \gamma \beta \alpha \rightarrow \delta^\circ) \rightarrow \varepsilon \\
&(\delta \rightarrow \alpha^\circ \beta^\circ \gamma^\circ \delta^\circ) \rightarrow \varepsilon
\end{aligned}$$

2.11. R = (00, 01, 000, 001)

$$\begin{aligned}
&(\delta \gamma \rightarrow \delta^\circ) \rightarrow \beta^\circ \gamma^\circ \delta^\circ \\
&(\delta \rightarrow \gamma^\circ \delta^\circ) \rightarrow \beta^\circ \gamma^\circ \delta^\circ
\end{aligned}$$

$$(\gamma \rightarrow \delta) \rightarrow \beta^\circ \gamma^\circ$$

$$(\delta^\circ \rightarrow \gamma^\circ) \rightarrow \beta^\circ \gamma^\circ$$

$$(\gamma^\circ \rightarrow \delta \gamma) \rightarrow \beta^\circ$$

$$(\gamma^\circ \delta^\circ \rightarrow \gamma) \rightarrow \beta^\circ$$

$$(\delta \gamma \beta \rightarrow \delta^\circ) \rightarrow \gamma^\circ \delta^\circ$$

$$(\delta \rightarrow \beta^\circ \gamma^\circ \delta^\circ) \rightarrow \gamma^\circ \delta^\circ$$

$$(\gamma \beta \rightarrow \delta) \rightarrow \gamma^\circ$$

$$(\delta^\circ \rightarrow \beta^\circ \gamma^\circ) \rightarrow \gamma^\circ$$

$$(\delta \gamma \beta \rightarrow \gamma^\circ \delta^\circ) \rightarrow \delta^\circ$$

$$(\delta \gamma \rightarrow \beta^\circ \gamma^\circ \delta^\circ) \rightarrow \delta^\circ$$

$$(\beta^\circ \rightarrow \gamma \beta) \rightarrow \delta \gamma \beta$$

$$(\beta^\circ \gamma^\circ \rightarrow \beta) \rightarrow \delta \gamma \beta$$

$$(\beta \rightarrow \gamma) \rightarrow \delta \gamma$$

$$(\gamma^\circ \rightarrow \beta^\circ) \rightarrow \delta \gamma$$

$$(\beta^\circ \rightarrow \delta \gamma \beta) \rightarrow \gamma \beta$$

$$(\beta^\circ \gamma^\circ \delta^\circ \rightarrow \beta) \rightarrow \gamma \beta$$

$$(\gamma \beta \rightarrow \gamma^\circ) \rightarrow \delta$$

$$(\gamma \rightarrow \beta^\circ \gamma^\circ) \rightarrow \delta$$

$$(\beta \rightarrow \delta \gamma) \rightarrow \gamma$$

$$(\gamma^\circ \delta^\circ \rightarrow \beta^\circ) \rightarrow \gamma$$

$$(\beta^\circ \gamma^\circ \rightarrow \delta \gamma \beta) \rightarrow \beta$$

$$(\beta^\circ \gamma^\circ \delta^\circ \rightarrow \gamma \beta) \rightarrow \beta$$

2.12. R = (00, 01, 000, 012)

$$(\varepsilon\delta\gamma \rightarrow \delta^\circ\varepsilon^\circ) \rightarrow \beta^\circ\gamma^\circ\delta^\circ\varepsilon^\circ$$

$$(\varepsilon\delta \rightarrow \gamma^\circ\delta^\circ\varepsilon^\circ) \rightarrow \beta^\circ\gamma^\circ\delta^\circ\varepsilon^\circ$$

$$(\varepsilon\delta\gamma\beta \rightarrow \delta^\circ\varepsilon^\circ) \rightarrow \gamma^\circ\delta^\circ\varepsilon^\circ$$

$$(\varepsilon\delta \rightarrow \beta^\circ\gamma^\circ\delta^\circ\varepsilon^\circ) \rightarrow \gamma^\circ\delta^\circ\varepsilon^\circ$$

$$(\gamma \rightarrow \varepsilon\delta) \rightarrow \beta^\circ\gamma^\circ$$

$$(\delta^\circ\varepsilon^\circ \rightarrow \gamma^\circ) \rightarrow \beta^\circ\gamma^\circ$$

$$(\gamma^\circ \rightarrow \varepsilon\delta\gamma) \rightarrow \beta^\circ$$

$$(\gamma^\circ\delta^\circ\varepsilon^\circ \rightarrow \gamma) \rightarrow \beta^\circ$$

$$(\gamma\beta \rightarrow \varepsilon\delta) \rightarrow \gamma^\circ$$

$$(\delta^\circ\varepsilon^\circ \rightarrow \beta^\circ\gamma^\circ) \rightarrow \gamma^\circ$$

$$(\beta^\circ \rightarrow \gamma\beta) \rightarrow \varepsilon\delta\gamma\beta$$

$$(\beta^\circ\gamma^\circ \rightarrow \beta) \rightarrow \varepsilon\delta\gamma\beta$$

$$(\beta \rightarrow \gamma) \rightarrow \varepsilon\delta\gamma$$

$$(\gamma^\circ \rightarrow \beta^\circ) \rightarrow \varepsilon\delta\gamma$$

$$(\beta^\circ \rightarrow \varepsilon\delta\gamma\beta) \rightarrow \gamma\beta$$

$$(\beta^\circ\gamma^\circ\delta^\circ\varepsilon^\circ \rightarrow \beta) \rightarrow \gamma\beta$$

$$(\beta \rightarrow \varepsilon\delta\gamma) \rightarrow \gamma$$

$$(\gamma^\circ\delta^\circ\varepsilon^\circ \rightarrow \beta^\circ) \rightarrow \gamma$$

$$(\beta^\circ\gamma^\circ \rightarrow \varepsilon\delta\gamma\beta) \rightarrow \beta$$

$$(\beta^\circ\gamma^\circ\delta^\circ\varepsilon^\circ \rightarrow \gamma\beta) \rightarrow \beta$$

$$(\varepsilon\delta\gamma\beta \rightarrow \gamma^\circ\delta^\circ\varepsilon^\circ) \rightarrow \delta^\circ\varepsilon^\circ$$

$$(\varepsilon\delta\gamma \rightarrow \beta^\circ\gamma^\circ\delta^\circ\varepsilon^\circ) \rightarrow \delta^\circ\varepsilon^\circ$$

$$(\gamma\beta \rightarrow \gamma^\circ) \rightarrow \varepsilon\delta$$

$$(\gamma \rightarrow \beta^\circ\gamma^\circ) \rightarrow \varepsilon\delta$$

2.13. $R = (00, 01, 001, 012)$

$$(\varepsilon\delta\gamma \rightarrow \varepsilon^\circ) \rightarrow \beta^\circ\gamma^\circ\delta^\circ\varepsilon^\circ$$

$$(\varepsilon \rightarrow \gamma^\circ\delta^\circ\varepsilon^\circ) \rightarrow \beta^\circ\gamma^\circ\delta^\circ\varepsilon^\circ$$

$$(\delta\gamma \rightarrow \varepsilon) \rightarrow \beta^\circ\gamma^\circ\delta^\circ$$

$$(\varepsilon^\circ \rightarrow \gamma^\circ\delta^\circ) \rightarrow \beta^\circ\gamma^\circ\delta^\circ$$

$$(\varepsilon\delta\gamma\beta \rightarrow \varepsilon^\circ) \rightarrow \gamma^\circ\delta^\circ\varepsilon^\circ$$

$$(\varepsilon \rightarrow \beta^\circ\gamma^\circ\delta^\circ\varepsilon^\circ) \rightarrow \gamma^\circ\delta^\circ\varepsilon^\circ$$

$$(\delta\gamma\beta \rightarrow \varepsilon) \rightarrow \gamma^\circ\delta^\circ$$

$$(\varepsilon^\circ \rightarrow \beta^\circ\gamma^\circ\delta^\circ) \rightarrow \gamma^\circ\delta^\circ$$

$$(\gamma^\circ\delta^\circ \rightarrow \varepsilon\delta\gamma) \rightarrow \beta^\circ$$

$$(\gamma^\circ\delta^\circ\varepsilon^\circ \rightarrow \delta\gamma) \rightarrow \beta^\circ$$

$$(\varepsilon\delta\gamma\beta \rightarrow \gamma^\circ\delta^\circ\varepsilon^\circ) \rightarrow \varepsilon^\circ$$

$$(\varepsilon\delta\gamma \rightarrow \beta^\circ\gamma^\circ\delta^\circ\varepsilon^\circ) \rightarrow \varepsilon^\circ$$

$$(\beta^\circ \rightarrow \delta\gamma\beta) \rightarrow \varepsilon\delta\gamma\beta$$

$$(\beta^\circ\gamma^\circ\delta^\circ \rightarrow \beta) \rightarrow \varepsilon\delta\gamma\beta$$

$$(\beta \rightarrow \delta\gamma) \rightarrow \varepsilon\delta\gamma$$

$$(\gamma^\circ\delta^\circ \rightarrow \beta^\circ) \rightarrow \varepsilon\delta\gamma$$

$$(\beta^\circ \rightarrow \varepsilon\delta\gamma\beta) \rightarrow \delta\gamma\beta$$

$$(\beta^\circ\gamma^\circ\delta^\circ\varepsilon^\circ \rightarrow \beta) \rightarrow \delta\gamma\beta$$

$$(\beta \rightarrow \varepsilon\delta\gamma) \rightarrow \delta\gamma$$

$$(\gamma^\circ\delta^\circ\varepsilon^\circ \rightarrow \beta^\circ) \rightarrow \delta\gamma$$

$$(\beta^\circ\gamma^\circ\delta^\circ \rightarrow \varepsilon\delta\gamma\beta) \rightarrow \beta$$

$$(\beta^\circ\gamma^\circ\delta^\circ\varepsilon^\circ \rightarrow \delta\gamma\beta) \rightarrow \beta$$

$$(\delta\gamma\beta \rightarrow \gamma^\circ\delta^\circ) \rightarrow \varepsilon$$

$$(\delta\gamma \rightarrow \delta\gamma\beta) \rightarrow \varepsilon$$

$$2.14. R = (00, 000, 001, 012)$$

$$(\varepsilon\delta \rightarrow \varepsilon^\circ) \rightarrow \beta^\circ\gamma^\circ\delta^\circ\varepsilon^\circ$$

$$(\varepsilon \rightarrow \delta^\circ\varepsilon^\circ) \rightarrow \beta^\circ\gamma^\circ\delta^\circ\varepsilon^\circ$$

$$(\delta \rightarrow \varepsilon) \rightarrow \beta^\circ\gamma^\circ\delta^\circ$$

$$(\varepsilon^\circ \rightarrow \delta^\circ) \rightarrow \beta^\circ\gamma^\circ\delta^\circ$$

$$(\delta^\circ\varepsilon^\circ \rightarrow \delta) \rightarrow \beta^\circ\gamma^\circ$$

$$(\delta^\circ \rightarrow \varepsilon\delta) \rightarrow \beta^\circ\gamma^\circ$$

$$(\varepsilon\delta\gamma\beta \rightarrow \delta^\circ\varepsilon^\circ) \rightarrow \varepsilon^\circ$$

$$(\varepsilon\delta \rightarrow \beta^\circ\gamma^\circ\delta^\circ\varepsilon^\circ) \rightarrow \varepsilon^\circ$$

$$(\delta\gamma\beta \rightarrow \varepsilon) \rightarrow \delta^\circ$$

$$(\varepsilon^\circ \rightarrow \delta\gamma\beta) \rightarrow \delta^\circ$$

$$(\varepsilon\delta\gamma\beta \rightarrow \varepsilon^\circ) \rightarrow \delta^\circ\varepsilon^\circ$$

$$(\varepsilon \rightarrow \varepsilon\delta\gamma\beta) \rightarrow \delta^\circ\varepsilon^\circ$$

$$(\beta^\circ\gamma^\circ \rightarrow \delta\gamma\beta) \rightarrow \varepsilon\delta\gamma\beta$$

$$(\beta^\circ\gamma^\circ\delta^\circ \rightarrow \gamma\beta) \rightarrow \varepsilon\delta\gamma\beta$$

$$(\beta^\circ\gamma^\circ \rightarrow \varepsilon\delta\gamma\beta) \rightarrow \delta\gamma\beta$$

$$(\beta^\circ\gamma^\circ\delta^\circ\varepsilon^\circ \rightarrow \gamma\beta) \rightarrow \delta\gamma\beta$$

$$(\beta^\circ\gamma^\circ\delta^\circ\varepsilon^\circ \rightarrow \delta\gamma\beta) \rightarrow \gamma\beta$$

$$(\beta^\circ\gamma^\circ\delta^\circ \rightarrow \varepsilon\delta\gamma\beta) \rightarrow \gamma\beta$$

$$(\gamma\beta \rightarrow \delta) \rightarrow \varepsilon\delta$$

$$(\delta^\circ \rightarrow \beta^\circ\gamma^\circ) \rightarrow \varepsilon\delta$$

$$(\gamma\beta \rightarrow \varepsilon\delta) \rightarrow \delta$$

$$(\delta^\circ\varepsilon^\circ \rightarrow \beta^\circ\gamma^\circ) \rightarrow \delta$$

$$(\delta\gamma\beta \rightarrow \delta^\circ) \rightarrow \varepsilon$$

$$(\delta \rightarrow \beta^\circ\gamma^\circ\delta^\circ) \rightarrow \varepsilon$$

$$2.15. R = (01, 000, 001, 012)$$

$$(\varepsilon\delta \rightarrow \varepsilon^\circ) \rightarrow \gamma^\circ\delta^\circ\varepsilon^\circ$$

$$(\varepsilon \rightarrow \delta^\circ\varepsilon^\circ) \rightarrow \gamma^\circ\delta^\circ\varepsilon^\circ$$

$$(\delta \rightarrow \varepsilon) \rightarrow \gamma^\circ\delta^\circ$$

$$(\varepsilon^\circ \rightarrow \delta^\circ) \rightarrow \gamma^\circ\delta^\circ$$

$$(\varepsilon\delta\gamma \rightarrow \varepsilon^\circ) \rightarrow \delta^\circ\varepsilon^\circ$$

$$(\varepsilon \rightarrow \gamma^\circ\delta^\circ\varepsilon^\circ) \rightarrow \delta^\circ\varepsilon^\circ$$

$$(\delta^\circ \rightarrow \varepsilon\delta) \rightarrow \gamma^\circ$$

$$(\delta^\circ\varepsilon^\circ \rightarrow \delta) \rightarrow \gamma^\circ$$

$$(\delta\gamma \rightarrow \varepsilon) \rightarrow \delta^\circ$$

$$(\varepsilon^\circ \rightarrow \gamma^\circ\delta^\circ) \rightarrow \delta^\circ$$

$$(\varepsilon\delta\gamma \rightarrow \delta^\circ\varepsilon^\circ) \rightarrow \varepsilon^\circ$$

$$(\varepsilon \rightarrow \gamma^\circ\delta^\circ\varepsilon^\circ) \rightarrow \varepsilon^\circ$$

$$(\gamma^\circ \rightarrow \varepsilon\delta\gamma) \rightarrow \varepsilon\delta\gamma$$

$$(\gamma^\circ\delta^\circ\varepsilon^\circ \rightarrow \gamma) \rightarrow \varepsilon\delta\gamma$$

$$(\gamma^\circ\delta^\circ \rightarrow \gamma) \rightarrow \delta\gamma$$

$$(\gamma^\circ \rightarrow \delta\gamma) \rightarrow \delta\gamma$$

$$(\gamma^\circ\delta^\circ \rightarrow \varepsilon\delta\gamma) \rightarrow \gamma$$

$$(\gamma^\circ\delta^\circ\varepsilon^\circ \rightarrow \delta\gamma) \rightarrow \gamma$$

$$(\gamma \rightarrow \delta) \rightarrow \varepsilon\delta$$

$$(\delta^\circ \rightarrow \gamma^\circ) \rightarrow \varepsilon\delta$$

$$(\gamma \rightarrow \varepsilon\delta) \rightarrow \delta$$

$$(\delta^\circ \varepsilon^\circ \rightarrow \gamma^\circ) \rightarrow \delta$$

$$(\delta \gamma \rightarrow \delta^\circ) \rightarrow \varepsilon$$

$$(\delta \rightarrow \gamma^\circ \delta^\circ) \rightarrow \varepsilon$$

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20.6.2019