

## Aufgabe 3

$$\delta(\gamma(x_3), \gamma(\gamma(\alpha)), \sigma(\gamma(x_2), x_1))$$
$$\delta(\gamma(x_3), \gamma(x_3), \sigma(\gamma(\alpha), \gamma(\gamma(x_2))))$$

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$$\left\{ \begin{pmatrix} \delta(\gamma(x_3), \gamma(\gamma(\alpha)), \sigma(\gamma(x_2), x_1)) \\ \delta(\gamma(x_3), \gamma(x_3), \sigma(\gamma(\alpha), \gamma(\gamma(x_2)))) \end{pmatrix} \right\}$$

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$$\begin{aligned} & \left\{ \begin{pmatrix} \delta(\gamma(x_3), \gamma(\gamma(\alpha)), \sigma(\gamma(x_2), x_1)) \\ \delta(\gamma(x_3), \gamma(x_3), \sigma(\gamma(\alpha), \gamma(\gamma(x_2)))) \end{pmatrix} \right\} \\ \text{Dekomp.} \Rightarrow & \left\{ \begin{pmatrix} \gamma(x_3) \\ \gamma(x_3) \end{pmatrix}, \begin{pmatrix} \gamma(\gamma(\alpha)) \\ \gamma(x_3) \end{pmatrix}, \begin{pmatrix} \sigma(\gamma(x_2), x_1) \\ \sigma(\gamma(\alpha), \gamma(\gamma(x_2))) \end{pmatrix} \right\} \end{aligned}$$

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$$\left\{ \begin{pmatrix} \delta(\gamma(x_3), \gamma(\gamma(\alpha)), \sigma(\gamma(x_2), x_1)) \\ \delta(\gamma(x_3), \gamma(x_3), \sigma(\gamma(\alpha), \gamma(\gamma(x_2)))) \end{pmatrix} \right\}$$

$$\begin{array}{l} \text{Dekomp.} \\ \Rightarrow \end{array} \left\{ \begin{pmatrix} \gamma(x_3) \\ \gamma(x_3) \end{pmatrix}, \begin{pmatrix} \gamma(\gamma(\alpha)) \\ \gamma(x_3) \end{pmatrix}, \begin{pmatrix} \sigma(\gamma(x_2), x_1) \\ \sigma(\gamma(\alpha), \gamma(\gamma(x_2))) \end{pmatrix} \right\}$$

$$\begin{array}{l} \text{Dekomp.} \\ \Rightarrow \end{array} \left\{ \begin{pmatrix} x_3 \\ x_3 \end{pmatrix}, \begin{pmatrix} \gamma(\alpha) \\ x_3 \end{pmatrix}, \begin{pmatrix} \gamma(x_2) \\ \gamma(\alpha) \end{pmatrix}, \begin{pmatrix} x_1 \\ \gamma(\gamma(x_2)) \end{pmatrix} \right\}$$

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$$\left\{ \begin{pmatrix} \delta(\gamma(x_3), \gamma(\gamma(\alpha)), \sigma(\gamma(x_2), x_1)) \\ \delta(\gamma(x_3), \gamma(x_3), \sigma(\gamma(\alpha), \gamma(\gamma(x_2)))) \end{pmatrix} \right\}$$

$$\begin{array}{l} \text{Dekomp.} \\ \Rightarrow \end{array} \left\{ \begin{pmatrix} \gamma(x_3) \\ \gamma(x_3) \end{pmatrix}, \begin{pmatrix} \gamma(\gamma(\alpha)) \\ \gamma(x_3) \end{pmatrix}, \begin{pmatrix} \sigma(\gamma(x_2), x_1) \\ \sigma(\gamma(\alpha), \gamma(\gamma(x_2))) \end{pmatrix} \right\}$$

$$\begin{array}{l} \text{Dekomp.} \\ \Rightarrow \end{array} \left\{ \begin{pmatrix} x_3 \\ x_3 \end{pmatrix}, \begin{pmatrix} \gamma(\alpha) \\ x_3 \end{pmatrix}, \begin{pmatrix} \gamma(x_2) \\ \gamma(\alpha) \end{pmatrix}, \begin{pmatrix} x_1 \\ \gamma(\gamma(x_2)) \end{pmatrix} \right\}$$

$$\begin{array}{l} \text{Elim.} \\ \Rightarrow \end{array} \left\{ \begin{pmatrix} \gamma(\alpha) \\ x_3 \end{pmatrix}, \begin{pmatrix} \gamma(x_2) \\ \gamma(\alpha) \end{pmatrix}, \begin{pmatrix} x_1 \\ \gamma(\gamma(x_2)) \end{pmatrix} \right\}$$

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$$\left\{ \begin{pmatrix} \delta(\gamma(x_3), \gamma(\gamma(\alpha)), \sigma(\gamma(x_2), x_1)) \\ \delta(\gamma(x_3), \gamma(x_3), \sigma(\gamma(\alpha), \gamma(\gamma(x_2)))) \end{pmatrix} \right\}$$

$$\begin{array}{l} \text{Dekomp.} \\ \Rightarrow \end{array} \left\{ \begin{pmatrix} \gamma(x_3) \\ \gamma(x_3) \end{pmatrix}, \begin{pmatrix} \gamma(\gamma(\alpha)) \\ \gamma(x_3) \end{pmatrix}, \begin{pmatrix} \sigma(\gamma(x_2), x_1) \\ \sigma(\gamma(\alpha), \gamma(\gamma(x_2))) \end{pmatrix} \right\}$$

$$\begin{array}{l} \text{Dekomp.} \\ \Rightarrow \end{array} \left\{ \begin{pmatrix} x_3 \\ x_3 \end{pmatrix}, \begin{pmatrix} \gamma(\alpha) \\ x_3 \end{pmatrix}, \begin{pmatrix} \gamma(x_2) \\ \gamma(\alpha) \end{pmatrix}, \begin{pmatrix} x_1 \\ \gamma(\gamma(x_2)) \end{pmatrix} \right\}$$

$$\begin{array}{l} \text{Elim.} \\ \Rightarrow \end{array} \left\{ \begin{pmatrix} \gamma(\alpha) \\ x_3 \end{pmatrix}, \begin{pmatrix} \gamma(x_2) \\ \gamma(\alpha) \end{pmatrix}, \begin{pmatrix} x_1 \\ \gamma(\gamma(x_2)) \end{pmatrix} \right\}$$

$$\begin{array}{l} \text{Vert.} \\ \Rightarrow \end{array} \left\{ \begin{pmatrix} x_3 \\ \gamma(\alpha) \end{pmatrix}, \begin{pmatrix} \gamma(x_2) \\ \gamma(\alpha) \end{pmatrix}, \begin{pmatrix} x_1 \\ \gamma(\gamma(x_2)) \end{pmatrix} \right\}$$

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$$\left\{ \begin{pmatrix} \delta(\gamma(x_3), \gamma(\gamma(\alpha)), \sigma(\gamma(x_2), x_1)) \\ \delta(\gamma(x_3), \gamma(x_3), \sigma(\gamma(\alpha), \gamma(\gamma(x_2)))) \end{pmatrix} \right\}$$

$$\begin{array}{l} \text{Dekomp.} \\ \Rightarrow \end{array} \left\{ \begin{pmatrix} \gamma(x_3) \\ \gamma(x_3) \end{pmatrix}, \begin{pmatrix} \gamma(\gamma(\alpha)) \\ \gamma(x_3) \end{pmatrix}, \begin{pmatrix} \sigma(\gamma(x_2), x_1) \\ \sigma(\gamma(\alpha), \gamma(\gamma(x_2))) \end{pmatrix} \right\}$$

$$\begin{array}{l} \text{Dekomp.} \\ \Rightarrow \end{array} \left\{ \begin{pmatrix} x_3 \\ x_3 \end{pmatrix}, \begin{pmatrix} \gamma(\alpha) \\ x_3 \end{pmatrix}, \begin{pmatrix} \gamma(x_2) \\ \gamma(\alpha) \end{pmatrix}, \begin{pmatrix} x_1 \\ \gamma(\gamma(x_2)) \end{pmatrix} \right\}$$

$$\begin{array}{l} \text{Elim.} \\ \Rightarrow \end{array} \left\{ \begin{pmatrix} \gamma(\alpha) \\ x_3 \end{pmatrix}, \begin{pmatrix} \gamma(x_2) \\ \gamma(\alpha) \end{pmatrix}, \begin{pmatrix} x_1 \\ \gamma(\gamma(x_2)) \end{pmatrix} \right\}$$

$$\begin{array}{l} \text{Vert.} \\ \Rightarrow \end{array} \left\{ \begin{pmatrix} x_3 \\ \gamma(\alpha) \end{pmatrix}, \begin{pmatrix} \gamma(x_2) \\ \gamma(\alpha) \end{pmatrix}, \begin{pmatrix} x_1 \\ \gamma(\gamma(x_2)) \end{pmatrix} \right\}$$

$$\begin{array}{l} \text{Dekomp.} \\ \Rightarrow \end{array} \left\{ \begin{pmatrix} x_3 \\ \gamma(\alpha) \end{pmatrix}, \begin{pmatrix} x_2 \\ \alpha \end{pmatrix}, \begin{pmatrix} x_1 \\ \gamma(\gamma(x_2)) \end{pmatrix} \right\}$$

## Aufgabe 3 (cont.)

$$\left\{ \begin{pmatrix} x_3 \\ \gamma(\alpha) \end{pmatrix}, \begin{pmatrix} x_2 \\ \alpha \end{pmatrix}, \begin{pmatrix} x_1 \\ \gamma(\gamma(x_2)) \end{pmatrix} \right\}$$



## Aufgabe 3 (cont.)

$$\begin{array}{l} \left\{ \begin{pmatrix} x_3 \\ \gamma(\alpha) \end{pmatrix}, \begin{pmatrix} x_2 \\ \alpha \end{pmatrix}, \begin{pmatrix} x_1 \\ \gamma(\gamma(x_2)) \end{pmatrix} \right\} \\ \text{Subst.} \\ \Rightarrow \left\{ \begin{pmatrix} x_3 \\ \gamma(\alpha) \end{pmatrix}, \begin{pmatrix} x_2 \\ \alpha \end{pmatrix}, \begin{pmatrix} x_1 \\ \gamma(\gamma(\alpha)) \end{pmatrix} \right\} \end{array}$$

## Aufgabe 3 (cont.)

$$\begin{array}{c} \left\{ \begin{pmatrix} x_3 \\ \gamma(\alpha) \end{pmatrix}, \begin{pmatrix} x_2 \\ \alpha \end{pmatrix}, \begin{pmatrix} x_1 \\ \gamma(\gamma(x_2)) \end{pmatrix} \right\} \\ \text{Subst.} \\ \Rightarrow \left\{ \begin{pmatrix} x_3 \\ \gamma(\alpha) \end{pmatrix}, \begin{pmatrix} x_2 \\ \alpha \end{pmatrix}, \begin{pmatrix} x_1 \\ \gamma(\gamma(\alpha)) \end{pmatrix} \right\} \end{array}$$

$$x_1 \mapsto \gamma(\gamma(\alpha)) \qquad x_2 \mapsto \alpha \qquad x_3 \mapsto \gamma(\alpha)$$