

$$\text{Def 5: } \begin{array}{c} \bullet \\ \square \\ \bullet \end{array} := \begin{array}{c} \bullet \\ \diagup \quad \diagdown \\ \square \end{array}$$

$$\text{Def 2: } \begin{array}{c} \oplus \\ \square \\ \bullet \end{array} := \begin{array}{c} \oplus \\ \square \end{array} \quad \begin{array}{c} \bullet \\ \square \\ \bullet \end{array}$$

$$\text{Def 4: } \begin{array}{c} \oplus \\ \square \\ \bullet \end{array} := \begin{array}{c} \oplus \\ \square \end{array} \quad \begin{array}{c} \bullet \\ \square \\ \bullet \end{array}$$

$$C_{15}^8: \begin{array}{c} \bullet \\ \oplus \\ \square \\ \bullet \end{array} = \begin{array}{c} \bullet \\ \diagup \quad \diagdown \\ \square \end{array}$$

$$C_6^*: \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \end{array} = \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \end{array}$$

$$R_{16}: \begin{array}{c} \bullet \\ \diagup \quad \diagdown \\ \square \end{array} = \begin{array}{c} \bullet \\ \bullet \\ \bullet \end{array}$$

$$C_{15}: \begin{array}{c} \bullet \\ \square \\ \bullet \end{array} = \begin{array}{c} \bullet \\ \diagup \quad \diagdown \\ \square \end{array}$$

$$C_{16}: \begin{array}{c} \bullet \\ \oplus \\ \square \\ \bullet \end{array} = \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \end{array}$$

$$R_{17}: \begin{array}{c} \bullet \\ \bullet \\ \bullet \end{array} = \begin{array}{c} \bullet \\ \diagup \quad \diagdown \\ \square \end{array}$$

$$R_{31}: \begin{array}{c} \bullet \\ \oplus \\ \square \end{array} = \begin{array}{c} \bullet \\ \diagup \quad \diagdown \\ \square \end{array}$$

Lem J Def 2, Def 4-5, R₁₆, R₁₇, R₃₁, C₆, C₁₅ & C₁₆ imply

$$C_{16}^1: \begin{array}{c} \bullet \\ \bullet \\ \oplus \\ \bullet \\ \bullet \end{array} = \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \end{array}$$

$$C_{16}^2: \begin{array}{c} \bullet \\ \oplus \\ \bullet \\ \bullet \end{array} = \begin{array}{c} \bullet \\ \bullet \\ \oplus \\ \bullet \end{array}$$

$$C_{16}^3: \begin{array}{c} \bullet \\ \bullet \\ \oplus \\ \bullet \\ \bullet \end{array} = \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \end{array}$$

$$C_{16}^4: \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \end{array} = \begin{array}{c} \bullet \\ \oplus \\ \bullet \\ \bullet \\ \bullet \\ \bullet \end{array} = \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \end{array}$$

Proof: $C_{16}^1 \cdot \text{RHS} :=$ $\stackrel{C_{16}}{=} \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \end{array}$ $\stackrel{C_6^*}{=} \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \end{array} =: C_{16}^1 \cdot \text{LHS}.$

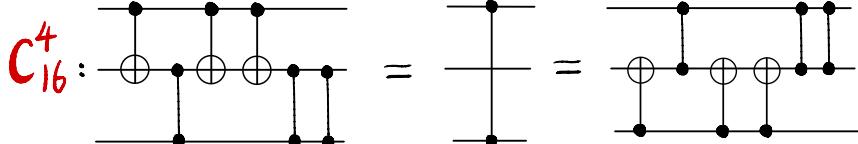
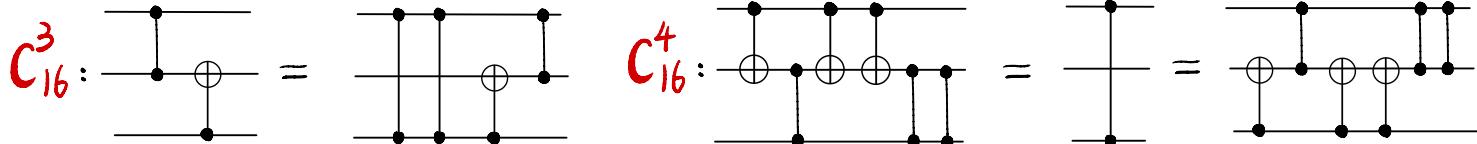
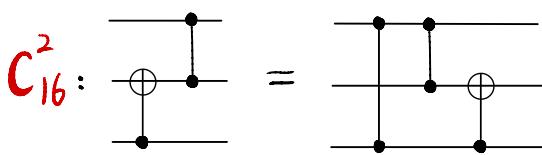
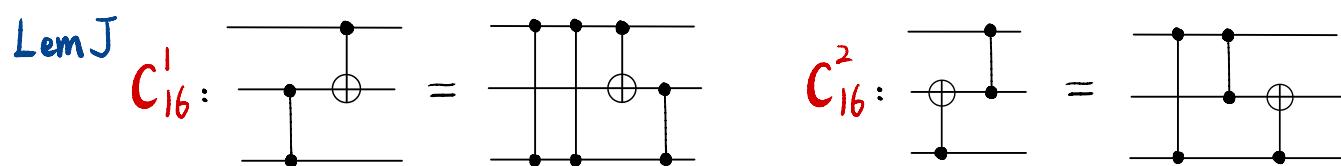
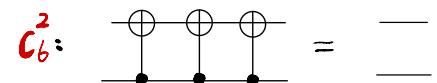
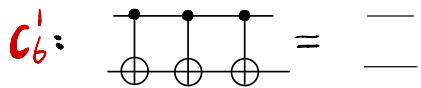
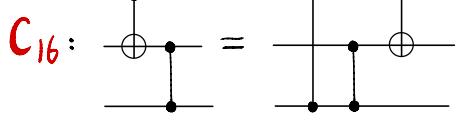
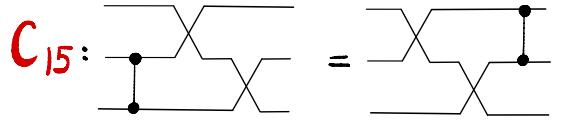
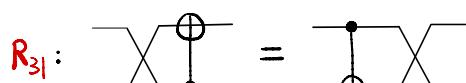
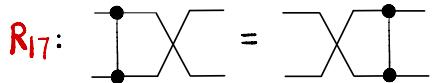
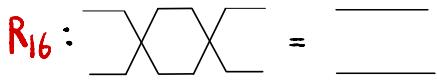
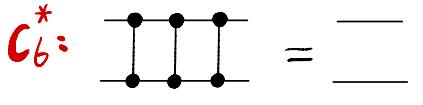
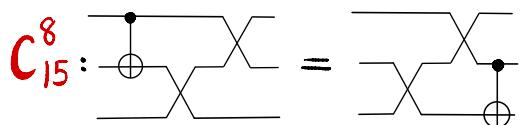
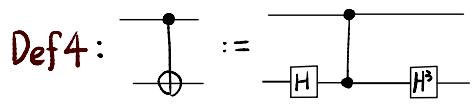
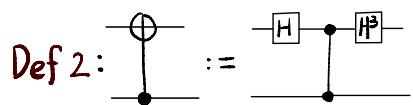
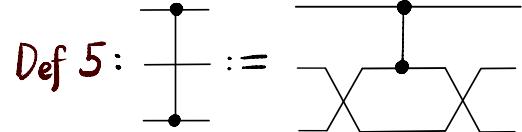
$$C_{16}^2 \cdot \text{LHS} := \begin{array}{c} \bullet \\ \bullet \\ \oplus \\ \bullet \end{array} \stackrel{R_{16}}{=} \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \end{array}$$

$$\stackrel{R_{31}}{=} \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \end{array} \stackrel{C_{15}^8}{=} \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \end{array}$$

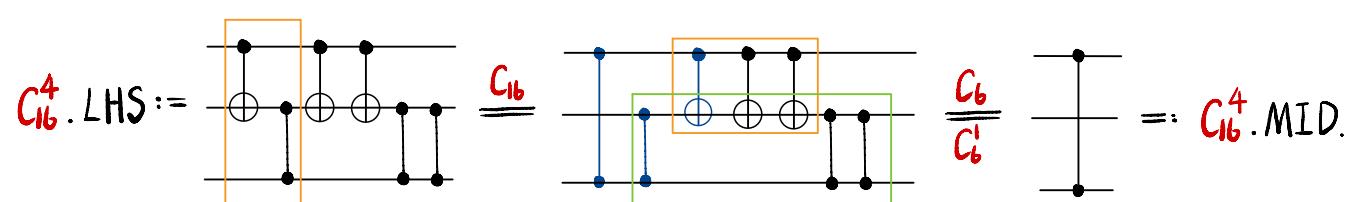
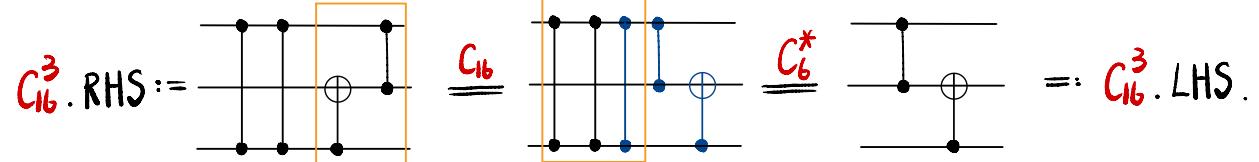
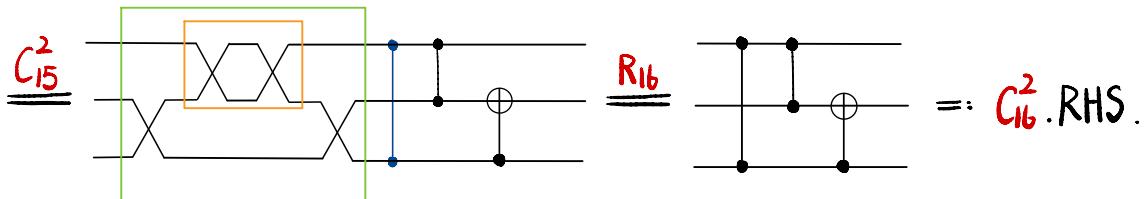
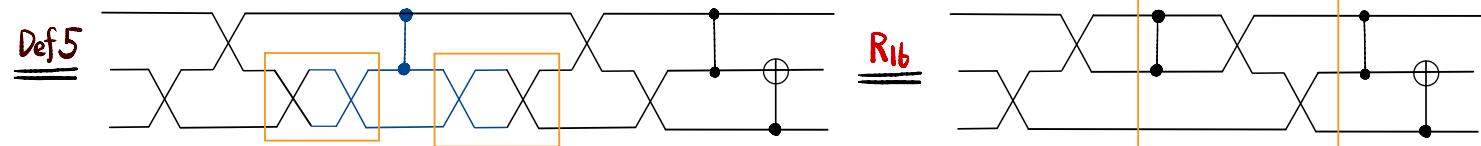
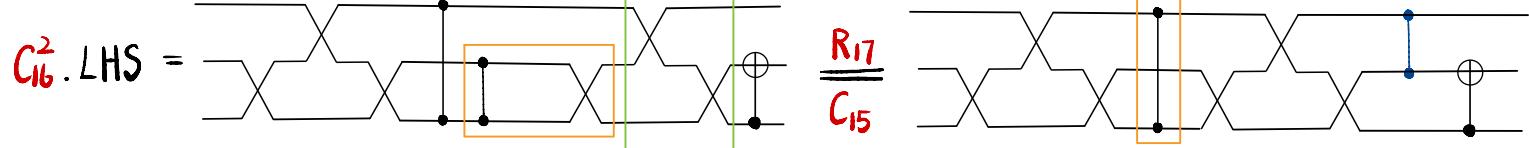
$$\stackrel{C_{15}}{=} \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \end{array} \stackrel{R_{17}}{=} \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \end{array}$$

$$\stackrel{C_{16}}{=} \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \end{array}$$

$$\stackrel{R_{31}}{=} \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \end{array} \stackrel{C_{15}^8}{=} \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \end{array}$$



Proof cont.



$$C_6^*: \quad \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \end{array} = \quad C_6^1: \quad \begin{array}{c} \bullet \\ \oplus \\ \bullet \\ \bullet \\ \oplus \\ \bullet \end{array} = \quad C_6^2: \quad \begin{array}{c} \oplus \\ \oplus \\ \oplus \\ \bullet \\ \bullet \\ \bullet \end{array} = \quad$$

Lem J

$$C_{16}^1: \quad \begin{array}{c} \bullet \\ \bullet \\ \oplus \\ \bullet \\ \bullet \\ \bullet \end{array} = \quad \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \end{array}$$

$$C_{16}^2: \quad \begin{array}{c} \bullet \\ \oplus \\ \bullet \\ \bullet \\ \bullet \\ \bullet \end{array} = \quad \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \end{array}$$

$$C_{16}^3: \quad \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \oplus \\ \bullet \\ \bullet \end{array} = \quad \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \end{array}$$

$$C_{16}^4: \quad \begin{array}{c} \bullet \\ \oplus \\ \bullet \\ \bullet \\ \bullet \\ \bullet \end{array} = \quad \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \end{array} = \quad \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \end{array}$$

Proof cont.

$$C_{16}^4 \cdot \text{RHS} := \quad \boxed{\begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \end{array}} \quad \stackrel{C_{16}^2}{=} \quad \boxed{\begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \end{array}} \quad \stackrel{C_6}{=} \quad \boxed{\begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \end{array}} =: C_{16}^4 \cdot \text{MID.}$$

IV

$$\text{Def 5: } \begin{array}{c} \bullet \\ \square \\ \bullet \end{array} := \begin{array}{c} \bullet \\ \diagup \quad \diagdown \\ \diagdown \quad \diagup \end{array}$$

$$\text{Def 2: } \begin{array}{c} \oplus \\ \square \\ \bullet \end{array} := \begin{array}{c} \oplus \\ \square \quad \square \\ \bullet \quad \bullet \end{array}$$

$$\text{Def 4: } \begin{array}{c} \oplus \\ \square \\ \bullet \end{array} := \begin{array}{c} \oplus \\ \square \quad \square \\ \bullet \quad \bullet \end{array}$$

$$C_{15}^{17}: \begin{array}{c} \oplus \\ \diagup \quad \diagdown \\ \diagdown \quad \diagup \end{array} = \begin{array}{c} \bullet \\ \diagup \quad \diagdown \\ \diagdown \quad \diagup \end{array}$$

$$C_6^*: \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \end{array} = \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \end{array}$$

$$R_{16}: \begin{array}{c} \diagup \quad \diagdown \\ \diagdown \quad \diagup \end{array} = \begin{array}{c} \bullet \\ \bullet \end{array}$$

$$R_{17}: \begin{array}{c} \bullet \\ \diagup \quad \diagdown \\ \diagdown \quad \diagup \end{array} = \begin{array}{c} \bullet \\ \bullet \end{array}$$

$$R_{31}: \begin{array}{c} \diagup \quad \diagdown \\ \diagdown \quad \diagup \end{array} = \begin{array}{c} \oplus \\ \bullet \end{array}$$

$$C_{15}^{11}: \begin{array}{c} \oplus \\ \diagup \quad \diagdown \\ \diagdown \quad \diagup \end{array} = \begin{array}{c} \bullet \\ \diagup \quad \diagdown \\ \diagdown \quad \diagup \end{array}$$

$$C_{16}: \begin{array}{c} \oplus \\ \bullet \\ \bullet \\ \bullet \end{array} = \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \end{array}$$

$$C_{16}^2: \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \end{array} = \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \end{array}$$

Lem J¹ Def 2, Def 4-5, R₁₆, R₁₇, R₃₁, C₆, C₁₅ & C₁₆ imply

$$C_{16}^5: \begin{array}{c} \bullet \\ \bullet \\ \oplus \end{array} = \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \oplus \end{array}$$

$$C_{16}^7: \begin{array}{c} \oplus \\ \bullet \\ \bullet \end{array} = \begin{array}{c} \bullet \\ \bullet \\ \oplus \end{array}$$

$$C_{16}^6: \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \oplus \end{array} = \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \\ \oplus \end{array}$$

$$C_{16}^8: \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \\ \oplus \end{array} = \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \\ \oplus \end{array}$$

Proof:

$$C_{16}^5. \text{LHS} := \begin{array}{c} \bullet \\ \bullet \\ \oplus \end{array} \xrightarrow{\text{R}_{16}} \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \oplus \end{array} \xrightarrow{\text{R}_{17} \text{ R}_{16}} \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \\ \oplus \end{array}$$

$$\xrightarrow{\text{C}_{15}^7 \text{ R}_{31}} \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \\ \oplus \end{array} \xrightarrow{\text{R}_{16} \text{ C}_{16}} \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \\ \bullet \\ \oplus \end{array}$$

$$\xrightarrow{\text{R}_{16}} \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \\ \oplus \end{array} \xrightarrow{\text{C}_{15}^{11} \text{ R}_{31}} \begin{array}{c} \bullet \\ \oplus \end{array}$$

$$\xrightarrow{\text{R}_{16}} \begin{array}{c} \bullet \\ \oplus \end{array} \xrightarrow{\text{R}_{17} \text{ R}_{16}} \begin{array}{c} \bullet \\ \oplus \end{array}$$

$$C_{15}^{17}:$$

$$=$$

$C_6:$

$$\begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \end{array} =$$

$$R_{16}: \quad \begin{array}{c} \diagup \quad \diagdown \\ \diagdown \quad \diagup \end{array} =$$

$$C_{15}^{11}:$$

$$=$$

$C_{16}:$

$$\begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \end{array} =$$

$$R_{17}: \quad \begin{array}{c} \diagup \quad \diagdown \\ \diagdown \quad \diagup \end{array} =$$

$$C_{15}^5:$$

$C_{16}^2:$

$$\begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \end{array} =$$

$$R_{31}: \quad \begin{array}{c} \diagup \quad \diagdown \\ \diagdown \quad \diagup \end{array} =$$

Lem J¹

$C_{16}^5:$

$$\begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \end{array} =$$

$C_{16}^7:$

$$\begin{array}{c} \oplus \\ \bullet \\ \bullet \\ \bullet \end{array} =$$

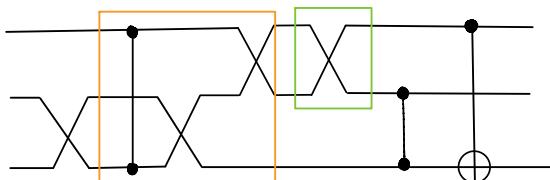
$C_{16}^6:$

$$\begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \end{array} =$$

$C_{16}^8:$

$$\begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \end{array} =$$

Proof cont. $C_{16}^5.$ LHS =



$$\begin{array}{c} \text{C}_5 \\ \text{R}_7 \end{array} \quad \begin{array}{c} \text{C}_5 \\ \text{R}_7 \end{array} =: C_{16}^5.\text{RHS}.$$

$$C_{16}^6.\text{RHS} := \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \end{array} \stackrel{C_{16}}{=} \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \end{array} \stackrel{C_6}{=} \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \end{array} =: C_{16}^6.\text{LHS}.$$

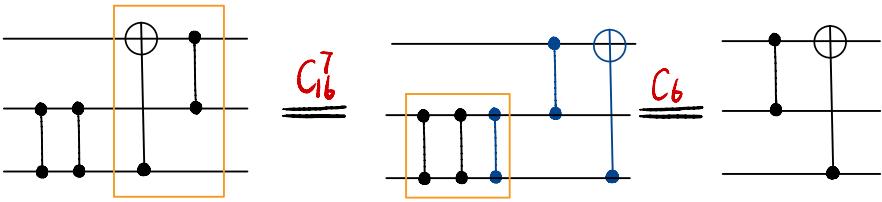
$$C_{16}^7.\text{LHS} := \begin{array}{c} \oplus \\ \bullet \\ \bullet \\ \bullet \end{array} \stackrel{R_{16}}{=} \begin{array}{c} \oplus \\ \bullet \\ \bullet \\ \bullet \end{array} \dots \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \end{array}$$

$$\begin{array}{c} \text{C}_6^2 \\ \text{R}_6 \end{array} \quad \dots \quad \begin{array}{c} \text{C}_6^2 \\ \text{R}_6 \end{array} \stackrel{R_{16}}{=} \begin{array}{c} \oplus \\ \bullet \\ \bullet \\ \bullet \end{array} =: C_{16}^7.\text{RHS}.$$

$$\begin{array}{ll}
 C_{15}^{17}: & \text{Diagram} = \text{Diagram} \\
 C_{15}^{11}: & \text{Diagram} = \text{Diagram} \\
 C_{15}^5: & \text{Diagram} = \text{Diagram} \\
 C_6: & \text{Diagram} = \text{Diagram} \\
 C_{16}: & \text{Diagram} = \text{Diagram} \\
 C_{16}^2: & \text{Diagram} = \text{Diagram} \\
 R_{16}: & \text{Diagram} = \text{Diagram} \\
 R_{17}: & \text{Diagram} = \text{Diagram} \\
 R_{31}: & \text{Diagram} = \text{Diagram}
 \end{array}$$

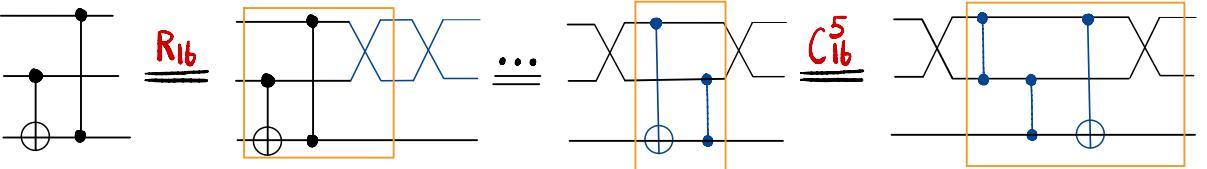
Lem J¹

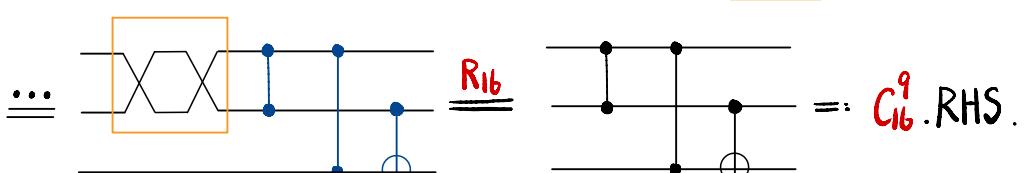
$$\begin{array}{ll}
 C_{16}^5: & \text{Diagram} = \text{Diagram} \\
 C_{16}^6: & \text{Diagram} = \text{Diagram} \\
 C_{16}^7: & \text{Diagram} = \text{Diagram} \\
 C_{16}^8: & \text{Diagram} = \text{Diagram}
 \end{array}$$

Proof cont. $C_{16}^8 \cdot \text{RHS} :=$  $\underline{\underline{C_{16}^7}}$ $\underline{\underline{C_6}}$ $=: C_{16}^8 \cdot \text{RHS}$. □

Lem J² Def 2, Def 4-5, R₁₆, R₁₇, R₃₁, C₆, C₁₅ & C₁₆ imply

$$\begin{array}{ll}
 C_{16}^9: & \text{Diagram} = \text{Diagram} \\
 C_{16}^{10}: & \text{Diagram} = \text{Diagram} \\
 C_{16}^{11}: & \text{Diagram} = \text{Diagram} \\
 C_{16}^{12}: & \text{Diagram} = \text{Diagram}
 \end{array}$$

Proof: $C_{16}^9 \cdot \text{LHS} :=$ 

\cdots 

$$\text{Def 5: } \begin{array}{c} \bullet \\ \square \\ \bullet \end{array} := \begin{array}{c} \bullet \\ \diagup \quad \diagdown \\ \square \end{array}$$

$$\text{Def 2: } \begin{array}{c} \oplus \\ \square \\ \bullet \end{array} := \begin{array}{c} \oplus \\ \square \end{array} \quad \begin{array}{c} \bullet \\ \square \\ \bullet \end{array}$$

$$\text{Def 4: } \begin{array}{c} \oplus \\ \square \\ \bullet \end{array} := \begin{array}{c} \oplus \\ \square \end{array} \quad \begin{array}{c} \bullet \\ \square \\ \bullet \end{array}$$

$$C_{15}^{17}: \begin{array}{c} \oplus \\ \diagup \quad \diagdown \\ \square \end{array} = \begin{array}{c} \bullet \\ \diagup \quad \diagdown \\ \square \end{array}$$

$$C_6: \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \end{array} = \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \end{array}$$

$$R_{16}: \begin{array}{c} \diagup \quad \diagdown \\ \square \end{array} = \begin{array}{c} \bullet \\ \bullet \end{array}$$

$$C_{15}^{11}: \begin{array}{c} \oplus \\ \diagup \quad \diagdown \\ \square \end{array} = \begin{array}{c} \bullet \\ \diagup \quad \diagdown \\ \square \end{array}$$

$$C_{16}^5: \begin{array}{c} \bullet \\ \bullet \\ \bullet \end{array} = \begin{array}{c} \bullet \\ \bullet \\ \bullet \end{array}$$

$$R_{17}: \begin{array}{c} \bullet \\ \diagup \quad \diagdown \\ \square \end{array} = \begin{array}{c} \bullet \\ \bullet \\ \bullet \end{array}$$

$$C_{15}^5: \begin{array}{c} \diagup \quad \diagdown \\ \square \end{array} = \begin{array}{c} \bullet \\ \diagup \quad \diagdown \\ \square \end{array}$$

$$C_{16}^7: \begin{array}{c} \bullet \\ \bullet \\ \bullet \end{array} = \begin{array}{c} \bullet \\ \bullet \\ \bullet \end{array}$$

$$R_{31}: \begin{array}{c} \diagup \quad \diagdown \\ \square \end{array} = \begin{array}{c} \oplus \\ \square \end{array}$$

Lem J² Def 2, Def 4-5, R₁₆, R₁₇, R₃₁, C₆, C₁₅ & C₁₆ imply

$$C_{16}^9: \begin{array}{c} \bullet \\ \bullet \\ \bullet \end{array} = \begin{array}{c} \bullet \\ \bullet \\ \bullet \end{array}$$

$$C_{16}^{11}: \begin{array}{c} \oplus \\ \bullet \\ \bullet \end{array} = \begin{array}{c} \bullet \\ \oplus \\ \bullet \end{array}$$

$$C_{16}^{10}: \begin{array}{c} \bullet \\ \bullet \\ \bullet \end{array} = \begin{array}{c} \bullet \\ \bullet \\ \bullet \end{array}$$

$$C_{16}^{12}: \begin{array}{c} \bullet \\ \bullet \\ \bullet \end{array} = \begin{array}{c} \bullet \\ \bullet \\ \bullet \end{array}$$

$$\text{Proof cont. } C_{16}^{10}. \text{RHS} := \begin{array}{c} \bullet \\ \bullet \\ \bullet \end{array} \boxed{\begin{array}{c} \bullet \\ \bullet \\ \bullet \end{array}} \underline{\underline{C_{16}^9}} \quad \boxed{\begin{array}{c} \bullet \\ \bullet \\ \bullet \end{array}} \underline{\underline{C_6}} \quad \begin{array}{c} \bullet \\ \bullet \\ \bullet \end{array} =: C_{16}^{10}. \text{LHS.}$$

$$C_{16}^{11}. \text{LHS} := \begin{array}{c} \oplus \\ \bullet \\ \bullet \end{array} \underline{\underline{R_{16}}} \quad \begin{array}{c} \oplus \\ \bullet \\ \bullet \end{array} \quad \dots \quad \begin{array}{c} \oplus \\ \bullet \\ \bullet \end{array} \boxed{\begin{array}{c} \bullet \\ \bullet \\ \bullet \end{array}} \underline{\underline{C_{16}^7}} \quad \begin{array}{c} \bullet \\ \bullet \\ \bullet \end{array}$$

$$\dots \quad \boxed{\begin{array}{c} \diagup \quad \diagdown \\ \square \end{array}} \underline{\underline{R_{16}}} \quad \begin{array}{c} \bullet \\ \bullet \\ \bullet \end{array} =: C_{16}^{11}. \text{RHS.}$$

$$C_{16}^{12}. \text{RHS} := \begin{array}{c} \bullet \\ \bullet \\ \bullet \end{array} \boxed{\begin{array}{c} \bullet \\ \bullet \\ \bullet \end{array}} \underline{\underline{C_{16}^{11}}} \quad \boxed{\begin{array}{c} \bullet \\ \bullet \\ \bullet \end{array}} \underline{\underline{C_6}} \quad \begin{array}{c} \bullet \\ \bullet \\ \bullet \end{array} =: C_{16}^{12}. \text{LHS.}$$

$$C_{13}^3 : \begin{array}{c} \text{Diagram 1} \\ \text{Diagram 2} \end{array} = \begin{array}{c} \text{Diagram 3} \\ \text{Diagram 4} \end{array}$$

$$C_{13}^6 : \begin{array}{c} \text{Diagram 1} \\ \text{Diagram 2} \end{array} = \begin{array}{c} \text{Diagram 3} \\ \text{Diagram 4} \end{array}$$

$$C_{13}^8 : \begin{array}{c} \text{Diagram 1} \\ \text{Diagram 2} \end{array} = \begin{array}{c} \text{Diagram 3} \\ \text{Diagram 4} \end{array}$$

$$\text{Def 2: } \begin{array}{c} \text{Diagram 1} \end{array} := \begin{array}{c} \text{Diagram 2} \\ \text{Diagram 3} \\ \text{Diagram 4} \end{array}$$

$$\text{Def 4: } \begin{array}{c} \text{Diagram 1} \end{array} := \begin{array}{c} \text{Diagram 2} \\ \text{Diagram 3} \\ \text{Diagram 4} \end{array}$$

$$C_{13} : \begin{array}{c} \text{Diagram 1} \\ \text{Diagram 2} \end{array} = \begin{array}{c} \text{Diagram 3} \\ \text{Diagram 4} \end{array} \quad C_2 : H^4 = I$$

Lem F" Def 2, Def 4 & G_3 imply

$$C_{13}^9 : \begin{array}{c} \text{Diagram 1} \\ \text{Diagram 2} \end{array} = \begin{array}{c} \text{Diagram 3} \\ \text{Diagram 4} \end{array}$$

$$C_{13}^{10} : \begin{array}{c} \text{Diagram 1} \\ \text{Diagram 2} \end{array} = \begin{array}{c} \text{Diagram 3} \\ \text{Diagram 4} \end{array}$$

$$C_{13}^{11} : \begin{array}{c} \text{Diagram 1} \\ \text{Diagram 2} \end{array} = \begin{array}{c} \text{Diagram 3} \\ \text{Diagram 4} \end{array}$$

$$C_{13}^{12} : \begin{array}{c} \text{Diagram 1} \\ \text{Diagram 2} \end{array} = \begin{array}{c} \text{Diagram 3} \\ \text{Diagram 4} \end{array}$$

$$C_{13}^{13} : \begin{array}{c} \text{Diagram 1} \\ \text{Diagram 2} \end{array} = \begin{array}{c} \text{Diagram 3} \\ \text{Diagram 4} \end{array}$$

$$C_{13}^{14} : \begin{array}{c} \text{Diagram 1} \\ \text{Diagram 2} \end{array} = \begin{array}{c} \text{Diagram 3} \\ \text{Diagram 4} \end{array}$$

$$\text{Proof: } C_{13}^9 \cdot \text{LHS} := \begin{array}{c} \text{Diagram 1} \end{array} \xrightarrow{\text{Def 4}} \begin{array}{c} \text{Diagram 2} \\ \text{Diagram 3} \\ \text{Diagram 4} \end{array} \xrightarrow{\text{Def 4}} \begin{array}{c} \text{Diagram 5} \\ \text{Diagram 6} \end{array} =: C_{13}^9 \cdot \text{RHS.}$$

$$C_{13}^{10} \cdot \text{LHS} := \begin{array}{c} \text{Diagram 1} \end{array} \xrightarrow{\text{Def 4}} \begin{array}{c} \text{Diagram 2} \\ \text{Diagram 3} \\ \text{Diagram 4} \end{array} \xrightarrow{\text{Def 4}} \begin{array}{c} \text{Diagram 5} \\ \text{Diagram 6} \end{array} =: C_{13}^{10} \cdot \text{RHS.}$$

$$C_{13}^{11} \cdot \text{LHS} := \begin{array}{c} \text{Diagram 1} \end{array} \xrightarrow{\text{Def 2}} \begin{array}{c} \text{Diagram 2} \\ \text{Diagram 3} \\ \text{Diagram 4} \end{array} \xrightarrow{\text{Def 2}} \begin{array}{c} \text{Diagram 5} \\ \text{Diagram 6} \end{array} =: C_{13}^{11} \cdot \text{RHS.}$$

$$C_{13}^{12} \cdot \text{LHS} := \begin{array}{c} \text{Diagram 1} \end{array} \xrightarrow{\text{Def 2}} \begin{array}{c} \text{Diagram 2} \\ \text{Diagram 3} \\ \text{Diagram 4} \end{array} \xrightarrow{\text{Def 4}} \begin{array}{c} \text{Diagram 5} \\ \text{Diagram 6} \end{array} =: C_{13}^{12} \cdot \text{RHS.}$$

$$\xrightarrow{\text{Def 2}} \begin{array}{c} \text{Diagram 1} \\ \text{Diagram 2} \end{array} \xrightarrow{\text{Def 4}} \begin{array}{c} \text{Diagram 3} \\ \text{Diagram 4} \end{array} =: C_{13}^{12} \cdot \text{RHS.}$$

Reasoning analogously, we can prove C_{13}^{13} & C_{13}^{14} .