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phy 5100  
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HW 9 # 3.2.9, 3.2.13, 3.2.14, 3.4.12

①

②

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3.2.9.  $[A, [B, C]] = [B, [A, C]] - [C, [A, B]]$

$[A, B] = A \cdot B - B \cdot A$   $A = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$   $B = \begin{bmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{bmatrix}$   $C = \begin{bmatrix} c_{11} & c_{12} \\ c_{21} & c_{22} \end{bmatrix}$

left side:

$[A, [B, C]] ; [B, C] = (BC - CB)$

$[B, C] = \begin{bmatrix} b_{11}c_{11} + b_{12}c_{21} & b_{11}c_{12} + b_{12}c_{22} \\ b_{21}c_{11} + b_{22}c_{21} & b_{21}c_{12} + b_{22}c_{22} \end{bmatrix}$

$\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$

$[A, [B, C]] = (A[BC] - [BC]A)$

①  $= \begin{bmatrix} a_{11}(b_{11}c_{11} + b_{12}c_{21}) + a_{12}(b_{21}c_{11} + b_{22}c_{21}) & a_{11}(b_{11}c_{12} + b_{12}c_{22}) + a_{12}(b_{21}c_{12} + b_{22}c_{22}) \\ a_{21}(b_{11}c_{11} + b_{12}c_{21}) + a_{22}(b_{21}c_{11} + b_{22}c_{21}) & a_{21}(b_{11}c_{12} + b_{12}c_{22}) + a_{22}(b_{21}c_{12} + b_{22}c_{22}) \end{bmatrix}$

Right side:  $[B, [A, C]] ; [A, C] = (AC - CA)$

$[A, C] = \begin{bmatrix} a_{11}c_{11} + a_{12}c_{21} & a_{11}c_{12} + a_{12}c_{22} \\ a_{21}c_{11} + a_{22}c_{21} & a_{21}c_{12} + a_{22}c_{22} \end{bmatrix}$

$[B, [A, C]] = (B[AC] - [AC]B)$

②  $= \begin{bmatrix} b_{11}(a_{11}c_{11} + a_{12}c_{21}) + b_{12}(a_{21}c_{11} + a_{22}c_{21}) & b_{11}(a_{11}c_{12} + a_{12}c_{22}) + b_{12}(a_{21}c_{12} + a_{22}c_{22}) \\ b_{21}(a_{11}c_{11} + a_{12}c_{21}) + b_{22}(a_{21}c_{11} + a_{22}c_{21}) & b_{21}(a_{11}c_{12} + a_{12}c_{22}) + b_{22}(a_{21}c_{12} + a_{22}c_{22}) \end{bmatrix}$