⑤

- Definition of a generalized inverse

  - Given any matrix A, a generalized inverse (G) is the matrix that satisfies

$$A \cdot G \cdot A = A \iff (A \cdot G \cdot A)^T = A^T$$

Recall: the inverse A^{-1} was defined as

$$A^{-1} A = I \; ; \; A \cdot A^{-1} = I$$

$$A \cdot A^{-1} \cdot A = A$$

- Why is generalize inverse (G) useful for us?

- Given a system of equations, $A \cdot b = r$

the vector $b = G \cdot r$ is a solution, if G is a generalized inverse of A. So G is defined such that $A G A = A$, the solutions are given by

$$b = G \cdot r \quad ; \text{pre-multiply with } A$$

$$A \cdot b = A \cdot G \cdot r$$

$$A \cdot b = A \cdot G \cdot A \cdot b \implies A = AGA \text{ only true if } G \text{ is a generalized inverse of } A$$