2.7.1 Vectors as special matrices

Vectors are matrices, too

$$\vec{a} = \begin{pmatrix} a_{11} \\ \cdots \\ a_{M1} \end{pmatrix} \Rightarrow M \times 1 \text{ matrix! column vector!}$$

$$\text{transposed} \quad \vec{a}^{\top} = (a_{11}, \ldots, a_{M1}) \Rightarrow 1 \times M \text{ matrix! row or line vector!}$$

Product of two matrices:

Definition 23 *$\tilde{A}$ an $M \times N$ matrix and $\tilde{B}$ is an $N \times P$ matrix then: $\underbrace{\tilde{C}}_{M \times P} = \tilde{A} \cdot \tilde{B}$ is defined as the product of $\tilde{A}$ and $\tilde{B}$ with:*

$$C_{ls} = \sum_{j=1}^{N} a_{lj}\, b_{js} \quad \left.\begin{array}{l} l = 1, \ldots, M \\ s = 1, \ldots, P \end{array}\right\} \textit{rule: line} \times \textit{column!}$$

Examples:

$$\overset{M}{2} \times \overset{N}{3} \qquad \overset{N}{3} \times \overset{P}{2} \qquad \left.\begin{array}{l} \text{l'th line of } \tilde{A} \\ \text{s'th row of } \tilde{B} \end{array}\right\} \qquad c_{ls} = 2 \times 2$$

$$\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{pmatrix} \begin{pmatrix} 1 & 4 \\ 2 & 5 \\ 3 & 6 \end{pmatrix} = \begin{pmatrix} 14 & 32 \\ 32 & 77 \end{pmatrix}$$