3.2: matrix multiplication

ex:

	Tests	Hw	Final	
Dusty	70	80	90	.50
Macie	75	85	95	.15
				.35

$$= \begin{bmatrix} 70(.5) + 80(.15) + 90(.35) \\ 75(.5) + 85(.15) + 95(.35) \end{bmatrix}$$

$$= \begin{bmatrix} 78.5 \\ 83.5 \end{bmatrix} \leftarrow \begin{matrix} 2.9 \text{ GPA} \\ 3.4 \text{ GPA} \end{matrix}$$

This is an example of matrix multiplication.

Two ways to multiply 2 matrices

(1) scalar mult.

(2) matrix multiplication.

ex of (1):

$$3 \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} = \begin{bmatrix} 3 & 6 \\ 9 & 12 \end{bmatrix}$$

↑ scalar

ex of (2):

$$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}\begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix} = \begin{bmatrix} 1\cdot 5 + 2\cdot 7 & 1\cdot 6 + 2\cdot 8 \\ 3\cdot 5 + 4\cdot 7 & 3\cdot 6 + 4\cdot 8 \end{bmatrix}$$

method: mult row by col. $= \begin{bmatrix} 19 & 22 \\ 43 & 50 \end{bmatrix}$

ex: $\begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} = \begin{bmatrix} 5\cdot 1 + 6\cdot 3 & 5\cdot 2 + 6\cdot 4 \\ 7\cdot 1 + 8\cdot 3 & 7\cdot 2 + 8\cdot 4 \end{bmatrix}$

$$= \begin{bmatrix} 23 & 34 \\ 31 & 46 \end{bmatrix}$$

$AB \neq BA$ matrix mult. is not commutative.

ex: $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}\begin{bmatrix} 2 & 1 & 0 \\ 3 & 2 & 1 \end{bmatrix} = \begin{bmatrix} 8 & 5 & 2 \\ 18 & 11 & 4 \end{bmatrix}_{2\times 3}$

$2\times\boxed{2}$ match $\boxed{2}\times 3$

ex: $\left[A_{4\times\boxed{5}} \right)\left(B_{\boxed{5}\times 7} \right]_{4\times 7}$

match

if the inside dimensions don't match, the operation is undefined: mismatched dimensions.

ex: $\begin{bmatrix}1 & 2 & 3\end{bmatrix}\begin{bmatrix}4\\5\\6\end{bmatrix} = \begin{bmatrix}32\end{bmatrix}_{1\times1}$

$$\begin{bmatrix}4\\5\\6\end{bmatrix}\begin{bmatrix}1 & 2 & 3\end{bmatrix} = \begin{bmatrix}4 & 8 & 12\\5 & 10 & 15\\6 & 12 & 18\end{bmatrix}_{3\times3}$$

ex: If $E = \begin{bmatrix}1 & 0 & 2\\3 & 1 & 0\end{bmatrix}$ Find

(a) $E \cdot E^T = \begin{bmatrix}1 & 0 & 2\\3 & 1 & 0\end{bmatrix}_{2\times3}\begin{bmatrix}1 & 3\\0 & 1\\2 & 0\end{bmatrix}_{3\times2}$

$$= \begin{bmatrix}5 & 3\\3 & 10\end{bmatrix}_{2\times2}$$

(b) $E^T E = \begin{bmatrix}1 & 3\\0 & 1\\2 & 0\end{bmatrix}_{3\times2}\begin{bmatrix}1 & 0 & 2\\3 & 1 & 0\end{bmatrix}_{2\times3}$

$$= \begin{bmatrix}10 & 3 & 2\\3 & 1 & 0\\2 & 0 & 4\end{bmatrix}_{3\times3}$$

Multiplication w/ identity matrix.

ex: $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$

$A \cdot I = A$

$AI = IA = A$