

Matrix Multiplication

$$\begin{array}{c} \text{1} \\ \text{2} \end{array} \begin{vmatrix} 1 & 3 & 4 & -2 \\ 6 & 2 & -3 & 1 \end{vmatrix} \times \begin{array}{c} \text{1} \\ \text{1} \end{array} \begin{vmatrix} 1 & -2 \\ 4 & 3 \\ -3 & -2 \\ 0 & 4 \end{vmatrix} = \begin{vmatrix} 1 & -9 \\ 23 & 4 \end{vmatrix}$$

$$1 \cdot 1 + 3 \cdot 4 + 4 \cdot -3 + -2 \cdot 0 = 1$$

Matrix Multiply in MapReduce

$$C = A \times B$$

A has dimensions L, M

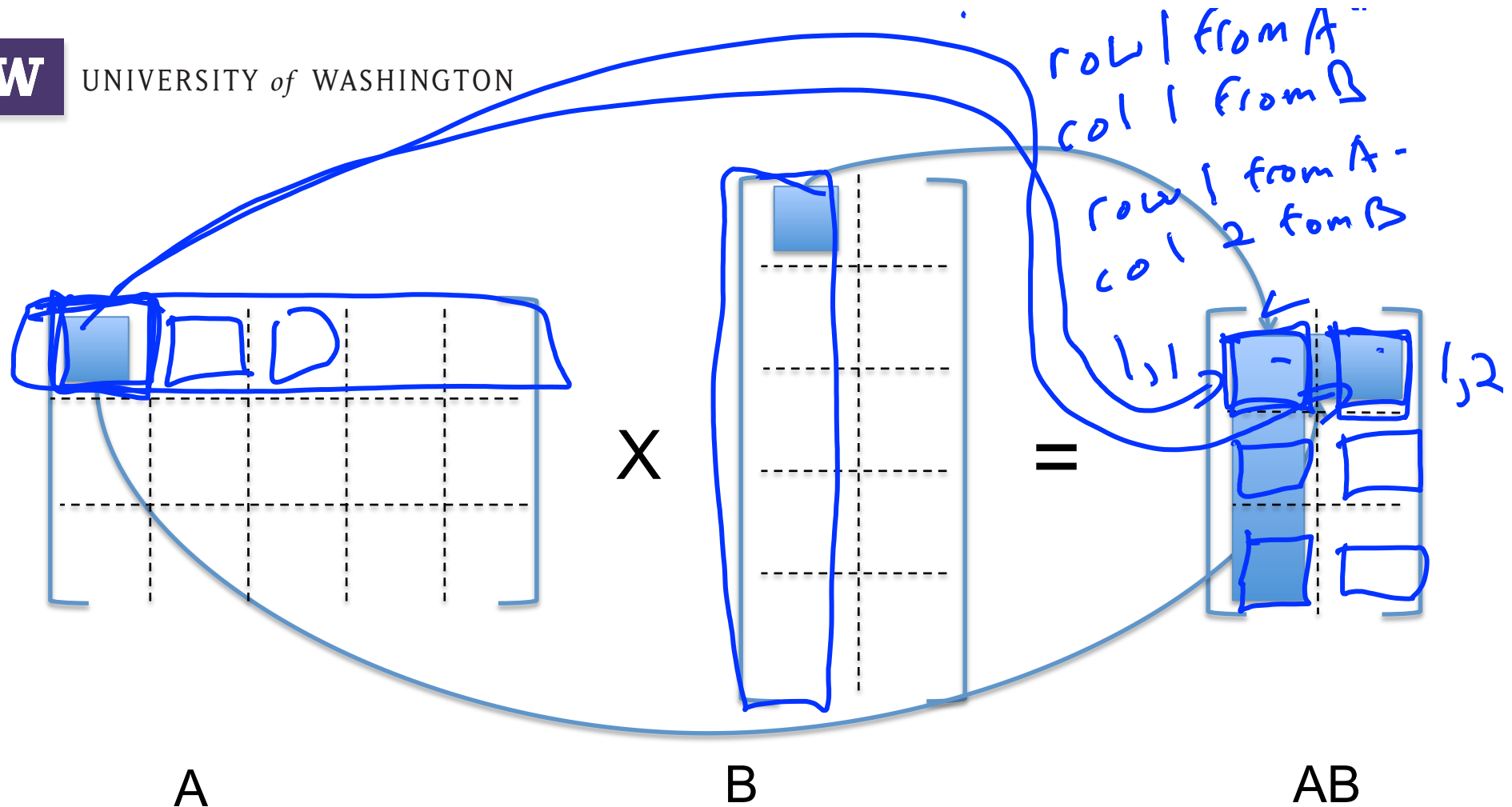
B has dimensions M, N

- In the map phase:
 - for each element (i,j) of A, emit $((i,k), A[i,j])$ for k in $1..N$
 - for each element (j,k) of B, emit $((i,k), B[j,k])$ for i in $1..L$
- In the reduce phase, emit
 - key = (i,k)
 - value = $\text{Sum}_j (A[i,j] * B[j,k])$

(i, j, val)

key = (i, k) , value = $A[i, j]$
 k in $1..N$

key = (i, k)
 value = $B[j, k]$
 $\forall i$ in $1..L$



- One reducer per output cell
- Each reducer computes $\text{Sum}_j (A[i,j] * B[j,k])$