# Matrix Operations (+,-,\*)

#### Matrices Addition

The addition of two matrices A  $m^*n$  and  $B_{m^*n}$  gives a matrix  $C_{m^*n}$ . Here, m and n represents the number of rows and columns in the matrix respectively. The elements of C are sum of corresponding elements in A and B which can be shown as:

$$\begin{bmatrix} 1 & 2 \\ 4 & 5 \end{bmatrix} + \begin{bmatrix} 5 & 6 \\ 8 & 9 \end{bmatrix} = \begin{bmatrix} 6 & 8 \\ 12 & 14 \end{bmatrix}$$

The algorithm for addition of matrices can be written as:

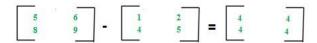
for i in 1 to m  
for j in 1 to n  
$$c_{ij} = a_{ij} + b_{ij}$$

#### Key points:

- · Addition of matrices is commutative which means A+B = B+A
- Addition of matrices is associative which means A+(B+C) = (A+B)+C
- . The order of matrices A, B and A+B is always same
- · If order of A and B is different, A+B can't be computed
- . The complexity of addition operation is O(m\*n) where m\*n is order of matrices

#### Matrices Subtraction

The subtraction of two matrices  $A_{m^*n}$  and  $B_{m^*n}$  gives a matrix  $C_{m^*n}$ . Here, m and n represents the number of rows and columns in the matrix respectively. The elements of C are difference of corresponding elements in A and B which can be represented as:



The algorithm for subtraction of matrices can be written as:

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for i in 1 to m  c_{ij} = a_{ij} - b_{ij}
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#### Key points:

- Subtraction of matrices is non-commutative which means A-B ≠ B-A
- Subtraction of matrices is non-associative which means A-(B-C) ≠ (A-B)-C
- . The order of matrices A, B and A-B is always same
- If order of A and B is different, A-B can't be computed
- . The complexity of subtraction operation is O(m\*n) where m\*n is order of matrices

## Matrices Multiplication

The multiplication of two matrices  $A_{m^*n}$  and  $B_{n^*p}$  gives a matrix  $C_{m^*p}$ . It means number of columns in A must be equal to number of rows in B to calculate C=A\*B. To calculate element  $c_{11}$ , multiply elements of 1st row of A with 1st column of B and add them (5\*1+6\*4) which can be shown as:



The algorithm for multiplication of matrices A with order m\*n and B with order n\*p can be written as:

### Key points:

- Multiplication of matrices is non-commutative which means  $A*B \neq B*A$
- Multiplication of matrices is associative which means A\*(B\*C) = (A\*B)\*C
- For computing A\*B, the number of columns in A must be equal to number of rows in B
- Existence of A\*B does not imply existence of B\*A
- The complexity of multiplication operation (A\*B) is O(m\*n\*p) where m\*n and n\*p are order of A and B respectively
- The order of matrix C computed as A\*B is O(m\*p) where m\*n and n\*p are order of A and B respectively