IT 1002 – Mathematics for Computing

Matrices

Transpose of a matrix

- A matrix which is formed by turning all the rows of a given matrix into columns & vice versa.
- In other words $M^T_{ij} = M_{ji}$
- Transpose of a matrix M is denoted by M^T or M'
- eg: if A = $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \\ 10 & 11 & 12 \end{bmatrix}$
- $A^T = \begin{bmatrix} 1 & 4 & 7 & 10 \\ 2 & 5 & 8 & 11 \\ 3 & 6 & 9 & 12 \end{bmatrix}$

- For vectors transposition turns row vector into column vector and vice versa
- $(M^T)^T = M$ for a matrix M of any dimension
- $D^T = D$ for any diagonal matrix D including the identity matrix I
- For a symmetric matrix $M^T = M$

Vectors

- Matrices with one row or one column are called vectors
- 1xn matrix is known as a row vector and nx1 matrix is known as a column vector
- Row vectors are written horizontally $[1,2,3,4]_{1x4}$
- Column vectors are written vertically $\begin{bmatrix} 7 \\ 8 \\ 9 \end{bmatrix}_{3x1}$

Matrix Equality

- For two matrices to be equal, they must have
  - The same dimensions.
  - Corresponding elements must be equal.
- In other words, say that $A_{n \times m} = [a_{ij}]$ and that $B_{p \times q} = [b_{ij}]$.
- Then $A = B$ if and only if $n=p$, $m=q$, and $a_{ij}=b_{ij}$ for all i and j in range

MATRIX OPERATIONS

Multiplying a matrix with a scalar

- A matrix M may be multiplied with a scalar k resulting in a matrix of the same dimension as M
- kM=k $\begin{bmatrix} m_{11} & m_{12} & m_{13} \\ m_{21} & m_{22} & m_{23} \\ m_{31} & m_{32} & m_{33} \end{bmatrix}_{3x3}$

$$=\begin{bmatrix} km_{11} & km_{12} & km_{13} \\ km_{21} & km_{22} & km_{23} \\ km_{31} & km_{32} & km_{33} \end{bmatrix}_{3x3}$$

Addition & Subtraction of matrices

- The simplest operation acting on two matrices is addition
- Addition of the matrices A & B is written as A+B and defined by
- $A+B=[a_{ij}+b_{ij}]$ for all i and j in range
- For subtraction replace "+" with "-"

- Matrix addition is commutative

  $$A+B = B + A$$

- Matrix addition is associative

  $$A + (B+C) = (A+B) + C$$