MATHEMATICS FOR COMPUTER SCIENCE (WHAT YOU SHOULD KNOW)

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Chapter 2: Progressions and Sequences

Special Progressions/Combined Progressions
(you could get this by trying to add them).

$1 + 2 +3 + 4 + \ldots\ldots + n = n/2(n + 1)$
$1^2 + 2^2 + 3^2 + \ldots. + n^2 = n/6(n + 1)((2n + 1)$
$1^3 + 2^3 + 3^3 + \ldots. + n^3 = n^2/4(n + 1)^2$

Chapter 3: Matrix Algebra

3.1 The Transpose of a matrix

Transpose

Let A be an $m \times n$ matrix. The *tranpsose of* A, denoted A^T, is the $n \times m$ matrix whose columns are the respective rows of A.

A **diagonal matrix** is an n x n matrix in which the only nonzero entries lie on the diagonal.

An **upper(lower) triangular matrix** is a matrix in which all nonzero entries lie above(below) the diagonal.

Properties of the Matrix Transpose

Let A and B be matrices where the following operations are defined. Then:

1. $(A+B)^T = A^T + B^T$ and $(A-B)^T = A^T - B^T$
2. $(kA)^T = kA^T$
3. $(AB)^T = B^T A^T$
4. $(A^{-1})^T = (A^T)^{-1}$
5. $(A^T)^T = A$

3.2 The Determinant

Determinant of 2×2 Matrices

Let

$$A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}.$$

The *determinant of A*, denoted by

$$\det(A) \text{ or } \begin{vmatrix} a & b \\ c & d \end{vmatrix},$$

is $ad - bc$.

$$\begin{bmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{bmatrix}$$

$$= a_1 \begin{bmatrix} b_2 & c_2 \\ b_3 & c_3 \end{bmatrix} - b_1 \begin{bmatrix} a_2 & c_2 \\ a_3 & c_3 \end{bmatrix} + c_1 \begin{bmatrix} a_2 & b_2 \\ a_3 & b_3 \end{bmatrix}$$

Determinant Properties

Let A and B be $n \times n$ matrices and let k be a scalar. The following are true:

1. $\det(kA) = k^n \cdot \det(A)$
2. $\det\left(A^T\right) = \det(A)$
3. $\det(AB) = \det(A)\det(B)$
4. If A is invertible, then

$$\det\left(A^{-1}\right) = \frac{1}{\det(A)}.$$

5. A matrix A is invertible if and only if $\det(A) \neq 0$.