# IT 1002 – Mathematics for Computing

## Matrices

# Inverse of a matrix

- For a square matrix A the inverse is written as $A^{-1}$
- Not all square matrices have inverses
- A square matrix which has an inverse is called invertible
- A square matrix without inverse is called singular matrix
- $AA^{-1} = A^{-1}A = I$

- Note: $(AB)^{-1} = B^{-1}A^{-1}$
- $(A+B)^{-1} \neq A^{-1}+B^{-1}$

# Finding inverse for 2x2 matrix

- If A = $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$ then
- $A^{-1} = \frac{1}{\det A}\begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$

$$= \frac{1}{ad-bc}\begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$$

# Find inverse of a matrix : Adjoint Method

- $A^{-1} = \frac{1}{\det A}(\text{Adjoint } A)$

  $= \frac{1}{\det A}(\text{Cofactor matrix of } A)^T$

1. Create a matrix of minors

   for each element of the matrix

   a) Ignore the values on the current row & column
   b) Calculate the determinant of the remaining values
   c) Put those determinants into a matrix

2. Create a matrix of cofactors

According to the following rule add – signs to the elements in the matrix of minors

$$\begin{bmatrix} + & - & + \\ - & + & - \\ + & - & + \end{bmatrix}$$

3. Create adjoint matrix

transpose all elements of ‘matrix of cofactors’

4. Multiply by $\frac{1}{determinant}$

multiply the top row elements by their matching minor determinants

- Find inverse of A = $\begin{bmatrix} 3 & 0 & 2 \\ 2 & 0 & -2 \\ 0 & 1 & 1 \end{bmatrix}$

- A = $\begin{bmatrix} 3 & 0 & 2 \\ 2 & 0 & -2 \\ 0 & 1 & 1 \end{bmatrix}$

MoM = $\begin{bmatrix} 2 & 2 & 2 \\ -2 & 3 & 3 \\ 0 & -10 & 0 \end{bmatrix}$

MoC = $\begin{bmatrix} 2 & -2 & 2 \\ 2 & 3 & -3 \\ 0 & 10 & 0 \end{bmatrix}$

- Adj A = $\begin{bmatrix} 2 & 2 & 0 \\ -2 & 3 & 10 \\ 2 & -3 & 0 \end{bmatrix}$
- Det A=(3*2) – (0*2) + (2*2)

  =10

- $A^{-1}=\frac{1}{10}\begin{bmatrix} 2 & 2 & 0 \\ -2 & 3 & 10 \\ 2 & -3 & 0 \end{bmatrix}$