

# ACS234

# Maths and Data Modelling

**Tutorial 3**  
**Wednesday 1pm LT04**

<https://github.com/ineskris/ACS234/tree/master/Tutorial3>

## Done in Lecture (week 5)

- Multiple Linear Regression

# Matrix - Basics

Matrix 2 x 2

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

Transpose

$$A^T = A' = \begin{pmatrix} a & c \\ b & d \end{pmatrix}$$

Inverse

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

Multiplication Matrix 2 x 2

$$\begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix} \times \begin{pmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{pmatrix} = \begin{pmatrix} a_{11}b_{11} + a_{12}b_{21} & a_{11}b_{12} + a_{12}b_{22} \\ a_{21}b_{11} + a_{22}b_{21} & a_{21}b_{12} + a_{22}b_{22} \end{pmatrix}$$

**Exercise 1** - Let A, B, D be the matrices below.

$$A = \begin{pmatrix} 1 & -2 \\ 3 & 0 \end{pmatrix} \quad B = \begin{pmatrix} 4 & 4 \\ -1 & 1 \end{pmatrix} \quad C = \begin{pmatrix} 7 \\ 0 \end{pmatrix} \quad D = (-3 \quad 1)$$

Compute AB, BA, BB', B'B, AC, BD' and  $A^{-1}$

## Exercise 1 - Solution

# Multiple Linear Regression

Multiple regression is like linear regression, but with more than one independent value, meaning that we try to predict a value based on **two or more** variables.

$$y = a_0 + a_1x_1 + a_2x_2 + \dots + a_mx_m + e$$

Response

Coefficients

Variables

<b>Coefficient of determination</b>	$R^2 = 1 - \frac{S_r}{S_t}$	<b>Sum of squared deviations</b>	$S_t = \sum_{i=1}^n (y_i - \bar{y})^2$
<b>Standard Error of Estimate</b>	$S_{y/x} = \sqrt{\frac{S_r}{n - (m + 1)}}$	<b>Sum of squares of the errors</b>	$S_r = \sum_{i=1}^n (y_i - \hat{y}_i)^2$
<b>Standard Error of Estimate</b>	$\hat{a} = (XX')^{-1}X'Y$		

**Exercise 2** - Find the coefficients of the model as well as  $R^2$  and  $S_{y/x}$  .

Height	76	69	63	72
Age	57	25	28	36
Mass	451	302	288	385

$$\text{Height} = a_0 + a_1 \times \text{weight} + a_2 \times \text{age}$$

# Case Study

Can you use a multiple regression model to predict the housing price in Boston ?

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## Exercise 2 - Solution