

# ACS234

# Maths and Data Modelling

Find in this sheet a series of exercises to work during the holidays and which take up all the topics mentioned during the 3 previous tutorials.

# Interpolation

**Exercise 1** - Find the function of degree 3 that goes through these 3 points using :

- a) Polynomial interpolation
- b) Lagrange interpolation
- c) Newton interpolation

x	-1	0	1	2
f(x)	-1	1	0	0

**Exercise 2** - We have the data below representing the water kinematic viscosity  $\nu$  (in  $\text{m}^2 \text{s}^{-1}$ ) as a function of temperature  $T$  (in  $^{\circ}\text{C}$ ) :

T	15	16	17	18	19	20	21	22	23	24	25	26	27	28
$\nu$	1.14	1.11	1.08	1.06	1.03	1.01	0.983	0.960	0.938	0.917	0.896	0.876	0.857	0.839

1. What is the kinematic viscosity when  $T = 26.5^{\circ}\text{C}$  ?
2. For which temperature do we have  $\nu = 0.9 \text{ m}^2 \text{s}^{-1}$ ?

## Exercise 3

- a) Find the Lagrange polynomial going through the first three points in red.
- b) Find the Lagrange polynomial going through the first four points in red and blue.
- c) Using both functions, interpolate the value of the  $f(3)$ . Is it close to the real value in green ?

x	0.0	1.0	2.0	3.0	4.0
f(x)	0.0	2.0	36.0	252.0	1040.0

# Simple Linear Regression

**Exercise 1** - We have the weight of father and son given below. Calculate the coefficients of the linear model as well as the coefficient of determination  $R^2$  . Give an interpretation.

Father	65	63	67	64
Son	68	66	68	65

**Exercise 2** - We have the following linear model  $y = a_0 + a_1x + e$  and we know :

a) the regression line goes through  $(x_1, y_1) = (2, 2.5)$

b)  $\bar{x} = 3.0$  and  $\bar{y} = 5.0$

Find  $\hat{a}_0$  and  $\hat{a}_1$  .

**Exercise 3** - Can you write a Matlab (or python) code to solve the 2 exercises above ?

# Multiple Linear Regression

## Exercise

Using Matlab or Python code, construct a Multiple Linear Model of your choice . For that, you can use any data that you will find online. Calculate the performance of your model : MSE,  $R^2$  ...

You can use the famous dataset **Titanic** and participate in the competition to predict which passengers survived the Titanic shipwreck. Data available at : <https://www.kaggle.com/c/titanic>

**If you want your work to be shown to other students, please send us the Jupyter notebook or code with plots by email :)**