Exercise 1:

Which of the following statement(s) is/are correct?

(a) Interpretation methods are mainly needed to better explain real world phenomena.

(b) Model-agnostic methods need access to gradients to explain a model.

(c) In IML we distinguish between global IML methods, which explain the behavior of the model over the entire feature space, and local IML methods, which only explain the prediction of individual observations.

(d) We can also draw conclusions about feature importance from feature effect methods.

(e) Technically, correlation is a measure of *linear* statistical dependence.

(f) Features that have an equal feature effect are correlated.

Exercise 2:

You received a dataset with 11 observations and two features:

	1	2	3	4	5	6	7	8	9	10	11	$\sum_{i=1}^{n}$
y	-7.90	-6.08	-3.74	-1.18	-1.23	-0.55	0.05	0.88	4.74	2.93	2.55	-9.53
x1	-1.00	-0.80	-0.60	-0.40	-0.20	0.00	0.20	0.40	0.60	0.80	1.00	0
x2	0.95	0.65	0.40	0.07	0.06	0.02	0.02	0.14	0.34	0.60	0.98	4.23

The last column corresponds to the sum of values of each row.

a) Compute the Pearson correlation of x_1 and x_2. The formula is:

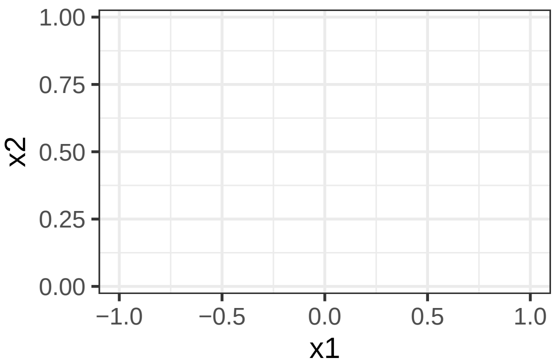
$$\rho(x_1, x_2) = \frac{\sum_{i=1}^{n}(x_1^{(i)} - \overline{x}_1)(x_2^{(i)} - \overline{x}_2)}{\sqrt{\sum_{i=1}^{n}(x_1^{(i)} - \overline{x}_1)^2}\sqrt{\sum_{i=1}^{n}(x_2^{(i)} - \overline{x}_2)^2}}$$

To speed up things, the individual differences to the means ($x_1^{(i)} - \overline{x_1}$, $x_2^{(i)} - \overline{x_2}$), are given in the table above.

	1	2	3	4	5	6	7	8	9	10	11
$x_1^{(i)} - \overline{x_1}$	-1.00	-0.80	-0.60	-0.40	-0.20	0.00	0.20	0.40	0.60	0.80	1.00
$x_2^{(i)} - \overline{x_2}$	0.57	0.27	0.02	-0.31	-0.32	-0.36	-0.36	-0.24	-0.04	0.22	0.6

Interprete the results. Based on $\rho(x_1, x_2)$, are x_1 and x_2 correlated?

b) Add points (x_1, x_2) to the following figure:



Based on your drawing, do you consider the Pearson correlation coefficient a reliable measure to detect dependencies for the above use case?

Exercise 3:

Show, that the following holds:

$$R^2 = \rho^2.$$

Recap:

$$\rho = \frac{\sum_{i=1}^{n} (x^{(i)} - \bar{x}) \cdot (y^{(i)} - \bar{y})}{\sqrt{\sum_{i=1}^{n} (x^{(i)} - \bar{x})^2} \sqrt{\sum_{i=1}^{n} (y^{(i)} - \bar{y})^2}},$$

$$R^2 = 1 - \frac{SSE_{LM}}{SSE_c},$$

where

$$SSE_{LM} = \sum_{i=1}^{n} (y^{(i)} - \hat{f}_{LM}(x^{(i)}))^2,$$

$$SSE_c = \sum_{i=1}^{n} (y^{(i)} - \bar{y})^2$$

are the sum of squares due to regression and the total sum of squares, respectively.

Exercise 4:

Consider the following function:

$$f(\mathbf{x}) = 2x_1 + 3x_2 - x_1|x_2|.$$

Mathematically check whether interactions are present.