

# TMA4268 Statistical Learning

## Module 6: Recommended exercises

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### Recommended exercise 1

1. Show that the least square estimator of a standard linear model is given by

$$\hat{\beta} = (\mathbf{X}^T \mathbf{X})^{-1} \mathbf{X}^T \mathbf{Y}$$

2. Show that the maximum likelihood estimator is equal to the least square estimator for the standard linear model.

### Recommended exercise 2

Write R code to create a similar representation of the Credit data figure shown below.

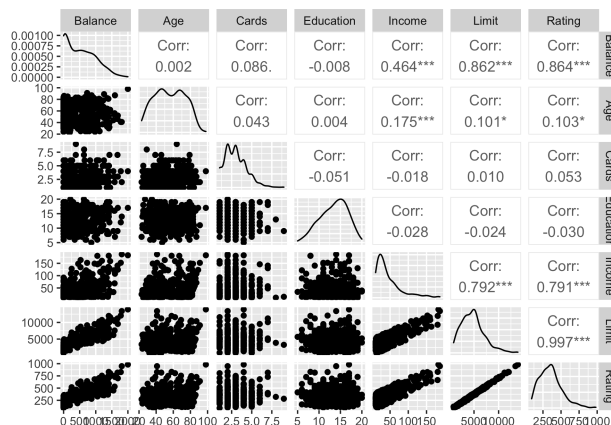


Figure 1: Credit data figure

### Recommended exercise 3

1. For the Credit Dataset, pick the best model using Best Subset Selection according to  $C_p$ ,  $BIC$  and Adjusted  $R^2$ 
  - Hint: Use the `regsubsets()` of the `leaps` library, similar to what was done in Lab 1 of the book.
2. For the Credit Dataset, pick the best model using Best Subset Selection according to a 10-fold CV

- Hint: Use the output obtained in the previous step and build your own CV function to pick the best model.
3. Compare the result obtained in Step 1 and Step 2.

## Recommended exercise 4

1. Select the best model for the Credit Data using Forward, Backward and Hybrid (sequential replacement) Stepwise Selection.
  - Hint: Use the `regsubsets()` of the `leaps` library
2. Compare with the results obtained with Best Subset Selection.

## Recommended exercise 5

1. Apply Ridge regression to the Credit Dataset.
2. Compare the results with the standard linear regression.

## Recommended exercise 6

1. Apply Lasso regression to the Credit Dataset.
2. Compare the results with the standard linear regression and the Ridge regression.

## Recommended exercise 7

How many principal components should we use for the Credit Dataset? Justify.

## Recommended exercise 8

Apply PCR on the Credit dataset and compare the results with the previous methods used in this module.

## Recommended exercise 9

Apply PLS on the Credit dataset and compare the results with the previous methods used in this module.