In this exercise we consider Chapter 7 of the book 'Deep Learning'. The exercise focuses on Regularization. We will implement various types of regularization:

1. L2 regularization
2. Dropout
3. Early stopping

In order to complete this assignment, please download the provided notebook from ILIAS.

1. **L2 Regularization**
   Work through the part of the notebook that feature L2 regularization. The points are roughly divided as follows.
   (a) Implement L2 regularization according to equations 7.2 - 7.5. (2)
   (b) Show how test performance varies for various values of α. (1)
   Points for Question 1: 3

2. **Dropout**
   Work through the part of the notebook that feature Dropout. The points are roughly divided as follows.
   (a) Implement Dropout (fitting the model and predicting using the arithmetic mean) (2)
   (b) Plot how the test performance varies for various values of k. (1)
   Points for Question 2: 3

3. **Early stopping**
   Work through the part of the notebook that feature early stopping. The points are roughly divided as follows.
   (a) Implement early stopping (2)
   (b) Demonstrate the algorithm on the digits dataset (1)
   Points for Question 3: 3

4. **Evaluation**
   For course improvements, we would like your feedback. In particular we are interested in how much time you spend on the exercises, and how useful you found the individual problems. Please fill out the short questionnaire on the second page. Points for Question 4: 1

You can achieve a total of **10** points for this exercise. Please hand in your solution before the lecture on **28.11.2017**.

Exercise 5

Question 1: ◯ not at all ◯ not very ◯ quite ◯ very

Question 2: ◯ not at all ◯ not very ◯ quite ◯ very

Question 3: ◯ not at all ◯ not very ◯ quite ◯ very

Total time spend on the exercise: _____