Exercise Sheet 3: Deep Learning

For the following exercises, it is best to use a deep learning framework like *pytorch*.
You can choose one of the two setups described in exercise 2) a (corresponding to a multi-step model with several output values for the different horizons) and b (corresponding to a model with the prediction for the next day as single output value) of exercise sheet 1. Repeat the evaluations of the predictions with each model.

1) **MLP**
   a) Predict the demand of all product-location-date combinations in `test` using a feed-forward neural network (if you want with several hidden layers).
   b) Include embedding layers for the categorical variables product ID (potentially also for product groups) and location ID to replace the one-hot encodings.
   c) Use t-SNE (for example from *scikit-learn*) to visualize the embeddings from the previous exercise.

2) **CNN**
   Predict the demand of all product-location-date combinations in `test` using a CNN. (Hints: You need to prepare sequence samples corresponding to time windows as inputs. You can go multivariate by means of several channels.)

3) **LSTM**
   Predict the demand of all product-location-date combinations in `test` using a LSTM. (The structure of inputs and outputs is very similar to CNNs.)

4) **Transformer**
   Predict the demand of all product-location-date combinations in `test` using a transformer, e.g., Temporal Fusion Transformer from *pytorch_forecasting*.