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Monographic Lecture in Mathematics
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Lab 1
Preliminaries

During this lab we will perform elementary time series analysis using Python's Pandas library. File co2.csv, available on ePortal, contains data of CO2 concentration in Earth's atmosphere. The concentrations are given in parts per million (ppm). We will analyze only the direct measurements which began in 1950.

1. Load co2.csv using Pandas library and set date as the data frame's index. File consists of four columns: date, mean global CO2 concentration, mean CO2 concentration in northern hemisphere, and mean CO2 concentration southern hemisphere.

2. Using line plot, plot all three *mean annual* CO2 concentrations in one figure as a function of time.

3. Using Seaborn library, visualize the spread of monthly CO2 concentrations with boxplots.

4. Choose one year and compare monthly CO2 concentrations in both hemispheres using bar plot.

5. Plot monthly CO2 concentrations in both hemispheres. Examine seasonality using autocorrelation function (acf in Statsmodels library) with lags up to 15. Interpret the results.

6. Please read following tutorial:
https://machinelearningmastery.com/decompose-time-series-data-trend-seasonality/
and decompose all series using additive and multiplicative models. Examine trends, seasonal, and residual components.