6th exercises for SIM'2019

Ex. 1
Do kernel density estimation for one-dimensional data `asteroid_density.dat`, where the densities (in g/cm^3) of some asteroids are recorded. Test either few different kernels or few values of smoothing parameter h. Plot the density estimates. Can there be 'unphysical' features in the density estimate?

Ex. 2
Draw a sample of 1000 observations from three-dimensional multinormal distribution. Vector of expected values is $\boldsymbol{\mu} = (1, 2, 3)$ and covariance matrix is

$$\boldsymbol{\Sigma} = \begin{bmatrix} 1 & 0.5 & 1.25 \\ 0.5 & 2 & 1.75 \\ 1.25 & 1.75 & 3 \end{bmatrix}$$

Use Eq. (6.7). When done, do scatterplots of Y_1 against Y_2, Y_1 against Y_3, and Y_2 against Y_3.

Ex. 3
Load three datafiles `MN-data-i.dat` from the course webpage. Each file has 500 observations from two-dimensional multinormal distribution. The covariance matrix is

$$\boldsymbol{\Sigma} = \begin{bmatrix} 10 & -4 \\ -4 & 2 \end{bmatrix}$$

for all the sets. Plot the data and compute mean vectors for the three sets. Compute so-called distance matrix between the means using both Euclidean distances and Mahalanobis distances. Distance matrix $\mathbf{D}$ is such that $[\mathbf{D}]_{ij}$ gives the distance between elements i and j.