1.

Problems from the book: 1.19, 1.20, 1.22, 1.23.

2

Continuing with the OSEBX data (From Øving 1). The python file "Plotte finansdata" may be useful. Let $P(t)$ be price (OSEBX data). Make a log-transformation, $Y_t = \log(P_t)$, and define the log-returns $r_t = Y_t - Y_{t-1}$.

a) Show that

$$r_t \approx \frac{P_t - P_{t-1}}{P_{t-1}}$$

for $P_t \approx P_{t-1}$

Hint: First order Taylor expansion of $\log x$ at $x = 1$.

b) Plot log-returns. Comment on the volatility (variability) in the time series (what happens around the 2008 financial crisis?).

c) Estimate and plot the auto-correlation function (ACF) of r_t. Comment. Based on this result, which class of models seems appropriate?

d) Estimate and plot the auto-correlation function (ACF) of $|r_t|$ (absolute value of log-returns). Comment on if the datapoints are: 1) Uncorrelated? Independent? Predictable in the future?

e) Compare the distribution of log-returns with the normal distrubution, in a QQ-plot and/or by plotting a histogram and comparing it with a plot of the normal distribution.

f) Repeat b) - e) for the Dow Jones index. Do these data behave similarly?

3

a) La

$$x_t = \frac{1}{2}(w_{t-1} + w_t)$$

der w_t er $\mathrm{WN}(0, \sigma_w^2)$. Beregn auto-kovariansfunksjon (acvf) og auto-korrelasjonsfunksjon (ACF). Simuler n observasjoner fra x_t og plot sample acvf og sample ACF. Prøv med forskjellig verdier for n, og observer at når du gjør n stor så konvergerer sample acvf og sample ACF (estimerte størrelser) mot henholdsvis acvf og ACF. Legg merke til at x_t er stasjonær.

b) Plot sample ACF for en Gaussisk random walk, eksempelvis for $n = 1000$ datapunkter. For en random walk, hvorfor konvergerer ikke sample ACF mot teoretisk ACF når vi gjør n større?