Christian-Albrechts-Universität zu Kiel **WS 2017/18**
Mathematisches Seminar
Prof. Dr. Jan Kallsen
Dr. Giso Jahncke Sheet 11

Risk Management

Exercises for participants of the programme **Quantitative Finance**

C-Exercise 19

(a) Write a *scilab*-function

```
tau = Kendall(x),
```

which estimates and returns *Kendall's tau* $\rho_\tau(X_1,X_2)$ for iid samples of a random vector $X=(X_1,X_2)$.

(b) Write a *scilab*-function

```
rho = Spearman(x),
```

which estimates and returns *Spearman's rho* $\rho_S(X_1,X_2)$ for iid samples of a random vector $X=(X_1,X_2)$.

(c) Assume that the log returns of DAX and S&P 500 time series on the olat-website are iid samples from a random vector (X_1,X_2). Estimate the correlation coefficients $\rho(X_1,X_2)$, *Kendall's tau* $\rho_\tau(X_1,X_2)$ and *Spearman's rho* $\rho_S(X_1,X_2)$. Plot the common daily log returns.

(d) Estimate the mean μ and the covariance matrix Σ of (X_1,X_2) with appropriate estimators $\widehat{\mu}$ and $\widehat{\Sigma}$. Simulate $N=6278$ iid samples of a $N(\widehat{\mu},\widehat{\Sigma})$ distribution. Plot these samples and estimate *Kendall's tau* and *Spearman's rho*.

T-Exercise 20

Proof Lemma 4.8. from the lecture.

Submit until: Thursday, 01.02.2018, 08:30 (before the lecture)