Christian-Albrechts-Universität zu Kiel **WS 2017/18**
Mathematisches Seminar
Prof. Dr. Jan Kallsen
Giso Jahncke Sheet 03

Risk Management

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

C-Exercise 5

Assume that we have a sample $v = (v_1, \dots, v_m) \in \{0,1\}^m$ of i.i.d. random variables with $\mathbb{P}(v_1 = 1) = p$. Hence their sum $\sum_{k=1}^{m} v_k$ follows a $\mathrm{bin}(m, p)$-distribution, i.e. a binomial distribution with m experiments and success probability $p \in [0,1]$. Design a one sided statistical test at significance level $\beta \in (0,1)$ for the null hypothesis $H_0 : p \leq p_0$ and implement this test in a *scilab* function called

```
test_binomial(v,p0,beta)
```

This function is supposed to return the value 1, if the null hypothesis is rejected, and 0 otherwise.
We want to apply this test on the results from C-Exercise 5(b): From T-Exercise 7M (see exercise sheet 2 for participants from mathematical programmes) we know that the number of violations follows a $\mathrm{bin}(m, 1-\alpha)$-distribution, where m is the number of considered trading days. Apply your function on the violation vectors from the DAX time series using a significance level of $\beta = 0.05$.

Hint: You may construct an exact test based on the cumulative distribution function of $\mathrm{bin}(m, p)$ or use a normal approximation to derive a test with asymptotic level β.

Please give a description of your *scilab* operations in the `sce`-file.

Useful *scilab* commands: `cdfbin`, `sum`

T-Exercise 6

(a) Let X be a random variable. Show that it holds

$$\mathrm{VaR}_\alpha(aX + b) = a\mathrm{VaR}_\alpha(X) + b, \; b \in \mathbb{R}, a \geq 0.$$

(b) Let X be a random variable with continuous and strictly increasing distribution function F. Show that it holds

$$\mathrm{VaR}_\alpha(-X) = -\mathrm{VaR}_{1-\alpha}(X).$$

Submit until: Thursday, 16.11.2017, 08:30 (before the lecture)