Christian-Albrechts-Universität zu Kiel **SS 2016**
Mathematisches Seminar
Prof. Dr. Jan Kallsen
Mark Feodoria Sheet 09

Computational Finance

Exercises for participants of mathematical programmes

C-Exercise 32
Write a scilab function

```
V0 = EuCall_BS_Laplace (S0, r, sigma, T, K, R)
```

that computes the initial price of a European call option in the Black-Scholes model via the Laplace transform approach. I.e., implement the formula

$$V(t) = \frac{e^{-r(T-t)}}{\pi} \int_0^\infty \mathrm{Re}\left(\tilde{f}(R+iu)\chi_t(u-iR)\right) \mathrm{d}u$$

from the course.

T-Exercise 33
Let χ_t be the characteristic function of $\log(S(t))$ in the Heston model. Compute the partial derivatives of χ_t with respect to the stock and the volatility v.

T-Exercise 34
Compute the Laplace transform of $f : \mathbb{R} \to \mathbb{R}$, $x \mapsto 1_{\{x \geq K\}}$, for $K \in \mathbb{R}$, and determine the domain of convergence.

T-Exercise 35
A *Poisson process* N with intensity parameter $\lambda \in \mathbb{R}_+$ is a stochastic process with right-continuous, increasing paths such that for all $s,t \in \mathbb{R}_+$ the increments $N(t+s) - N(t)$ are independent of $N(t)$ and such that $N(t)$ follows a Poisson distribution with parameter λt. For $\rho, \mu \in \mathbb{R}$ and a Poisson process N with intensity parameter $\lambda \in \mathbb{R}_+$, compute the characteristic function of the process $X(t) := \rho N(t) - \mu t$.

Please save your solution of each C-Exercise in a file named `Exercise_##.sce`, where ## denotes the number of the exercise. Please include your name(s) as comment in the beginning of the file.

Submit until: Thursday, 23.06.2016, 08:30
Discussion: in the tutorial on Mon, 27.06.2016